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FINAL RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION
WORK PLAN ZONE B WITH TRANSMITTAL CNC CHARLESTON SC
1/31/1997
ENSAFE/ ALLEN AND HOSHALL

**COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY**

**NAVBASE CHARLESTON
CHARLESTON, SOUTH CAROLINA**

**FINAL RFI REPORT
CTO-0029, ZONE B**



Prepared for:

**Department of the Navy
Southern Division Naval Facilities
Engineering Command
Charleston, South Carolina**

Prepared by:

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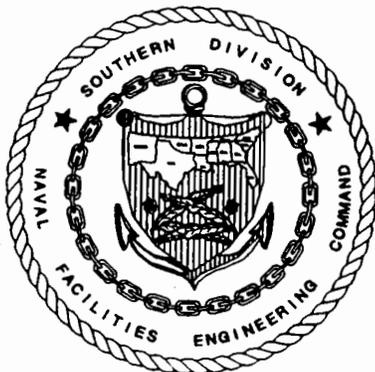
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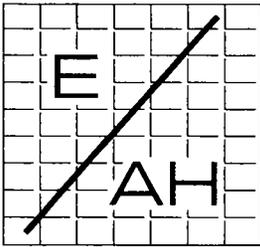
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January 31, 1997

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Bureau of Solid and Hazardous Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
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Subject: *Final Zone B RCRA Facility Investigation (RFI) Report*
Dated November 21, 1996
Charleston Naval Base
SCO 170 022 560

Dear Sir:

In accordance with the approval letter dated January 2, 1997 and signed by Mr. John T. Litton of your department, EnSafe/Allen & Hoshall is submitting the enclosed NAVBASE Charleston *Final Zone B RFI Report* on behalf of the U.S. Navy. The submittal is in the form of a new cover, spine, and revised pages to be inserted in the previously submitted document according to the attached instructions. Additional copies have been distributed as shown on the attached NAVBASE Charleston Final Document Distribution list.

If you have any questions or comments, please contact me at 901/372-7962 or Todd Haverkost at 803/884-0029.

Sincerely,

EnSafe/Allen & Hoshall

By: Lawson M. Anderson, CHMM
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Enclosures: As Stated

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ABBREVIATIONS, ACRONYMS, AND SYMBOLS FOR NAVBASE ZONE B

The following abbreviations, acronyms, and units of measurement are used in this report.

AA	Atomic Absorption
ABF	Absorption Factor
AEC	Area of Ecological Concern
AL	Action Level
AOC	Area of Concern
AOI	Area of Interest
AQTESOLV	Aquifer Test Solver
ARAR	Applicable or Relevant and Appropriate Requirement
AST	Aboveground Storage Tank
ASTM	American Society for Testing and Materials
atm	Atmosphere
AWQC	Ambient Water Quality Criteria
BAF	Bioaccumulation Factor
BaP	Benzo(a)pyrene
BDL	Below Detection Limit
BE	Barometric Efficiency
BEHP	bis(2-ethylhexyl)phthalate
BEQ	Benzo(a)pyrene Equivalent
BEST	Building Economic Solutions Together
bgs	Below ground surface
BHC	Benzenehexachloride
BOD	Biochemical Oxygen Demand
BRA	Baseline Risk Assessment
BRAC	Base Realignment and Closure Act of 1988 and Defense Base Closure and Realignment Act of 1990, collectively
BTEX	Benzene, toluene, ethylbenzene, and xylene
CAMP	Corrective Action Management Plan
CAMU	Corrective Action Management Unit
CDD	Chlorinated dibenzo-p-dioxin
CDF	Chlorinated dibenzofuran
CDI	Chronic Daily Intake
CEC	Cation Exchange Capacity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	Calibration Factor
CFR	Code of Federal Regulations
cm/sec	centimeter per second
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
CM	Corrective Measures

**ABBREVIATIONS, ACRONYMS, AND SYMBOLS FOR NAVBASE ZONE B
(Continued)**

CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
COD	Chemical Oxygen Demand
CNS	Central Nervous System
CNSY	Charleston Naval Shipyard
COC	Chemical of Concern
COPC	Chemical of Potential Concern
cPAH	Carcinogenic Polynuclear Hydrocarbon
CPSS	Chemical Present in Site Samples
CRAVE	Carcinogen Risk Assessment Verification Endeavor
CRDL	Contract Required Detection Limit
CSAP	Comprehensive Sampling and Analysis Plan
CSI	Confirmatory Sampling Investigation
CT	Central Tendency
CV	Coefficient of Variation
CWA	Clean Water Act
DCAA	2,4-dichlorophenylacetic acid
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyl-trichloroethane
DMA	Dredged Material Area
DNAPL	Dense Non-Aqueous Phase Liquid
DOD	Department of Defense
DQO	Data Quality Objectives
DRO	Diesel Range Organics
DWEL	Drinking Water Equivalent Level
E/A&H	EnSafe/Allen & Hoshall
ECAO	Environmental Criteria and Assessment Office
ECPC	Ecological Chemical of Potential Concern
ED	Exposure Duration
EF	Exposure Frequency
EMPC	Estimated Maximum Possible Concentration
EOD	Explosive Ordnance Disposal
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
ESA	Ecological Study Area
ESDSOPQAM	Environmental Services Division Standard Operating Procedures and Quality Assurance Manual

**ABBREVIATIONS, ACRONYMS, AND SYMBOLS FOR NAVBASE ZONE B
(Continued)**

FC	Fraction contacted
FFI	Focused Field Investigation
FI	Fraction Ingested
FID	Flameionization detector
ft ² /day	Square feet per day
GC/MS	Gas Chromatography/Mass Spectroscopy
g/cm ³	Gram per cubic centimeter
g/mole	Gram per mole
gpm	Gallon per minute
GPS	Global Positioning System
GRO	Gasoline Range Organics
HASP	Health and Safety Plan
HEAST	Health Effects Assessment Summary Table
HHRA	Human Health Risk Assessment
HL	Henry's Law constant
HMW	High Molecular Weight
HI	Hazard Index
HQ	Hazard Quotient
HSWA	Hazardous and Solid Waste Amendments
HTTD	High-Temperature Thermal Desorption
ICAP	Inductively Coupled Argon Plasma
ICM	Interim Corrective Measure
ICP	Inductively Coupled Plasma
ID	Inside Diameter
IDL	Instrument Detection Limit
ILCR	Incremental Lifetime Excess Cancer Risk
ILO	Indeterminate Lubricating Oil
IR	Intake Rate
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
IS	Internal Standard
kg/mg	Kilogram per milligram
km/hr	Kilometer per hour
LCS	Laboratory Control Sample
LC ₅₀	Lethal Concentration to 50 percent of test population
LD ₅₀	Lethal Dose to 50 percent of test population
LDRs	Land Disposal Restrictions

**ABBREVIATIONS, ACRONYMS, AND SYMBOLS FOR NAVBASE ZONE B
(Continued)**

L/kg	Liter per kilogram
LMW	Low Molecular Weight
LN	Natural Logarithm
LNAPL	Light Nonaqueous Phase Liquid
LQAC	Laboratory QA Coordinator
LTTD	Low-Temperature Thermal Desorption
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
meq/L	Milliequivalent per liter
mg/kg	Milligram per kilogram
mg/L	Milligram per liter
mg/cm ²	Milligram per square centimeter
ml	Milliliter
mm	Millimeter
mph	Mile per hour
msl	Mean sea level
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MW	Molecular Weight
NA	Not Applicable
NAD	North American Datum
NAVBASE	Naval Base Charleston
NCEA	National Center for Environmental Assessment
NCR	NEESA Contract Representative
ND	Not Detected
NFI	No Further Investigation
ng/kg	Nanogram per kilogram
NGVD	National Geodetic Vertical Datum
NIOSH	National Institute for Occupational Safety and Health
NL	Not Listed
NOAEL	No Observable Adverse Effect Level
NPDES	National Pollutant Discharge Elimination System
NR	Not Reported
NTP	National Toxicology Program
NTU	Nephelometric Turbidity Unit
OERR	Office of Emergency and Remedial Response
OP	Organophosphorus
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OVA	Organic Vapor Analyzer

**ABBREVIATIONS, ACRONYMS, AND SYMBOLS FOR NAVBASE ZONE B
(Continued)**

PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated biphenyl
PDE	Potential Dietary Exposure
PE	Performance Evaluation
PEM	Performance Evaluation Mixture
pg/g	Picogram per gram
pg/L	Picogram per liter
POLs	Petroleum, oils, and lubricants
POTW	Publicly Owned Treatment Works
ppb	Parts per billion
PPE	Personal Protective Equipment
ppm	Part per million
ppt	Part per trillion
PRC	Preliminary Risk Characterization
PRG	Preliminary Remedial Goal
PSA	Preliminary Site Assessment
psi	Pound per square inch
PVC	Polyvinyl Chloride
%D	Percent Difference
%R	Percent Recovery
%RSD	Percent Relative Standard Deviation
QA/QC	Quality Assurance/Quality Control
RAB	Restoration Advisory Board
RAD	Recommended Daily Allowance
RAGS	Risk Assessment Guidance for Superfund
RBC	Risk-Based Concentration
RBSL	Risk-Based Screening Level
RCRA	Resource Conservation and Recovery Act
RDA	Charleston Naval Complex Redevelopment Authority
RFA	RCRA Facility Assessment
RfC	Reference Concentration
RfD	Reference Dose
RFI	RCRA Facility Investigation
RGO	Remedial Goal Option
RME	Reasonable Maximum Exposure
RPD	Relative Percent Difference
RRF	Relative Response Factor
RTC	Reserve Training Center
RTV	Reference Toxicity Value

**ABBREVIATIONS, ACRONYMS, AND SYMBOLS FOR NAVBASE ZONE B
(Continued)**

SAA	Satellite Accumulation Area
SAS	Special Analytical Services
SC	South Carolina
SCDHEC	South Carolina Department of Health and Environmental Control
SDG	Sample Delivery Group
SF	Slope Factor
SFF	Site Foraging Factor
SMCL	Secondary Maximum Contaminant Level
SOP	Standard Operating Procedure
SOUTHDIV	Southern Division Naval Facilities Engineering Command
SPLP	Synthetic Precipitation Leachate Procedure
SQL	Sample Quantitation Limit
sqrt	Square root
SSL	Soil Screening Level
SSV	Sediment Screening Value
SVE	Soil Vapor Extraction
SVOA	Semivolatile Organic Analysis
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TCDD	Tetrachlorodibenzo-p-dioxin
TD/MS	Thermal Desorption/Mass Spectrometry
TD-GS/MS	Thermal Desorption-Gas Chromatography/Mass Spectrometry
TDS	Total Dissolved Solids
TEF	Toxicity Equivalency Factor
TEM	Transmission Electron Microscopy
TEQ	TCDD Equivalency Quotient
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TSCA	Toxic Substances Control Act
TU	Temporary Unit
UCL	Upper Confidence Limit
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
UTL	Upper Tolerance Limit
UV	Ultraviolet
UXO	Unexploded Ordinance

**ABBREVIATIONS, ACRONYMS, AND SYMBOLS FOR NAVBASE ZONE B
(Continued)**

VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
VP	Vapor Pressure
WBZ	Water-Bearing Zone
WQC	Water Quality Control
$\mu\text{g}/\text{cm}^2$	Microgram per square centimeter
$\mu\text{g}/\text{g}$	Microgram per gram
$\mu\text{g}/\text{kg}$	Microgram per kilogram
$\mu\text{g}/\text{L}$	Microgram per liter
2,4-D	2,4-dichlorophenoxyacetic acid
2,4-DB	2,4-dichlorophenoxybutyric acid
2,4,5-T	2,4,5-trichlorophenoxyacetic acid
2,4,5-TP	Silvex

1.0 INTRODUCTION

The environmental investigation and remediation at Naval Base Charleston (NAVBASE) are required by the Hazardous and Solid Waste Amendments (HSWA) portion of the NAVBASE Resource Conservation and Recovery Act (RCRA) Part B permit. These conditions are consistent with the RCRA Corrective Action Program, whose objectives are to evaluate the nature and extent of any hazardous waste or constituent releases, and to identify, develop, and implement appropriate corrective measures to protect human health and the environment. The scope of the RCRA Facility Investigation (RFI) includes the entire naval base, which has been divided into Zones A through L to accelerate the RFI process. This Zone B RFI Report, prepared by EnSafe/Allen & Hoshall (E/A&H), is submitted to satisfy condition II.C.6 of the HSWA portion of the Part B permit.

1.1 NAVBASE Description and Background

Location

NAVBASE is in the city of North Charleston, on the west bank of the Cooper River in Charleston County, South Carolina (Figure 1.1). This installation consists of two major areas: an undeveloped dredged materials area on the east bank of the Cooper River on Daniel Island in Berkeley County, and a developed area on the west bank of the Cooper River.

The developed portion of the base is on a peninsula bounded on the west by the Ashley River and on the east by the Cooper River. Major commands that occupied the base prior to closure in April 1996 included Charleston Naval Shipyard, Fleet Ballistic Missile Submarine Training Center, Fleet and Industrial Supply Center, Fleet and Mine Warfare Training Center, Naval Regional Medical Center Charleston, and Naval Station Charleston (Figure 1.2). NAVBASE also included the degaussing facility in downtown Charleston, the Shipboard Electronics System Evaluation Facility on Sullivan's Island, and the Naval Station Annex adjacent to the Charleston Air Force Base.

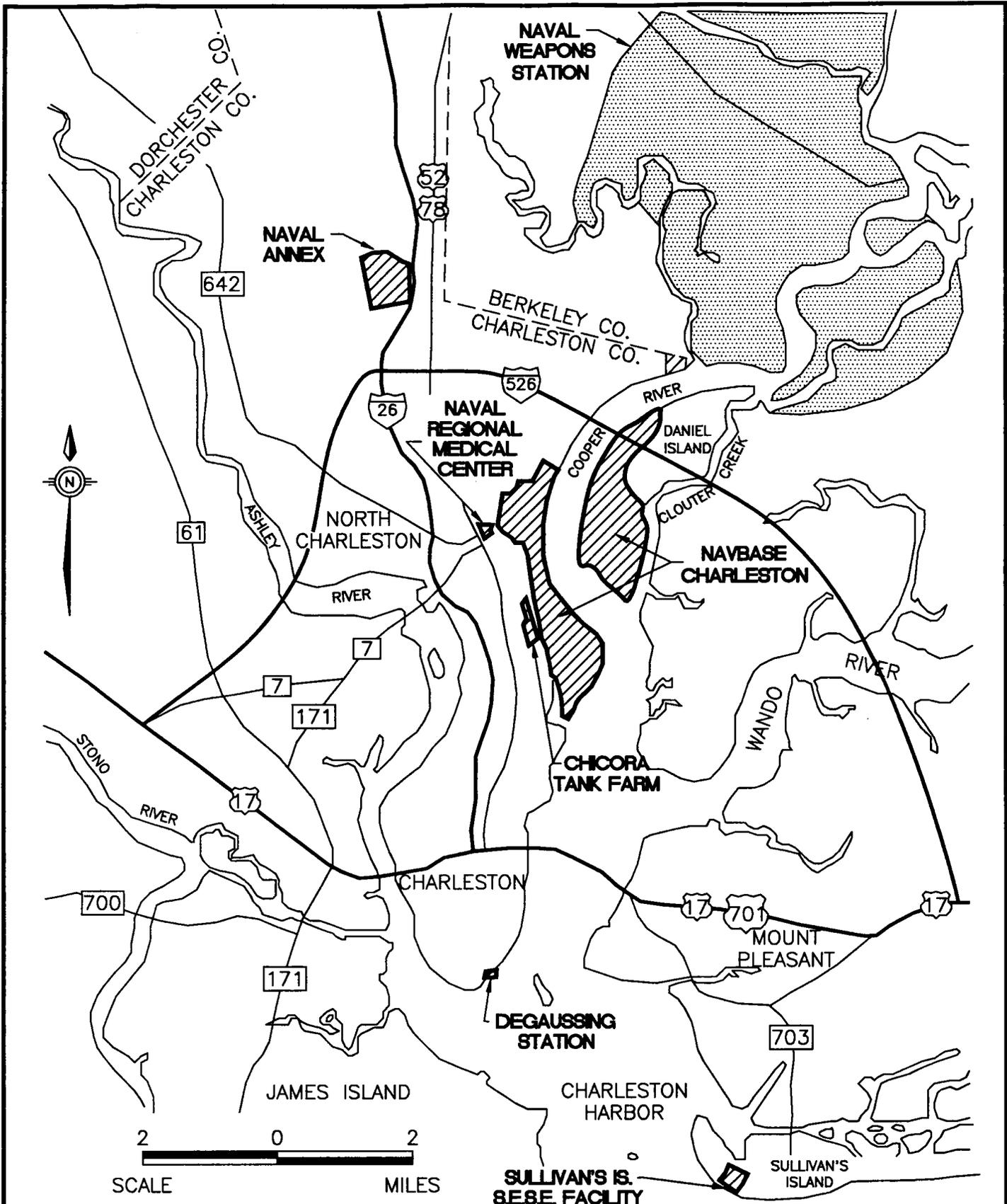
The areas surrounding NAVBASE are mature urban, having long been developed with commercial, industrial, and residential land uses. Commercial areas are primarily west of NAVBASE; industrial areas lie primarily north of NAVBASE and along the west bank of Shipyard Creek.

The area west of Shipyard Creek is concentrated with industrial users and has been for many years. Railways have served the area since the early 1900s. The presence of railways, when combined with nearby waterways, has made the area ideal for industry. While ownership has changed over time, the land adjacent to NAVBASE remains dedicated to chemical, fertilizer, oil refining, metallurgy, and lumber operations.

In contrast, the east bank of the Cooper River is undeveloped and contains extensive wetlands, particularly along Clouter Creek and Thomas Island. Active dredged materials disposal areas are on Navy property between the Cooper River and Clouter Creek.

History

In 1901, the U.S. Navy acquired 2,250 acres near Charleston to build a naval shipyard, and the first naval officer was assigned duty in early 1902. A work force was organized, the navy yard surveyed, and construction of buildings and a drydock began. The drydock was finished in 1909, along with several other brick buildings and the main power plant, which are still in use today. With a work force of approximately 300 civilians, the first ship was placed in drydock and work began on fleet vessels in 1910. World War I brought about an expansion of the yard, land area, and work force. Employment levels dropped following the war. Work increased at the yard beginning in 1933, when a larger workload, principally in construction of several Coast Guard tugs, a Coast Guard cutter, and a Navy gunboat, created the need for more facilities and a much larger work force.

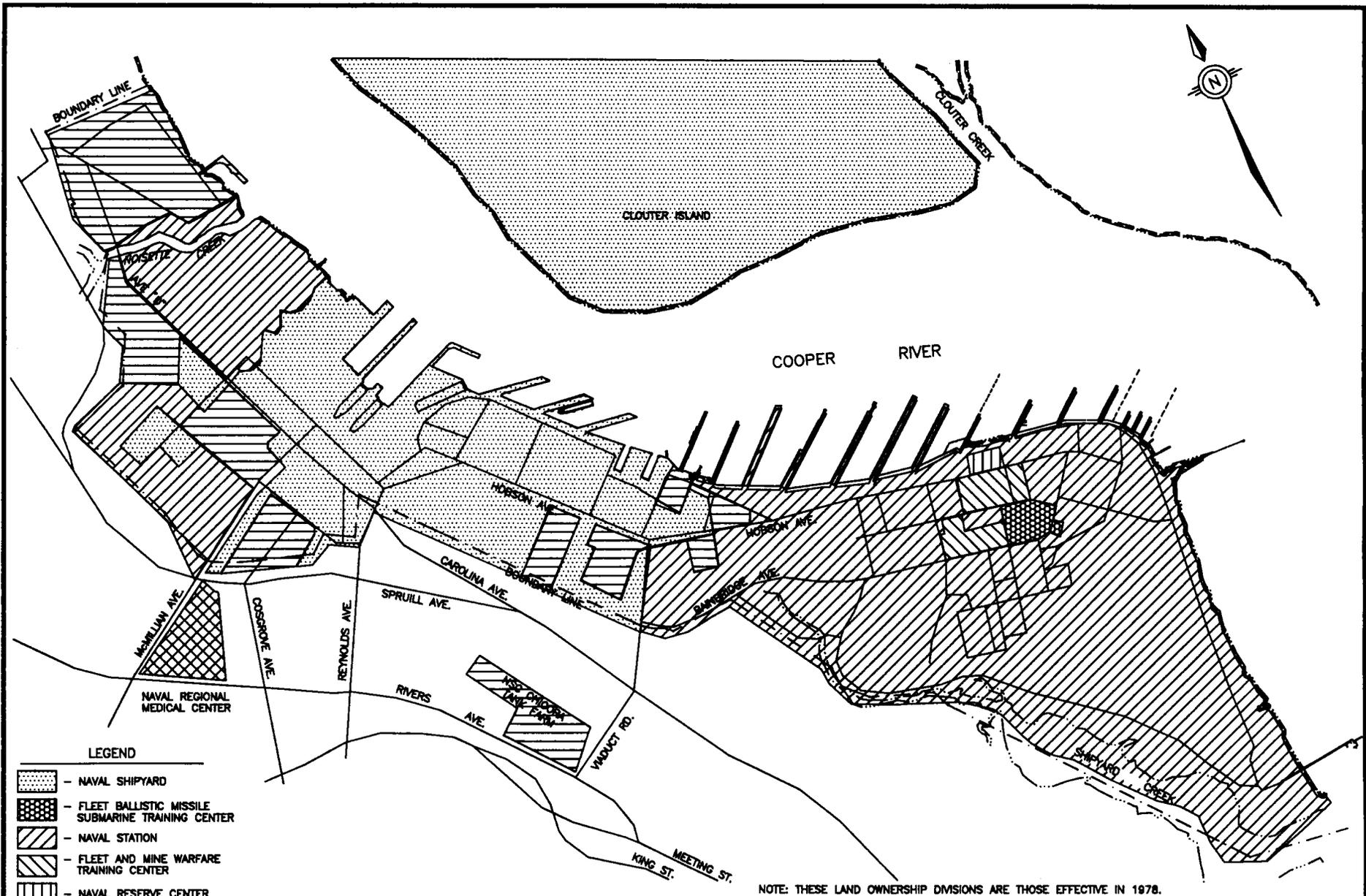


ZONE B
 RCRA FACILITY
 INVESTIGATION REPORT
 NAVAL BASE CHARLESTON
 CHARLESTON, S.C.

FIGURE 1.1
 LOCATION MAP
 NAVAL BASE CHARLESTON
 CHARLESTON, SOUTH CAROLINA

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- LEGEND**
- NAVAL SHIPYARD
 - FLEET BALLISTIC MISSILE SUBMARINE TRAINING CENTER
 - NAVAL STATION
 - FLEET AND MINE WARFARE TRAINING CENTER
 - NAVAL RESERVE CENTER
 - FLEET AND INDUSTRIAL SUPPLY CENTER
 - NAVAL REGIONAL MEDICAL CENTER

2000 0 2000
 SCALE FEET

SOURCES: SOUTHDIV, n.d. ESE, 1981.



ZONE B
 RCRA FACILITY
 INVESTIGATION REPORT
 NAVAL BASE CHARLESTON
 CHARLESTON, S.C.

NOTE: THESE LAND OWNERSHIP DIVISIONS ARE THOSE EFFECTIVE IN 1978.

FIGURE 1.2
 LOCATIONS OF
 LAND HOLDINGS AND OCCUPANTS

DWG DATE: 02/29/96 | DWG NAME: 29EBSLOB

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Civilian employment peaked in 1943 with almost 26,000 employees divided among three daily shifts. In 1956, construction began on new piers, barracks, and buildings for mine warfare ships and personnel. Later in the decade, Charleston became a major homeport for combatant ships and submarines of the U.S. Atlantic Fleet.

Base Closure

In 1993, NAVBASE Charleston was added to the list of bases scheduled for closure under the Defense Base Closure and Realignment Act (BRAC), which regulates the closure and transition of property to the community. As of April 1, 1996, operations have ceased and environmental cleanup has begun to make the property available for redevelopment.

1.2 Base Closure Process for Environmental Cleanup

The Installation Restoration Program

In 1980, the Department of Defense established the Installation Restoration Program (IRP) to investigate and clean up contamination which may have resulted from operations, storage, and disposal practices at federal facilities around the country. The Navy adopted this program, which has regulatory requirements similar to those developed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Although federal installations were not required to comply with this act until it was amended in 1986, the Navy has, in effect, been complying with its environmental regulations through participation in the IRP since 1980.

Resource Conservation and Recovery Act

The primary focus of NAVBASE environmental cleanup activities falls under RCRA, which was passed by Congress to control the handling of hazardous materials and wastes and to set standards for hazardous waste generation, transportation, treatment, storage, and disposal. NAVBASE was issued a hazardous waste permit in 1990 in accordance with this act, allowing the base to operate within these guidelines. Hazardous materials include substances such as

chemicals, pesticides, petroleum products, paints, and cleaners identified by the U.S. Environmental Protection Agency (USEPA) as being potentially harmful to human health or the environment.

The NAVBASE hazardous waste permit covers the investigation and cleanup of individual sites, called solid waste management units (SWMUs) and areas of concern (AOCs), resulting from past hazardous waste releases. SWMUs and AOCs are defined in the Part B permit as follows:

- **SWMU** — "Any unit which has been used for the treatment, storage, or disposal of solid waste at any time, regardless of whether the unit is or ever was intended for the management of solid waste. RCRA-regulated hazardous waste management units are also solid waste management units. SWMUs include areas that have been contaminated by routine and systematic releases of hazardous constituents, excluding one-time accidental spills that are immediately remediated and cannot be linked to solid waste management activities (e.g., product or process spills)."
- **AOC** — "Any area having a probable release of a hazardous waste or a hazardous constituent which is not from a solid waste management unit and is determined by the Regional Administrator to pose a current or potential threat to human health or the environment. Such areas of concern may require investigations and remedial actions as required under Section 3005(c)(3) of the Resource Conservation and Recovery Act and 40 CFR §270.32(b)(2) in order to ensure adequate protection of human health and the environment."

Where appropriate in this document, SWMUs and AOCs are collectively referred to as *sites*.

The investigation and cleanup activities are referred to as "corrective measures." The main steps of the corrective measures process are outlined as follows.

- *RCRA Facility Assessment (RFA)* identifies potential or actual contaminant releases through a records review and visual examination of each SWMU and AOC.
- *RCRA Facility Investigation (RFI)* confirms contamination and determines its nature. This investigation also examines the extent and rate of any migration and provides baseline data to evaluate corrective measures.
- *Corrective Measures Study (CMS)* determines and evaluates cleanup alternatives for the site. This study also recommends a preferred cleanup option or corrective measure.
- During *Corrective Measures Implementation (CMI)*, the selected corrective measure is designed, constructed, operated, maintained, and monitored for performance.
- *Interim Corrective Measures (ICMs)* are used to stabilize, control, or limit further releases from a site. Interim measures can be imposed at any point in the process.

1.3 Investigative Zone Delineation

Due to the size of the base and the level of detail required for investigations, NAVBASE has been divided into 12 investigative zones, identified as A through L, as shown in Figure 1.3.

The zone investigations and cleanups were ranked by the Restoration Advisory Board (RAB) and the BEST (Building Economic Solutions Together) committee (a board authorized by the state to study and report on the best reuse options for the property being transferred). In 1994, BEST was replaced by the Charleston Naval Complex Redevelopment Authority, which has authority to establish leases for the transferred property.

Zone B is in the northwest portion of NAVBASE. As shown in Figure 1.4, the zone is bounded by the Controlled Industrial Area (Zone E) and Building 234 to the south; the Cooper River to the east; Zone A to the north; and Avenue D, which includes the northeast portion of Zone C, to the west. Zone B consists primarily of former officer's quarters and a golf course and contains properties identified in the *Final Environmental Impact Statement for Disposal and Reuse of the Charleston Naval Base* (Ecology and Environment, Inc., June 1995) to be used for active recreation (e.g., golf course) or a cultural park or a waterfront park.

1.4 Current Investigation

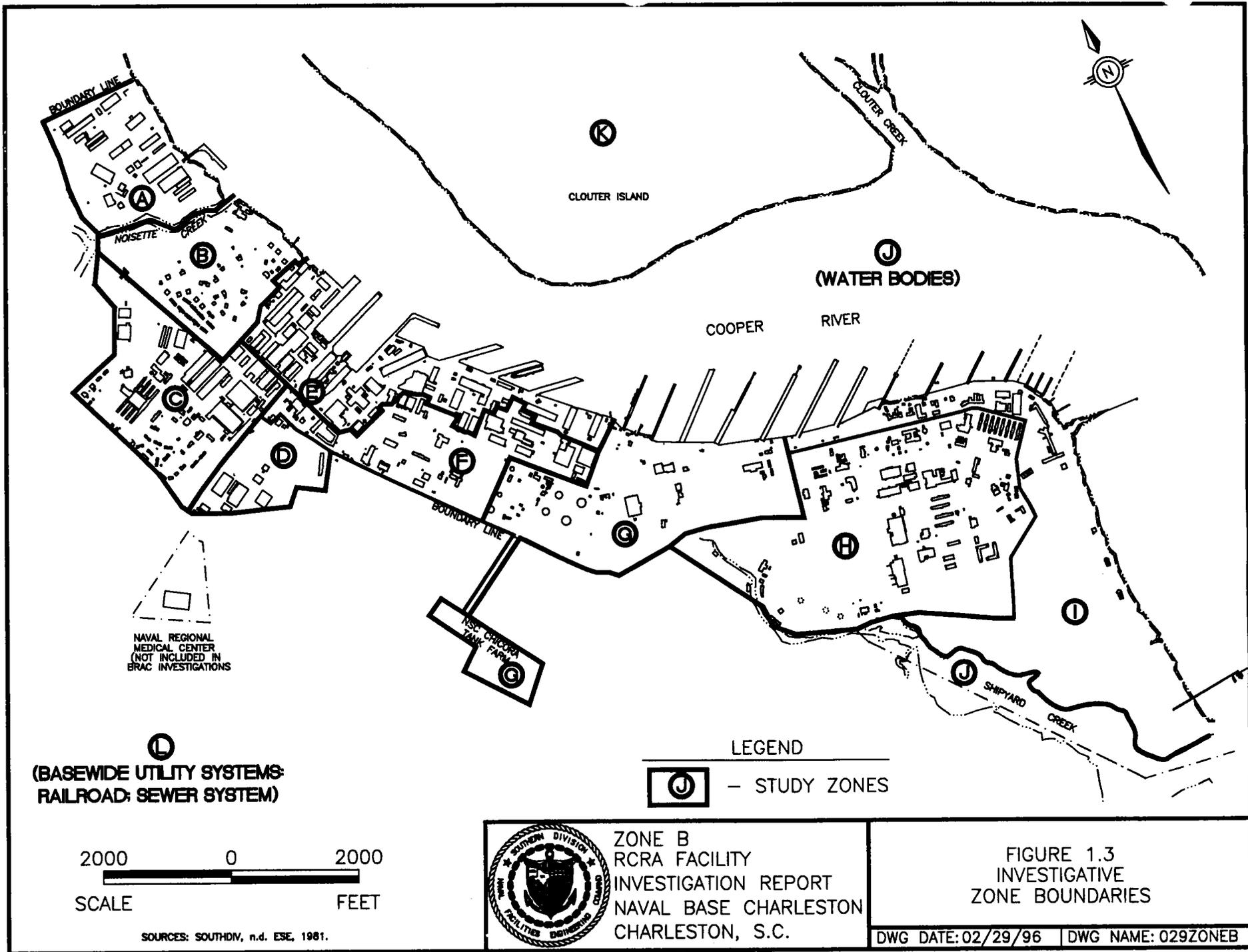
Objective

The objectives of the RFI are to characterize the nature and extent of contaminants associated with releases from SWMUs and AOCs, to evaluate contaminant migration pathways, and to identify both actual and potential receptors. The ultimate goal is to determine the need for ICMs or a CMS. This need will be evaluated by conducting a baseline risk assessment (BRA) to assess the risks posed to human health and the environment by individual and/or groups of sites within a zone.

Scope

The RFA process identified one site in Zone B requiring further investigation. This site, AOC 507 — Oil Storehouse, Former Building 1010, is discussed in detail in the *Final RCRA Facility Assessment* (E/A&H, June 1995).

The RFA recommendations for investigative approaches at NAVBASE sites were based on the best information available at that time and are subject to change should more information become available.



BOUNDARY LINE

CLOUTER ISLAND

(WATER BODIES)

COOPER RIVER

NOISETTE CREEK

SHIPYARD CREEK

NAVAL REGIONAL
 MEDICAL CENTER
 (NOT INCLUDED IN
 ERAC INVESTIGATIONS)

NSC CHARLESTON
 TANK FARM

LEGEND

— STUDY ZONES

(BASEWIDE UTILITY SYSTEMS:
 RAILROAD; SEWER SYSTEM)

2000 0 2000
 SCALE FEET

SOURCES: SOUTH DIV, n.d. ESE, 1981.

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These investigatory designations for individual sites are as follows:

- *No Further Investigation (NFI)* — This designation was applied to an AOC or SWMU if sufficient data were available during the RFA process to thoroughly assess the potential hazards associated with the site and to determine that it does not pose a threat to human health or the environment.
- *Confirmatory Sampling Investigation (CSI)* — This designation was applied to an AOC or SWMU if insufficient data were available during the RFA process to thoroughly assess the potential hazards associated with the AOC or SWMU. Generally, a limited amount of "confirmatory" samples are needed to determine whether a hazard exists. The result of the confirmatory sampling will determine whether no further investigation is appropriate or a full-scale RFI is warranted.
- *RFI* — This designation was applied to AOCs or SWMUs if visual evidence, historical information such as spill reports, or analytical data indicate that hazardous substances have been released to the environment. The RFI characterizes the site to determine the nature and extent of contamination, to identify migration pathways, to identify actual and potential receptors, and to evaluate the ecological and human health risks posed by the site.

The *Final Zones A and B RFI Work Plan* (E/A&H, September 1995) outlined the investigative strategy for AOC 507 to include a CSI. This RFI report addresses two sampling investigations: the CSI at AOC 507 (the only Zone B site included in the work plan) and Zone B "grid-based" sampling.

1.5 Previous Investigations

No sites in Zone B have been investigated previously.

1.6 RFI Report Organization

To facilitate review of the RFI report, sections have been formatted to discuss zone-wide information, overall technical approach, and evaluation methods first. These general informational sections are sequenced according to the natural progression of an RFI investigation. While this format is most applicable to zones with many sites, it was used for Zone B to maintain consistency between zones. The zone-wide sections are:

- 1.0 INTRODUCTION
- 2.0 PHYSICAL SETTING
- 3.0 FIELD INVESTIGATION
- 4.0 DATA VALIDATION
- 5.0 NATURE AND EXTENT OF CONTAMINATION
- 6.0 FATE AND TRANSPORT
- 7.0 HUMAN HEALTH RISK ASSESSMENT
- 8.0 ECOLOGICAL RISK ASSESSMENT
- 9.0 CORRECTIVE MEASURES

The site-specific sections are:

- 10.0 SITE-SPECIFIC EVALUATION
- 11.0 CONCLUSIONS

followed by:

- 12.0 REFERENCES
- 13.0 SIGNATORY REQUIREMENT

Section 10 of the RFI report follows the same chronology as Sections 1 through 9 (zone-wide) except on a site-specific basis for AOC 507. It includes the actual data summaries, risk calculations, and corrective measures evaluations specific to the site. In this manner, the entire investigation sequence, including conclusions, is contained within a specific tabbed section for easy reference. Section 10 also includes a summary of the grid-based sampling conducted in Zone B.

Section 11 of the RFI report summarizes the conclusions of Section 10. Section 12 is a compilation of references.

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2.0 NAVBASE PHYSICAL SETTING

2.1 Geology

2.1.1 Regional Physiographic and Geologic Description

NAVBASE is in the Lower South Carolina Coastal Plain Physiographic Province, on the Cooper River side of the Charleston Peninsula, which is formed by the confluence of the Cooper and Ashley rivers. Topography in the area is typical of the South Carolina lower coastal plain, having low-relief plains broken only by the meandering courses of sluggish streams and rivers which flow toward the coast past occasional marine terrace escarpments. NAVBASE is essentially flat. Elevations range from just over 20 feet above mean sea level (msl) in the northwest part of the base to sea level at the Cooper River. Most of the original topography at NAVBASE has been modified by activities such as dredge spoil deposition. The southern end of the base was originally tidal marsh drained by Shipyard Creek and its tributaries. The original elevations in other portions of the base were only slightly higher. The land surface at NAVBASE has been elevated with both solid wastes and dredged materials (primarily the latter) in increments over the last 93 years. Nonetheless, most of NAVBASE remains within the 100-year flood zone of less than 10 feet above msl.

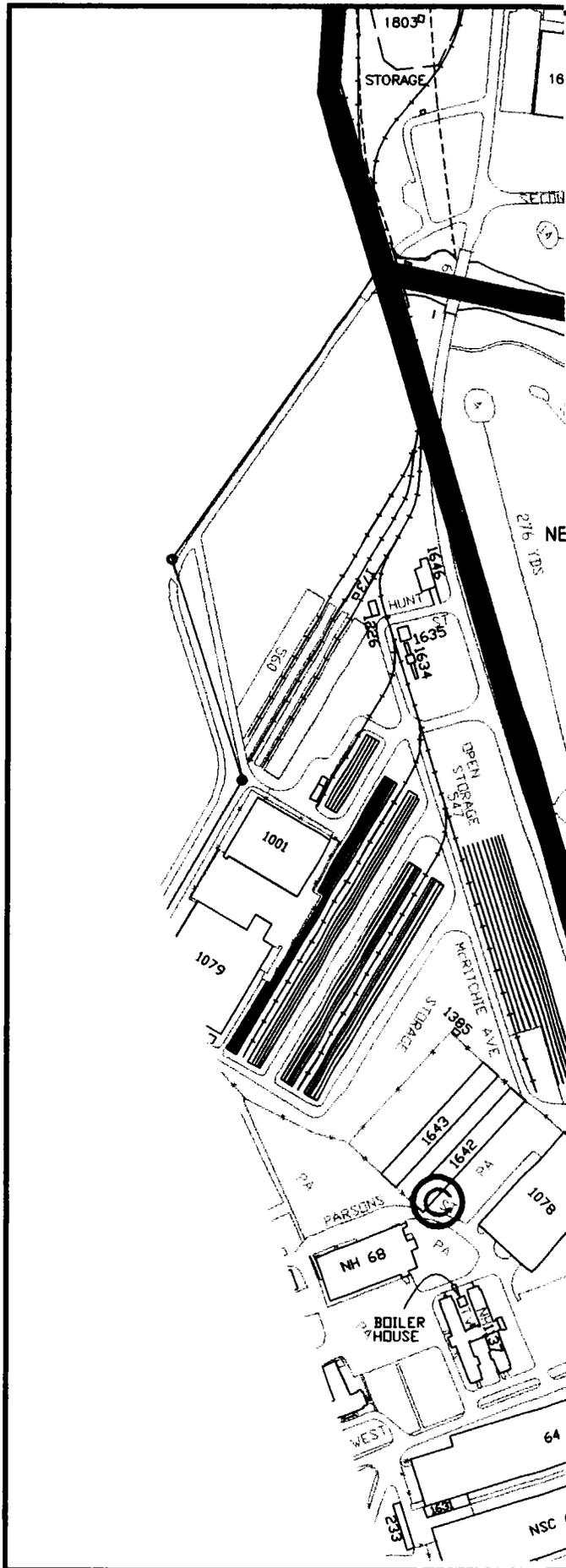
Charleston area geology is typical of the southern Atlantic Coastal Plain. Cretaceous and younger sediments thicken seaward and are underlain by older igneous and metamorphic basement rock. Surface exposures at NAVBASE, in the limited areas which remain undisturbed, consist of recent and/or Pleistocene sands, silts, and clays of high organic content referred to as the Wando Formation (Weems and Lemon, 1993). Underlying the Wando Formation, increasing with age, are the Oligocene-age Cooper Group and the Eocene-age Santee Limestone. The Cooper Group consists of the Parker's Ferry, Ashley, and Harleyville formations. The formation of particular importance in the Cooper Group is the Ashley Formation, which was formerly referred to as the Cooper Marl in most NAVBASE reports and regional geologic literature. In more recent geologic nomenclature, the name *Cooper* has been given to a group of formations which includes the Ashley Formation, which is a pale green to olive-brown,

sandy, phosphatic limestone or marl, locally muddy and/or sandy. The Ashley Formation in the vicinity of Charleston is encountered at a depth of approximately 30 to 70 feet below ground surface (bgs). The relief of the top of the Ashley Formation is associated with an erosional basin (Park, 1985). Park identifies the entire Cooper Group, of which the Ashley Formation is a member and hydrogeologically similar, as being approximately 300 feet thick.

Surface soil at NAVBASE has been extensively disturbed. Native soil is the fine-grained silt, silty sand, and clay typical of terrigenous tidal marsh environments. Sand lenses are present in localized areas; however, these are generally only a few feet thick. Much of NAVBASE, particularly the southern portion, has been filled using dredged materials from the Cooper River and Shipyard Creek. The dredged materials are an unsorted mixture of sands, silts, and clays. Most of the remainder of the base has been either filled or reworked.

2.1.2 NAVBASE Geologic Investigation

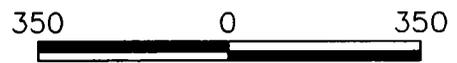
Geological and stratigraphic information has been obtained from soil and monitoring well borings installed during the RFIs for Zones H, I, C, E, A, and B. Data for the Zone B investigation have been assessed and are included in the geologic and hydrogeologic assessment presented in this report. The soil was classified and logged by an E/A&H geologist as described in the *Final Comprehensive Sampling and Analysis Plan RCRA Facility Investigation* (E/A&H, August 1994) (CSAP). Shelby tubes collected during soil sampling were analyzed for porosity, grain size, and vertical permeability. The depth of the deepest borehole in Zone B limited the information to the upper 105 feet of unconsolidated sediments. Figure 2.1 identifies all monitoring wells installed during the Zone B RFI investigation. Monitoring well construction diagrams and associated lithologic boring logs are included in Appendix A.



LEGEND

B

- RCRA INVESTIGATION ZONES
- — SHALLOW MONITORING WELL
- — DEEP MONITORING WELL
- — DEEP BORING, NO WELL INSTALLED



SCALE FEET



ZONE B
RCRA FACILITY
INVESTIGATION REPORT
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 2.1
MONITORING WELL LOCATION MAP
NAVAL BASE CHARLESTON
CHARLESTON, SOUTH CAROLINA

DWG DATE:11/19/96 | DWG NAME:29CHZB04

00 1600

Of the stratigraphic formations described in Section 2.1.1, only the Wando and Ashley Formations were encountered during the Zone B RFI. The lowermost stratigraphic unit identified is the Oligocene Ashley Formation of the Tertiary Cooper Group. Above the Ashley lies what are believed to be sediments of the Quaternary Wando Formation.

2.1.3 Wando Formation

Overlying the Ashley Formation and extending to ground surface (in areas not covered by dredged materials) is the Wando Formation which, based on the four deep borings drilled in Zone B (two completed as monitoring wells), ranges from approximately 20 feet thick at Boring GDB-02D to greater than 105 feet thick at NBCB-GDB-04D. Two Shelby tube samples were collected from the near-surface sediments (< 25 feet bgs) of the Wando Formation underlying Zone B. The average porosity for these samples was 43%. The grain-size distribution for these samples averaged 86% sand with 14% silt and clay. The reports from the Shelby tube samples are included as Appendix B.

Borings from the Zones H, I, and C RFIs suggest that the Wando Formation is generally composed of a basal sand unit, an intervening marsh clay layer, and an upper sand unit, each of which varies greatly in thickness and distribution. Observations from drilling the four deep borings in Zone B indicate that, locally, the Wando Formation is predominantly composed of marsh clay with occasional lenses of silty and clayey sand, well-sorted sand, silt, and sandy clay. The marsh clay is a dark gray to black, fat, silty clay with occasional thin sand lenses and disseminated plant material. It has a characteristic "rotten egg" odor signifying an oxygen-poor, reducing condition. The marsh clay layer is considered an aquitard; it does not readily yield water but serves as a storage unit.

The boring log for NBCB-GDB-01D illustrates the lithology encountered in the vicinity of the low-lying, golf course portion of Zone B. Stiff silty clay was present in this boring from the surface to 3 feet bgs, after which marsh clay predominated until 33 feet bgs. A well-sorted,

very fine to fine, silty sand was found from 33 to approximately 38 feet bgs followed by 2 feet of coarse gravel, phosphate nodules, and oyster shells in a poorly sorted sand and silt matrix. The Ashley Formation was encountered at the base of this gravel at 40 feet bgs.

Of note is a clay unit found beneath the lower aquifer in the Wando Formation but above the Ashley Formation in NBCB-GDB-04D and in several of the northern Zone E deep wells. The clay is dark gray, firm to stiff, medium to high in plasticity, and typically thinly interbedded with sand lenses and shell hash in its upper 5 to 10 feet. The remainder of the section is a clean, tight, silty clay that appears to be a dewatered marsh clay, showing characteristics typical of an aquitard or confining unit, but not associated with the Ashley Formation. The bottom of the clay unit and the top of the Ashley Formation were never encountered when drilling at these locations in Zones B or E. It appears that this unit may be a channel-fill deposit that has filled scoured sections in the Ashley Formation.

The boring log for NBCB-GDB-04D illustrates the lithology encountered near the residential portion of Zone B and shows the dewatered marsh clay. This section of Zone B consists of undulating, hummocky topography and encompasses some of the highest elevations at NAVBASE. Well-sorted, very fine to fine sand and silty sand with occasional clay lenses predominate the lithology from the ground surface to 47 feet bgs. Marsh clay with thin sand laminae and shell fragments was present from 47 to 55 feet bgs. Thinly interbedded, very fine to fine sand and plastic clay with shell fragments were found from 55 to 75 feet bgs. Stiff clay with several thin, very fine to fine sand laminae and disseminated shell fragments were found to 78 feet bgs overlying the dark gray, stiff, plastic, dewatered marsh clay. The dewatered marsh clay extended throughout the remaining 37 feet of the borehole to 105 feet bgs.

2.1.4 Ashley Formation

The Ashley Formation is an olive-yellow to olive-brown, tight, slightly calcareous silt with varying amounts of very fine sand and clay. It is firm to stiff, slightly plastic, and rapidly

decreasing in moisture with depth. The Ashley Formation is of importance because of its role as a confining unit between the lower members of the Cooper Group and Santee Limestone and the overlying water-bearing strata of the Wando Formation (Park, 1985).

The Wando Formation lies unconformably on the Ashley Formation, resulting in a paleo-erosional surface. Generally, a lag deposit may be found on top of the Ashley Formation that typically consists of pebble to gravel-sized phosphate nodules, oyster shells, medium to coarse sand and shell hash. These characteristics are indicative of a high-energy depositional environment and add further evidence to the scoured nature of the Ashley Formation. This variability in depth of the Ashley Formation was evident in Zone B, ranging from 20 feet to greater than 105 feet bgs. Paleogeologic maps of the top of the Ashley Formation in Zones I and H show similar elevation differences. A paleogeologic map has been constructed for Zone B using data from Zones A, C, and E. However, the Ashley Formation was not directly encountered in NBCB-GDB-04D and in deep boreholes in Zone E near the perimeter of Zone B. As a result, Figure 2.2 depicts the top of either the Ashley Formation or the dewatered marsh clay, which act as the confining unit beneath the Wando Formation. Each deep borehole location in Figure 2.2 is labeled, indicating which unit was encountered.

Figures 2.3 and 2.4 are geologic cross sections that present the stratigraphic relationship of the various units in the Wando Formation and the underlying confining layer of the Ashley Formation or dewatered marsh clay. The cross-section locations, labeled A-A' and B-B', are shown on Figure 2.1.

2.1.5 Soil

Surface soil at NAVBASE has been extensively disturbed. Native soil is the fine-grained silt, silty sand, and clay typical of tidal marsh environments. Sand lenses are present in localized areas; however, these are generally only a few feet thick. Much of NAVBASE, including areas within Zone B along Noisette Creek, have been filled using dredge materials from the

Cooper River and Shipyard Creek. The dredged materials are an unsorted mixture of sand, silt, and clay. The remaining area that includes Zone B is higher in elevation and is considered native soil.

2.2 NAVBASE Hydrogeology

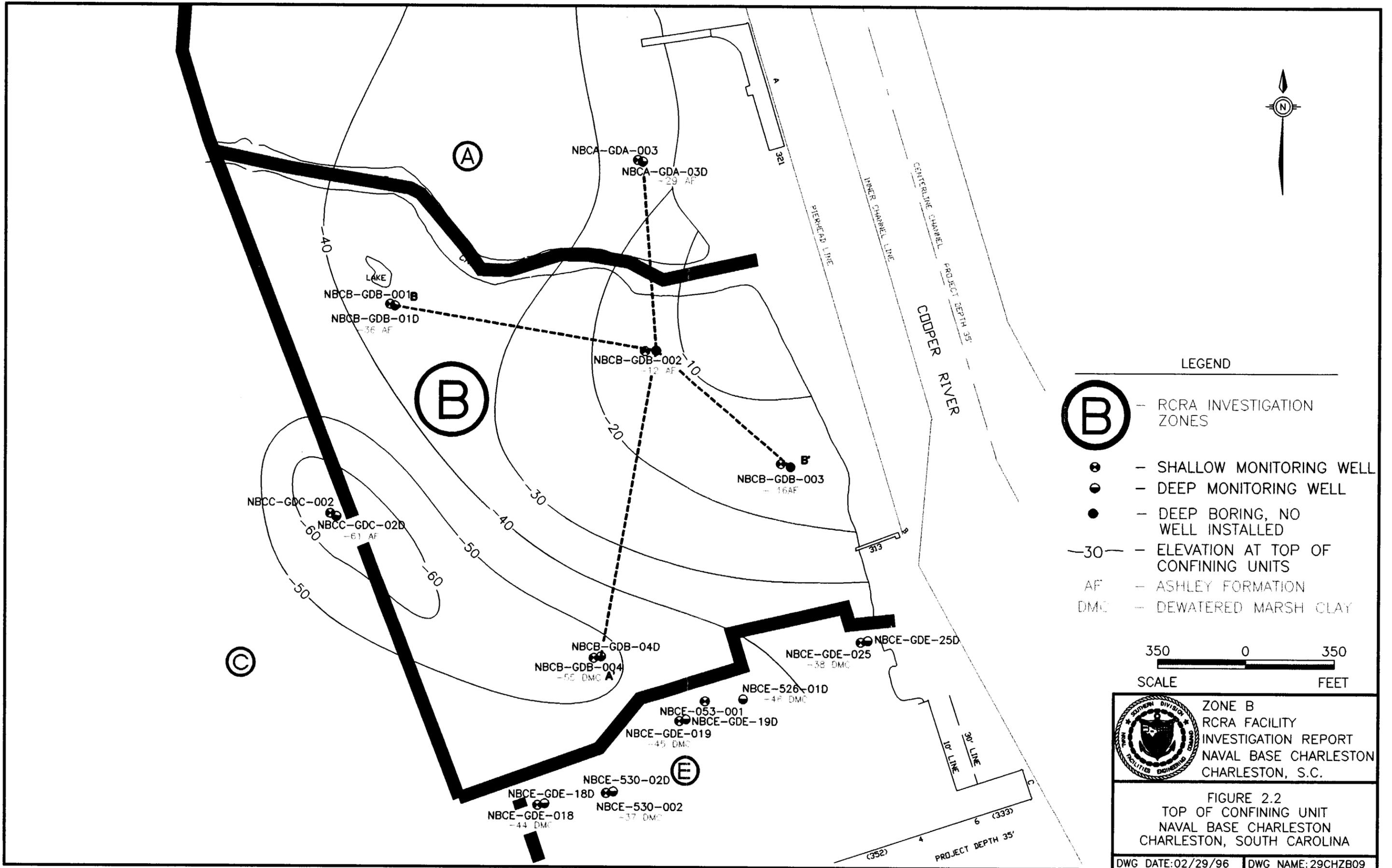
2.2.1 Regional Hydrologic and Hydrogeologic Background

Parts of the southern portion of NAVBASE are drained by Shipyard Creek, while northern areas are drained by Noisette Creek. The drainage basins of both waterways include areas other than NAVBASE. These waterways are tributaries of the Cooper River. Surface drainage over the remainder of NAVBASE flows directly into the Cooper River, which discharges into Charleston Harbor.

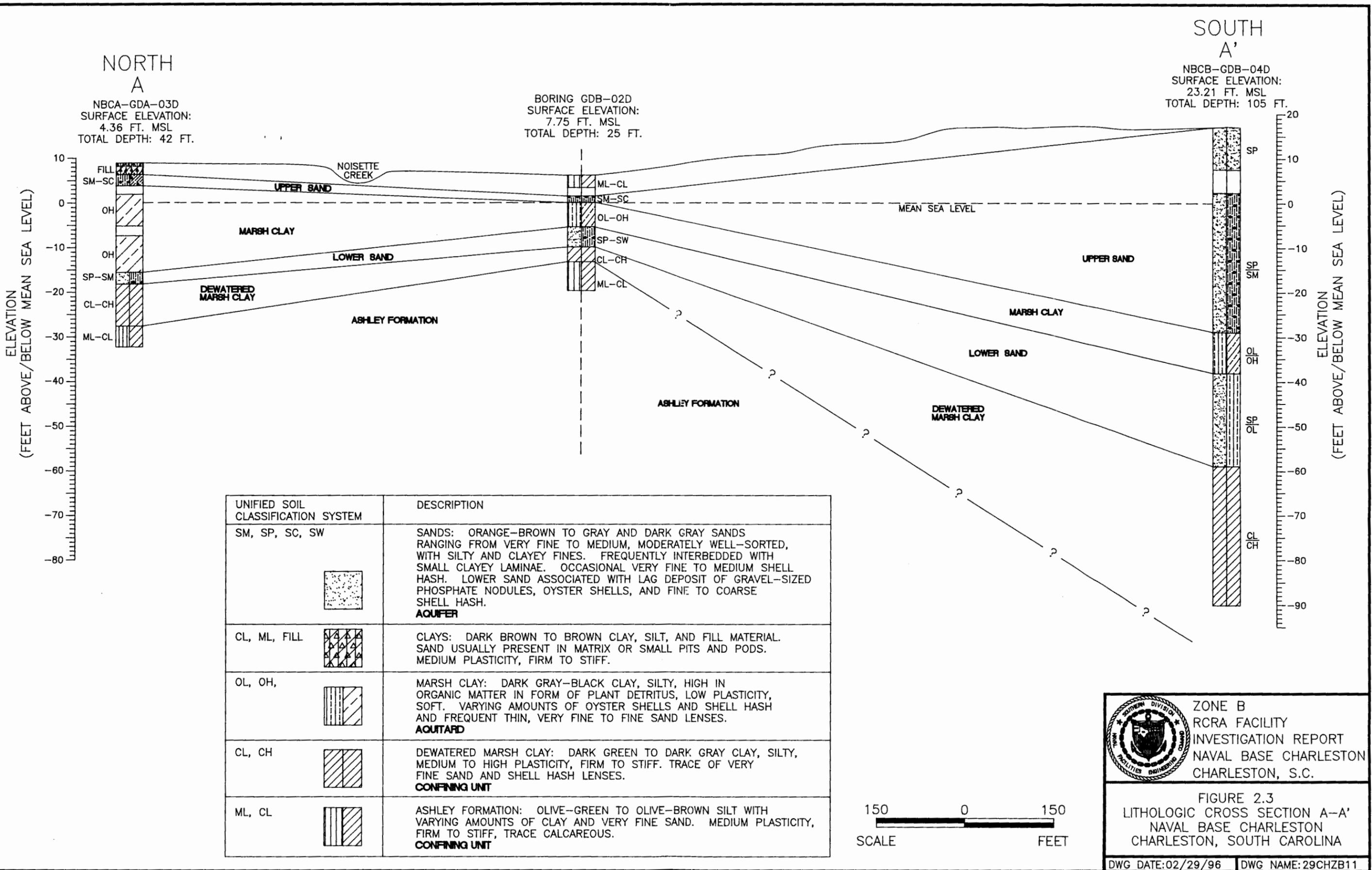
Shipyard Creek, a small tidal tributary approximately two miles long, flows southeast along the southwestern boundary of NAVBASE to its confluence with the Cooper River opposite the southern tip of Daniel Island. Piers lie along the western shore of the channel's lower mile, while the entire length of the eastern shore is bounded by tidal marshland.

Noisette Creek, which transects the northern portion of NAVBASE, is a tidal tributary approximately 2.5 miles long. The creek flows nearly due east from its headwaters in the city of North Charleston and empties into the Cooper River.

Groundwater occurs under water table or poorly confined conditions within the Pleistocene deposits overlying the Cooper Group. Transmissivities in the Pleistocene aquifer are generally less than 1,000 square feet per day (ft²/day) and well yields are variable, ranging from 0 to 200 gallons per minute (gpm). This groundwater contains high concentrations of iron and is commonly acidic at shallow depths (Park, 1985).



COOPER RIVER



ZONE B
RCRA FACILITY
INVESTIGATION REPORT
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 2.3
LITHOLOGIC CROSS SECTION A-A'
NAVAL BASE CHARLESTON
CHARLESTON, SOUTH CAROLINA

DWG DATE: 02/29/96 | DWG NAME: 29CHZB11

The Cooper Group is hydrogeologically significant mainly because of its low permeability. In most locales, its sandy, finely granular limestones produce little or no water and act as confining material that produces artesian conditions in the underlying Santee Limestone (Park, 1985).

The Santee Limestone aquifer is typically artesian, except in outcrop areas. Yields from wells in the Santee are typically less than 300 gpm (Park, 1985).

2.2.2 NAVBASE Hydrogeologic Investigation

Hydrogeological information was obtained from slug test analysis and water level measurements conducted during the Zone B RFI. Estimates of vertical permeability, grain-size distribution, and porosity were obtained from laboratory analysis of Shelby tube samples collected during drilling.

2.2.3 Lower Confining Unit

The high clay and silt content, laterally consistent overall thickness, and very low vertical permeabilities of the Ashley Formation strongly suggest that this formation serves as an aquitard beneath Zone B. Shelby tube samples collected from the Ashley in Zone H exhibited a very low average vertical hydraulic conductivity of 0.0027 feet per day. According to Fetter (1988), sediments with permeabilities of 10^{-5} centimeters per second (cm/sec) (0.03 feet/day) or less can be considered confining units. The low vertical permeability found in the Ashley indicates an extremely low potential for groundwater movement through the unit. As an aquitard, the Ashley serves as a lower confining unit to the water-bearing sediments of the overlying Wando Formation.

2.2.4 Shallow Aquifer

As shown on the cross-section diagrams (Figures 2.3 and 2.4), the upper and lower sand layers in the Wando Formation were encountered in the deep borings at Boring GDB-02D and NBCB-GDB-04D. These two sand layers are distinct water-bearing units. As discussed in the

Zones H and I RFI reports, the intervening marsh clay layer serves as an aquitard separating the upper and lower sands. The upper sand layer was not encountered at either NBCB-GDB-01D or NBCB-GDB-04D.

The upper sand layer is considered an unconfined aquifer at NAVBASE. Data from Zone B reflect this distinction. A Shelby tube sample collected at NBCB-GDB-004 exhibited a high sand content of approximately 91% and a vertical permeability of 0.45 feet/day. This permeability value is consistent with those for unconsolidated fine sand and silty sand of greater than 0.03 feet/day (Fetter, 1988). The upper sand may be semiconfined in areas where it is overlain by marsh clay or silty-clay fill material.

Water levels were generally encountered within 4 to 6 feet bgs in wells screening the upper sand in the low-lying golf course portion of Zone B (NBCB-GDB-001 - NBCB-GDB-003). These wells best represent water levels in the shallow sand aquifer and appear to be characteristic of an unconfined system.

The high silt and clay content of the marsh-clay layer makes it a viable aquitard that impedes flow between the sand layers. Analyses from four Shelby tube samples collected during the Zone I RFI had an average vertical hydraulic conductivity of 0.001 feet/day, 2.7 times lower than that of the Ashley Formation.

A Shelby tube collected from the lower sand aquifer at NBCB-GDB-002 exhibited a high sand content of 82% and a vertical permeability of 6.4 feet/day. The lower sand is considered to be semiconfined to confined by the intervening marsh clay layer because water levels in wells screened across the lower sand rise above the bottom of the unit. Water levels at the two deep wells in Zone B, NBCB-GDB-01D and NBCB-GDB-04D, are approximately 4.6 and 24 feet bgs, respectively. This large variation is due to approximately 20 feet of relief from NBCB-GDB-04D in the residential section to NBCB-GDB-01D at the golf course. These water

levels reflect conditions in the lower sand unit, and in both cases suggest semiconfined conditions.

The difference in water levels between the shallow and deep well pairs (NBCB-GDB-001/NBCB-GDB-01D and NBCB-GDB-004/NBCB-GDB-04D) was consistently 0.2 to 0.3 feet between the upper and lower sand units. Because the shallow well NBCB-GDB-002 is screened across both the upper and lower sand layers, its water levels will reflect conditions in both aquifers.

2.2.5 Groundwater Flow Direction

Water levels in the shallow aquifer were measured during low, mid, and high tides on February 12, 1996, in the shallow wells in Zones A and B. Also measured were selected wells in Zones C and E near the perimeter of Zone B to obtain additional groundwater data and better understand groundwater flow near the boundaries of Zone B. The emphasis of this exercise was to determine what effects, if any, tidal ranges in Noisette Creek and the Cooper River exhibited on groundwater flow within Zone B. Two measuring points on Noisette Creek (at the railroad bridge west of the junction of Zones A, B, and C and the golf course footbridge between Zones A and B) and one in the southeastern section of Zone B at Pier B on the Cooper River were selected to determine the height of the surface water. These points were surveyed the following day to produce surface water elevations.

Tidal fluctuations produced less than 0.1 foot variations in all of the Zone B shallow wells. While the surface water was found to vary greatly with tidal events, there was no significant change in groundwater flow direction within Zone B. This may be seen in Figures 2.5 and 2.6, which depict the equipotential surface during the low and high tides, respectively. These were plotted without surface water data due to the limited interaction between surface water and groundwater.

Three shallow wells in Zone B were screened in the upper portion of the Wando Formation in either the upper sand and/or the intervening marsh clay (NBCB-GDB-001, -003 and -004). As mentioned previously, NBCB-GDB-002 was screened in both the upper and lower sand aquifers, but was included in the potentiometric surface maps because of the lack of disparity observed in water levels at the grid well pairs in Zone B. The wells in Zones A and C that were integrated into this effort were either screened entirely in the upper sand aquifer or both the upper sand and underlying marsh clay aquitard.

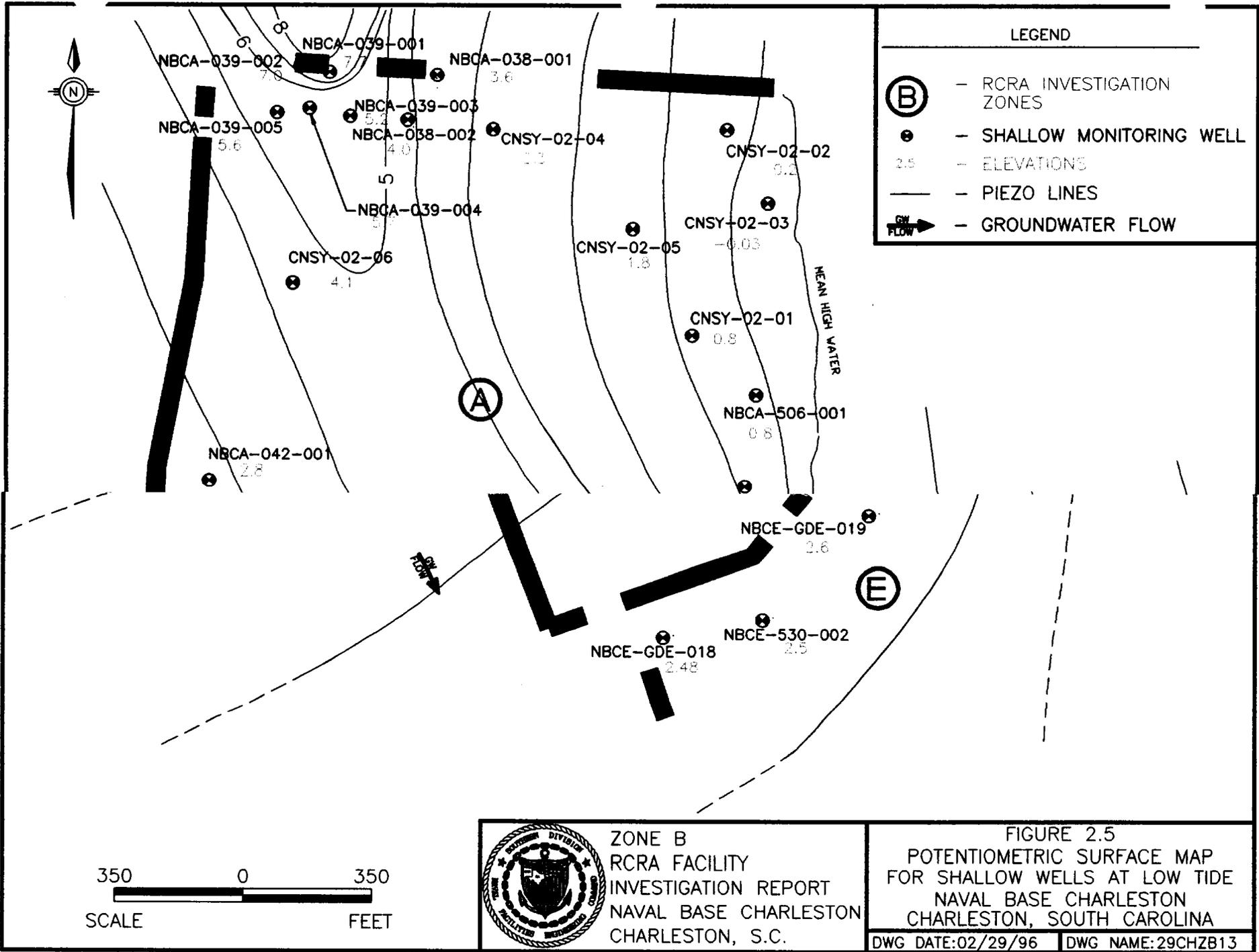
Figures 2.5 and 2.6 show that a groundwater divide crosses Zone B trending west to east. This suggests that the west-central section of Zone B extending west into Zone C acts as a recharge zone for the shallow aquifer. Water to the north of this divide flows east and north toward Noisette Creek. To the south, water flows southeast toward most of the residential section in Zone B and the northern portion of Zone E. Water in the eastern third of Zone B flows to the Cooper River.

A Zone B potentiometric surface map for deep wells in the lower sand aquifer was not constructed due to the limited number and spacing of deep wells. The deep wells will, however, be used in potentiometric surface maps encompassing Zones A, B, C, and the northern portion of E and will be presented in the Zone A RFI Report.

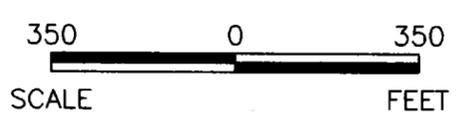
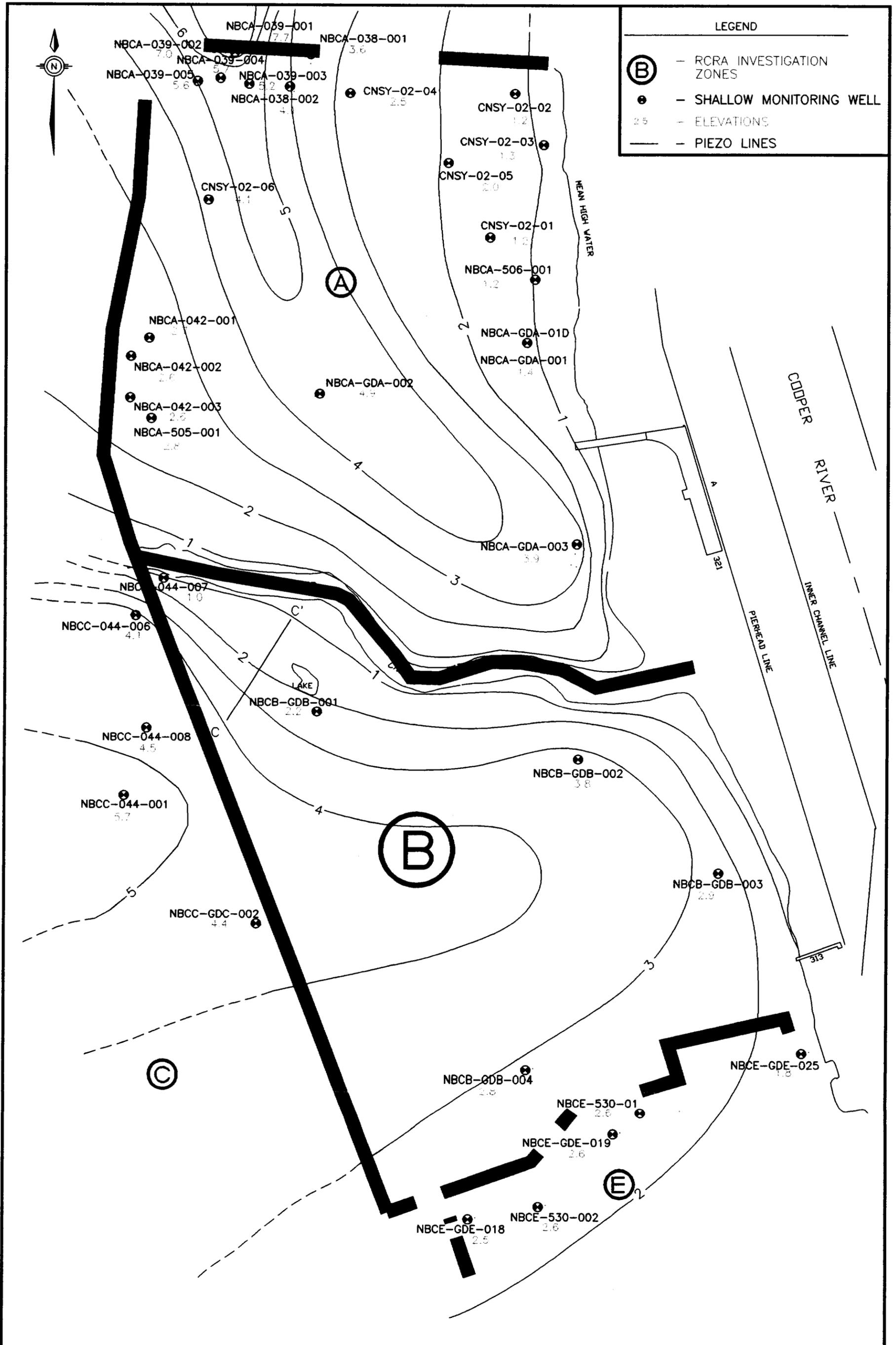
2.2.6 Vertical Hydraulic Gradient

Water levels at the two shallow/deep well pairs in Zone B show a positive vertical hydraulic gradient during both low and high tide. Positive gradients indicate a downward potential for vertical flow whereas negative gradients indicate potential for upward flow.

Table 2.1 presents the calculated vertical hydraulic gradients between the shallow/deep well pairs. The vertical gradients were calculated by dividing the differences between shallow and deep water level elevations by the vertical distance between the bottoms of the respective well screens.



00 10 1



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CHARLESTON, S.C.

FIGURE 2.6
POTENTIOMETRIC SURFACE MAP
FOR SHALLOW WELLS AT HIGH TIDE
NAVAL BASE CHARLESTON
CHARLESTON, SOUTH CAROLINA
DWG DATE:02/29/96 DWG NAME:29CHZB12

Table 2.1
Vertical Hydraulic Gradients

Well Pair	Tide	Groundwater Elevation Difference (ft)	Vertical Distance (ft)	Vertical Hydraulic Gradient (ft/ft)
NBCB-GDB-001/ NBCB-GDB - 01D	High Low	0.28 0.36	27.2	0.010 0.013
NBCB-GDB-004/ NBCB-GDB - 04D	High Low	0.21 0.23	48.8	0.004 0.005

A vertical hydraulic gradient map will not be constructed for Zone B because data from only two deep wells are available. These data will be included in the Zone A RFI report in a map depicting the vertical hydraulic gradient across this region at NAVBASE.

2.2.7 Horizontal Hydraulic Gradient

The potentiometric maps (Figures 2.5 and 2.6) were examined to find the highest and lowest horizontal hydraulic gradient for the shallow wells. None of the Zone B wells may be connected together with a line that is parallel to a groundwater flowpath, and consequently, perpendicular to the equipotential lines. However, lines may be drawn from Zone B wells to other wells that lie beyond the perimeter of Zone B in Zones C and E that closely parallel groundwater flowpaths. Table 2.2 presents the horizontal hydraulic gradients between the appropriate wells in Zone B and wells in Zones C (NBCC-GDC-002 and NBCC-044-001) and E (NBCE-GDE-018) and for high and low tide water level data illustrated in Figures 2.5 and 2.6.

Two other flowpath lines added to Figures 2.5 and 2.6 may represent groundwater flowpaths based on the contouring of the equipotential lines. One is labeled C-C' and represents flow in the vicinity of NBCB-GDB-001/NBCB-GDB-01D. The other represents flow from NBCB-GDB-002 north to Noisette Creek. It should be noted that these lines are purely based on the contoured data and represent order-of-magnitude estimates of horizontal hydraulic gradients.

Table 2.2
Horizontal Hydraulic Gradient

Measurement Points	Tide	Gradient
NBCC-GDC-002 to NBCB-GDB-003 (shallowest gradient)	High Low	0.00084 0.00086
NBCC-GDC-002 to NBCE-GDE-018	High Low	0.00128 0.00132
NBCC-044-001 to NBCB-GDB-001	High Low	0.00424 0.00425
Line C to C'	High Low	0.006 0.006
NBCB-GDB-002 to Noisette Creek (steepest gradient)	High Low	0.0130 0.0176

2.2.8 Hydraulic Conductivity

Rising and falling head slug tests were conducted in selected wells to determine hydraulic conductivity values in the upper and lower aquifer. The hydraulic conductivities for upper and lower aquifer depths are presented in Tables 2.3 and 2.4. Inserting the slug produced falling head data and withdrawing the slug produced rising heads.

Table 2.3
Zone B
Shallow-Well Slug Test Hydraulic Conductivity Results in feet/day

Well	Rising Head Hydraulic Conductivity	Falling Head Hydraulic Conductivity	Geometric Mean ^a
NBCB-GDB-001	0.00134	Not Used	0.00134
NBCB-GDB-002	0.855	0.734	0.792
NBCB-GDB-004	7.24	8.67	7.92

Note:

^a = Average calculated using the falling and rising head values.

Table 2.4
Zone B
Deep-Well Slug Test Hydraulic Conductivity Results in feet/day

Well	Rising Head Hydraulic Conductivity	Falling Head Hydraulic Conductivity	Geometric Mean ^a
NBCB-GDB-04D	0.276	Not Used	0.276

Note:

^a = Average calculated using the falling and rising head values.

Data from the slug tests were compiled using the computer program AQTESOLV (Aquifer Test Solver) by Geraghty and Miller Modeling Group (1989). Rising and falling head slug test data from the shallow aquifer were plotted using an unconfined aquifer solution. For this solution, elapsed time versus displacement (change in water levels) was plotted on a semilogarithmic graph. Hydraulic conductivity (K) was computed by the program using an equation developed by Bouwer and Rice (1976) for unconfined aquifers.

The slug test data collected from the deep wells were plotted using a solution developed by Cooper et al. (1967) to generate a value for transmissivity in a confined aquifer. Although boring logs and other geologic evidence indicate a confined condition in this zone and that the well fully penetrated the lower aquifer, the data from several of the wells did not fit this solution. An unconfined Bouwer and Rice solution was applied to the data and a fit was made. Consequently, conductivity values for the deep wells may not be as reliable. The output from the program is included in Appendix C. The well identifications were denoted with a -0 or -1 representing rising and falling head tests, respectfully.

Both rising and falling head slug tests were conducted on 67% of the wells installed in Zone B.

Because hydraulic conductivity data are lognormally distributed, the geometric mean is the best measure of central tendency (CT). Therefore, the average hydraulic conductivity for each well is presented as the geometric mean of the falling and rising head values when applicable.

The geometric means of hydraulic conductivity based upon slug-tested shallow wells varied from 0.001 to 8 feet/day and reflected the variation between marsh clay and sand deposits. Although slug tests were conducted on both deep wells in Zone B, conductivity could be determined from only one well. Therefore, no meaningful comparisons can be made.

The mean hydraulic conductivities from Tables 2.3 and 2.4 were plotted next to their respective wells to produce Figure 2.7.

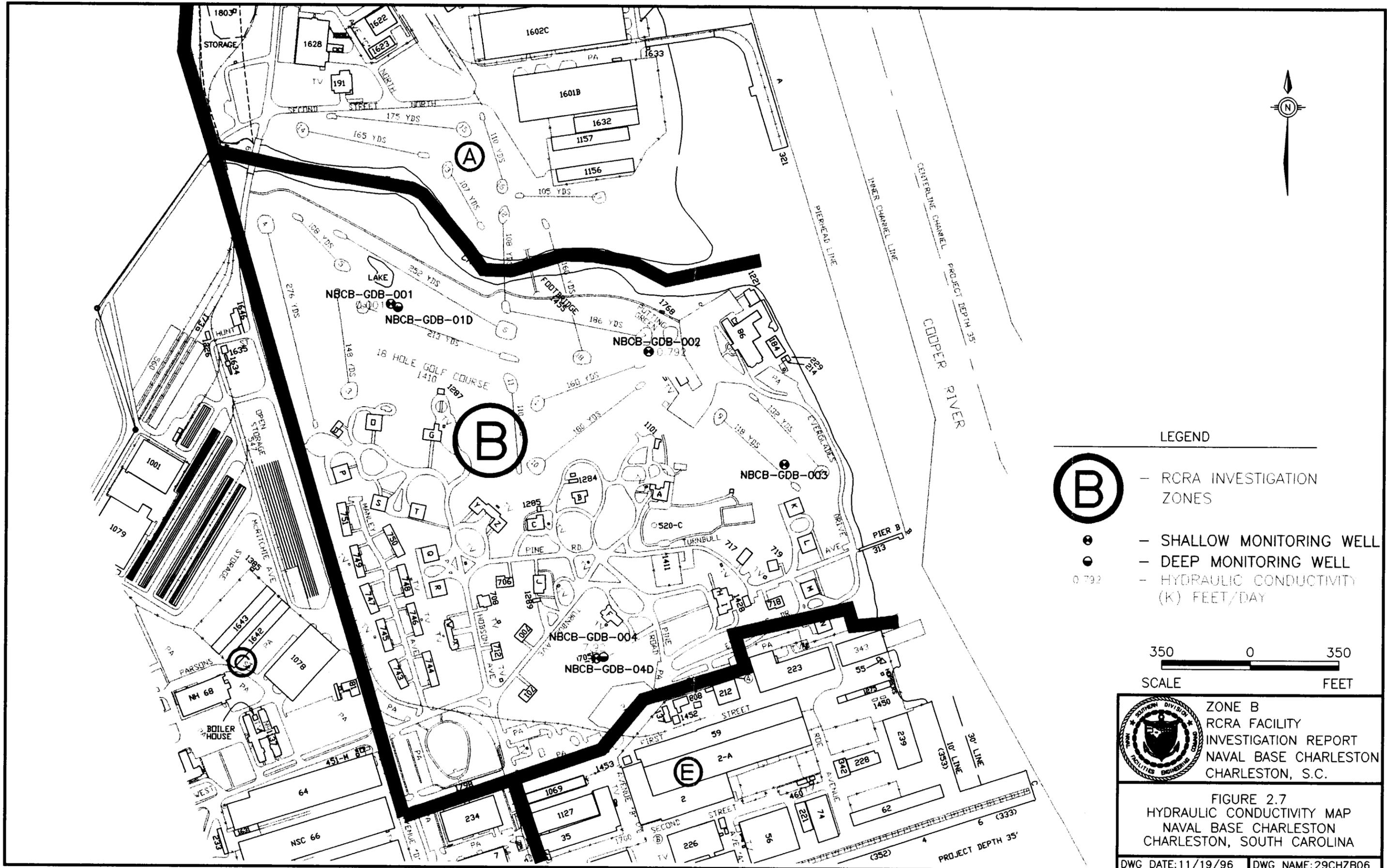
2.2.9 Horizontal Groundwater Velocity

To estimate the rate at which groundwater and possibly dissolved contaminants are migrating, groundwater velocity was calculated using the following formula:

$$V = \frac{K * i}{n_e}$$

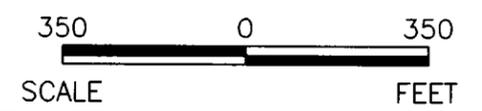
Where:

- V = horizontal groundwater velocity
- K = hydraulic conductivity
- i = horizontal hydraulic gradient
- n_e = effective porosity



LEGEND

- (B)** - RCRA INVESTIGATION ZONES
- - SHALLOW MONITORING WELL
- - DEEP MONITORING WELL
- 0.792 - HYDRAULIC CONDUCTIVITY (K) FEET/DAY




ZONE B
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 NAVAL BASE CHARLESTON
 CHARLESTON, S.C.

FIGURE 2.7
 HYDRAULIC CONDUCTIVITY MAP
 NAVAL BASE CHARLESTON
 CHARLESTON, SOUTH CAROLINA
 DWG DATE: 11/19/96 DWG NAME: 29CHZB06

000018002

The average porosity of 43% found in the Wando Formation was used as the effective porosity in the equation. The hydraulic gradients and geometric mean hydraulic conductivities were obtained from Sections 2.2.7 and 2.2.8.

Table 2.5 presents estimated maximum groundwater velocity at selected locations using the parameters and formula presented above. Hydraulic conductivity values used in the calculations are selected based upon the proximity of slug test data and lithology. Due to the limited differences in the horizontal gradient with respect to tidal ranges as seen in Table 2.2, only the highest gradient for each measurement point will be used to compute velocity. The flowpaths selected for use in calculating flow velocities from Figure 2.5 were used only if a representative hydraulic conductivity was available. No velocity estimates were made for the deep aquifer due to the limited availability of data for accurately determining groundwater flow directions since there are only two deep wells in Zone B.

**Table 2.5
 Groundwater Velocity Results**

Flowpath	Hydraulic Conductivity (ft/day)	Maximum Hydraulic Gradient (ft/ft)	Estimated Maximum Velocity (ft/day)
NBCC-GDC-002 to NBCE-GDE-018	7.92	0.0013	0.024
NBCC-044-001 to NBCB-GDB-001	0.00134	0.0043	0.000013
Line C to C'	0.00134	0.006	0.000019
NBCB-GDB-002 to Noisette Creek	0.792	0.018	0.033

The conductivity used in calculating groundwater velocity for the flowpath from NBCC-GDC-002 to NBCE-GDE-018 was that from well NBCB-GDB-004 since a conductivity

value was not available for the Zone E well. The value for NBCB-GDB-004 is roughly twice the conductivity value of 4.4 feet/day found at NBCC-GDC-002 during the Zone C RFI. Both conductivity values are believed to be representative of the residential portion of Zone B based on topography and the thicknesses of sand in the well logs.

The results in Table 2.5 reflect the heterogeneity in lithology that exists in Zone B. The low velocity values strictly mimic the low conductivity values in the low-lying golf course region near Noisette Creek, where marsh clay is the predominant lithology. Conversely, the high velocities are found where sand was the abundant lithology and conductivities were 100 to 1,000 times greater than those in the marsh clay. Consequently, the groundwater velocity will vary greatly depending upon the composition and direction of groundwater flow within the shallow aquifer at any point in Zone B.

2.3 Climate

The climate of the Charleston Harbor area is typically mild compared to other areas farther inland. The mountains in the northern portion of the state serve as a barrier to cold air masses from the northwest, and the Bermuda high pressure system limits the progress of cold fronts into the area. These conditions produce relatively mild, temperate winters. Summers are hot and humid, but relatively moderate with regard to temperature extremes. Moderate summer temperatures are largely due to the influence of the Gulf Stream (S.C. SEA Grant Consortium, 1992).

The average monthly air temperatures for the Charleston area are presented in Table 2.6. The temperatures are generally moderated by marine influences and are often 2°C to 3°C lower in the summer and 3°C to 8°C higher in the winter than areas farther inland. Temperatures higher than 38°C and lower than -6.5°C are unusual for the area (S.C. SEA Grant Consortium, 1992).

Table 2.6
Mean Temperature and Wind Data
for Charleston Harbor between 1970 and 1985^a

Month	Daily Max (°C)	Daily Min (°C)	Mean Speed (km/hr)	Prevailing Direction
January	16.4	3.1	14.8	SW
February	16.8	4.5	16.6	NNE
March	20.0	7.3	16.7	SSW
April	24.9	11.5	16.1	SSW
May	28.8	16.6	14.3	S
June	31.6	20.6	13.7	S
July	31.6	22.2	13.0	SW
August	31.5	21.4	12.1	SW
September	29.2	18.8	13.0	NNE
October	25.1	12.7	13.2	NNE
November	19.9	6.6	13.2	N
December	16.1	3.5	14.0	NNE
Annual	24.3	12.4	14.2	NNE

Note:

^a = S.C. SEA Grant Consortium, 1992

The wind direction and velocity in the Charleston area are highly variable, and rather evenly distributed in all directions. The inland portions of the region are subjected to a southwest-northeast wind regime. The prevailing winds are northerly in the fall and winter, and southerly in spring and summer. The monthly average wind velocities and directions for the area range from a low of 12.1 kilometers per hour (kph) in May to a high of 16.7 kph in March. The average monthly wind speeds and prevailing wind directions are also presented in Table 2.6 (S.C. SEA Grant Consortium, 1992).

The Charleston area averages 124.9 centimeters (cm) of precipitation annually, almost exclusively rainfall. Very little precipitation is recorded as snow, sleet, or hail. The greatest mean monthly precipitation is normally received in July while the smallest amount normally occurs in November (S.C. SEA Grant Consortium, 1992).

Relative humidity in the Charleston Harbor area is normally very high and fluctuates greatly. Generally, it is higher during the summer months than other times of the year, and the coastal areas exhibit a lower relative humidity than inland areas. The monthly mean relative humidity for four different times of day is presented in Table 2.7 (S.C. SEA Grant Consortium, 1992).

Cloud cover varies widely for Charleston, with annual averages of 101 clear days, 115 partly cloudy days, and 149 cloudy days. The mean monthly clear, partly cloudy, and cloudy days for the area are also presented in Table 2.7 (S.C. SEA Grant Consortium, 1992).

The primary concern as far as climate extremes are concerned is the occurrence of tropical cyclones or hurricanes. Hurricanes frequent the east coast of the United States and almost always have some effect on the weather around Charleston Harbor. Hurricanes normally occur between August and December. The last hurricane to make landfall in the Charleston area was Hurricane Hugo, a class IV hurricane which struck Charleston in September 1989 causing severe damage. Tornadoes are extremely rare in the vicinity but have occurred in the inland portions of Charleston County (S.C. SEA Grant Consortium, 1992).

Table 2.7
Monthly and Annual Mean Precipitation, Relative Humidity, and Cloud Cover
for Charleston Harbor between 1960 and 1985^a

Month	Precipitation (cm)	Relative Humidity by Time (%)				Cloud Cover % Number of Days		
		0100	0700	1300	1900	Clear	Partly Cloudy	Cloudy
January	6.45	82	84	55	73	8	8	15
February	8.36	79	82	52	68	9	6	13
March	9.98	81	83	50	67	9	9	13
April	7.32	84	84	50	67	11	8	11
May	9.17	88	84	54	72	8	12	11
June	12.65	90	86	59	75	6	12	12
July	19.58	91	88	64	79	4	13	14
August	16.79	92	91	63	80	5	14	12
September	14.81	91	91	63	82	7	11	12
October	7.21	88	89	56	80	12	8	11
November	5.31	85	87	51	77	13	6	11
December	7.24	82	84	54	74	9	8	14
Annual	124.87	86	86	56	75	101	115	149

Note:

^a = S.C. SEA Grant Consortium, 1992

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Section 2 — NAVBASE Physical Setting
Revision: 0
November 21, 1996

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3.0 FIELD INVESTIGATION

The following section lists the objectives of the field investigation and describes the technical sampling methods, procedures, and protocols implemented for Zone B data collection. Fieldwork was conducted in accordance with the CSAP and the USEPA Region IV, Environmental Services Division *Standard Operating Procedures and Quality Assurance Manual* (February 1991) (ESDSOPQAM). Sampling and investigatory methods used in the Zone B RFI are summarized in this section. Any deviations from the approved work plans, such as the number of samples collected, modified locations, or procedures, etc., were documented in the field and are discussed in detail in Section 10, Site-Specific Evaluations.

3.1 Investigation Objectives

The sampling strategy for AOC 507 in Zone B, as detailed in the *Final Zones A and B RFI Work Plan* (E/A&H, September 1995), was designed to collect sufficient environmental media data to accomplish the following:

- Characterize the site.
- Define contaminant pathways and potential receptors (on and offsite, where applicable).
- Define the nature and extent of contamination, if any, at AOC 507.
- Assess human health and ecological risk.
- Assess the need for corrective measures.

3.2 Sampling Procedures, Protocols, and Analyses

3.2.1 Sample Identification

All samples collected during this investigation were identified using the 10-character scheme from Section 11.4 of the CSAP. This scheme identifies the samples by site, sample matrix, location, and sample depth. The first three characters identify the site where the sample was collected. The fourth character identifies the matrix or quality control (QC) code for the sample. The fifth through eighth characters identify the sample location. The ninth and tenth characters

identify the soil sample interval. For example: sample ID 507SB00402 is a second-interval soil sample from Boring B004 at AOC 507. For the groundwater samples, the ninth and tenth characters identify the sampling sequence. For example, GDBGW00101 is the first groundwater sample collected from the Zone B grid-based monitoring well W001, and GDBGW00102 would indicate the second groundwater sample collected.

3.2.2 Soil Sampling

Section 4 of the CSAP describes soil sampling procedures and activities used in the RFI. The following subsections summarize these procedures.

3.2.2.1 Soil Sample Locations

Soil samples were collected from locations proposed in the *Final Zones A and B RFI Work Plan* (E/A&H, September 1995), which were based on the investigation strategy outlined in Section 1.2 of that document. For AOC 507, the primary sampling pattern is justified in Section 2.7 of the work plan. None of the proposed sample locations were significantly modified during field activities. After review of the Zone B data, it was determined that additional sampling was required to adequately evaluate the risk associated with the presence of benzo(a)pyrene (BaP). These sampling locations are detailed in Section 10, and the results will be included in the *Final Zone B RCRA Facility Investigation Report*.

3.2.2.2 Soil Sample Collection

Composite soil samples were collected for laboratory analysis from 0- to 1-foot bgs and from 3- to 5-foot bgs. The 0- to 1-foot bgs interval is referred to in this report as the first or upper interval sample. At soil sample locations overlain by pavement, the upper interval was collected from the base of the pavement to 1 foot below the base of the pavement. The 3- to 5-foot bgs interval is referred to as the second or lower interval sample. No other intervals were sampled due to the relatively shallow depth to groundwater in Zone B, typically from 3- to 6-feet bgs. No saturated soil samples were retained for laboratory analysis.

Stainless-steel hand augers were used to collect soil samples. At grassy locations, the vegetative root zone (generally less than 2 inches thick) overlying the soil at the upper interval was removed before augering to 1 foot bgs. As the auger filled with soil, it was removed from the hole, and the portion for volatile organic analysis (VOA) was immediately collected with a stainless-steel spoon. The remaining sample was placed in a stainless-steel mixing bowl. This process was repeated until the entire interval had been collected. The hole was then augered to approximately 3 feet bgs, and a new, decontaminated auger bucket was used. The lower interval sample was then collected, following the same procedures after removing the initial soil from the auger. A coring machine was used at one sampling location in Zone B (507SB005) to gain access to soil covered by concrete and/or asphalt.

3.2.2.3 Soil Sample Preparation, Packaging, and Shipment

Section 11 of the CSAP details procedures for sample preparation, packaging, and shipment. Below is a brief overview of the procedures for soil samples.

Sample material was transferred from the stainless-steel bowl to glass sample jars using a stainless-steel spoon. VOA samples were not homogenized, but were containerized immediately with zero headspace to minimize volatilization. Soil for all other analyses was homogenized with a stainless-steel spoon and placed into appropriate containers. Any remaining soil was returned to the auger hole. Bentonite pellets, hydrated in place with American Society for Testing and Materials (ASTM) Type III water, were used to fill any remaining space.

Soil samples were identified as described in Section 3.2.1 of this document, and in accordance with Section 11.4 of the CSAP. Immediately following collection, labels were affixed to each sample container. Other pertinent information such as weather conditions, date and time of collection, sampling team, and a sketch of the location was included in a Zone B soil sampling logbook.

Soil sample containers were individually custody-sealed, encased in protective bubble wrap, double-bagged in waterproof resealable plastic bags, and placed on ice in a cooler to ensure proper preservation at 4°C during shipment. A temperature blank was included inside each cooler that contained samples during shipment. All samples were entered on a preprinted chain-of-custody form, which was then affixed to the top, inside surface of the sample cooler.

After entering sample numbers, analyses, times, date, and an air-bill shipping number into an official shipping log, the coolers were shipped priority overnight via FedEx to the South Carolina (SC)-certified analytical laboratory (either Lockheed Analytical Services, Las Vegas, Nevada [first round samples] or Southwest Laboratory of Oklahoma, Inc., Broken Arrow, Oklahoma [second and third round samples]).

3.2.2.4 Soil Sample Analysis

Soil samples were analyzed per USEPA SW-846 methods at Data Quality Objective (DQO) Level III unless otherwise noted, as follows:

- Volatile organic compounds (VOCs) USEPA Method 8240
- Semivolatile organic compounds (SVOCs) USEPA Method 8270
- Pesticides/polychlorinated biphenyls (PCBs) USEPA Method 8080
- Cyanide USEPA Method 9010
- Appendix IX Metals USEPA Methods 6010/7000 Series

Approximately 10% of the soil samples collected at Zone B were duplicated and submitted for Appendix IX analytical parameters at DQO Level IV. These additional samples were collected to fulfill quality assurance/quality control (QA/QC) requirements while cost-effectively analyzing additional parameters.

In addition to the analyses listed above, Appendix IX parameters analyzed included:

- Hexavalent chromium USEPA Method 218.4
- Dioxins USEPA Method 8290
- Herbicides USEPA Method 8150
- Organophosphorus (OP) pesticides USEPA Method 8140

Shelby tube samples were collected at select locations to obtain soil engineering parameter data to be used in the CMS and the contaminant fate and transport assessment for this report.

The engineering parameters were as follows:

- Bulk density ASTM D-1587-83
- Soil moisture ASTM D-2216-80
- Unsaturated hydraulic conductivity ASTM D-2434-68
- Grain-size analysis ASTM D-422-63
- Hydrometer analysis ASTM D-422
- Porosity Sowers and Sowers, 1951

3.2.3 Monitoring Well Installation and Development

Section 5 of the CSAP describes monitoring well installation and development methods used. All monitoring wells were installed in accordance with South Carolina Well Standards and Regulations after permits were acquired from the South Carolina Department of Health and Environmental Control (SCDHEC) in the form of the work plan approval letter. The following subsections briefly describe the site-specific methods applied in Zone B. Appendix A includes all lithologic boring logs and monitoring well construction diagrams for Zone B.

3.2.3.1 Shallow Monitoring Well Installation

Four shallow monitoring wells were installed for the Zone B grid-based investigation; no wells were installed for the site-specific investigation. All shallow monitoring wells were installed so that groundwater samples could be collected from the upper portion of the shallow aquifer. These monitoring wells were installed using the hollow-stem auger drilling method, which involved augering to the total depth of the borehole using hollow-stem auger flights tipped with a lead auger head. The total depth of the shallow wells depended primarily on depth to groundwater. Every effort was made to bracket the water table surface at each shallow monitoring well location. However, this was not always possible due to the shallow depth to groundwater. Because groundwater is encountered at approximately 2- to 6-feet bgs across NAVBASE, the typical depth of a shallow monitoring well was 11- to 13-feet bgs.

For each monitoring well borehole, 2-foot split-spoon samples were collected for lithologic characterization at 5-foot intervals. These soil samples were visually classified and screened for organic vapors by the onsite geologist, but were not retained for chemical analysis. Typical split-spoon sample intervals in shallow monitoring well boreholes were collected between 3- to 5-feet bgs, 8- to 10-feet bgs, and 13- to 15-feet bgs. Shelby tube samples representing the lithology of the typical screened interval for selected areas in Zone B were collected for geophysical analyses from two well borings.

Typical shallow monitoring well construction involved placing a 10-foot section of 2-inch inside diameter (ID), polyvinyl chloride (PVC) screen with 0.010-inch slots attached to 10 feet of 2-inch ID, PVC riser pipe down the inside of the hollow-stem auger, after drilling to the desired depth. Filter pack material was then poured into the annular space between the hollow-stem auger and PVC to approximately 2 feet above the top of the screened section. As the sand was added, the level in the annulus borehole was measured with a weighted tape. The hollow-stem auger sections were gradually withdrawn while the sand was added to allow uniform placement of the filter pack and to avoid bridging and inadvertently raising the well screen and riser casing

with the augers. Care was taken to never raise the hollow-stem auger sections higher than the filter pack level in the borehole, preventing the formation from collapsing on the well screen. Bentonite pellets were placed from the top of the filter pack to ground surface, then hydrated with potable water. After allowing the bentonite to hydrate for approximately 24 hours, the surface mount was constructed. An expansion locking well cap provided temporary groundwater protection before the surface mount was completed.

3.2.3.2 Deep Monitoring Well Installation

Review of regional geology identified the Ashley Formation of the Cooper Group as the shallowest formation most capable of retarding or preventing downward flow of water and/or contaminants. This formation is widely noted in the Charleston area for its low permeability and its effectiveness as a confining layer over the underlying Santee Limestone. Four grid-based deep monitoring wells were proposed in Zone B to allow groundwater sampling at the shallow aquifer's contact with the underlying Ashley Formation.

Rotasonic drilling methods were used to install the deep monitoring wells. Rotasonic drilling combines standard rotary action with sonic vibration. The sonic vibration created at the surface is directed to the subsurface through the drill string, displacing formation material rather than forcing cuttings back to the surface as do more traditional drilling methods. The Rotasonic method produces a continuous core sample that allows for precise lithologic characterization. Soil cores were logged and classified continuously from the ground surface to the borehole terminus as described in Section 4.2 of the CSAP. Ten- to 20-foot core sections were typically produced, depending on the depth to the target formation.

Upon identification of the target depth, monitoring wells were constructed much as they were through hollow-stem augers. A 10-foot section of 2-inch ID, 0.010-inch factory slot PVC screen was installed with the base of the screen at the contact between the Ashley Formation and the overlying Pleistocene sediments. Attached to the screen was an appropriate length of 2-inch ID

PVC riser pipe. Filter pack sand was placed to approximately 2 feet above the screened interval and settled by activating the sonic vibration. A bentonite seal at least 3 feet thick was placed on top of the filter pack, settled with vibratory action, and then hydrated. The remaining interval of borehole was then tremied to the surface with a high solids bentonite grout.

While drilling two of the proposed deep grid-based locations in Zone B, the target depth was encountered 20 feet bgs. Because the screened interval would have overlapped the adjacent shallow well, deep wells were not constructed at these locations (Boring GDB-02D and Boring GDB-03D).

3.2.3.3 Monitoring Well Protector Construction

All well protectors installed in Zone B were above-grade protective casings. Well protectors were installed in accordance with Section 5.4 of the CSAP.

Above-grade well protectors were prepared by installing a 3.5-foot long, 4-inch by 4-inch section of steel protective surface casing approximately 1 to 1.5 feet over the PVC riser pipe. Care was taken not to compromise the integrity of the bentonite seal overlying the filter pack material. The protective casings were hinged approximately 6 inches from the top to allow access to the top of the PVC riser pipe. The hinged covers for each above-grade protective casing were designed to allow for security locking. A 3-foot by 3-foot concrete pad approximately 6 to 8 inches thick was then constructed around each protective casing. Weep holes were drilled through the well protector at a height that would not allow water to rise above the top of the well. A 3-inch diameter bumper post was set at each corner of the pad. A monitoring well identification tag listing the well number, date installed, drilling subcontractor, total well depth, and depth to groundwater was mounted onto the hinged cover of the protective casing or to the concrete pad. Each hinged cover was secured with a keyed-alike lock.

3.2.3.4 Monitoring Well Development

Well development consisted of initially stressing the filter pack by surging and pumping, then pumping until turbidity was reduced as much as practical and specific conductance, pH, and temperature stabilized, as described below. Monitoring wells were developed according to Section 5.5 of the CSAP.

Surging Procedures:

1. Decontaminated PVC rods were attached to a surge block.
2. The surge block was lowered into the monitoring well screen section.
3. The surge block was then raised and lowered the length of the screen to surge groundwater in and out of the well screen.
4. Surging was conducted for approximately 10 to 20 minutes per well.
5. The surge block was removed from the well for decontamination.

Shallow Well Pumping Procedures:

1. Decontaminated Teflon tubing was lowered into the well.
2. The tubing was attached to a centrifugal pump at the surface and pumping was begun.
3. If the productivity of the monitoring well was low, it would be alternately pumped then left idle to recover.

4. Monitoring wells were developed until the water column was as free of turbidity as possible given the subsurface conditions and until three consecutive pH, temperature, and specific conductance readings were stabilized to satisfy the following criteria.

Temperature:	within $\pm 1.0^{\circ}\text{C}$
pH:	within ± 0.5 standard unit
Conductivity:	within $\pm 10\%$
Turbidity:	generally between 10 and 30 nephelometric turbidity units (NTUs) or relatively stable (± 15 NTU)

At least three well volumes of groundwater were removed from each well during development.

3.2.4 Groundwater Sampling

Groundwater was sampled in accordance with Section 6 of the CSAP. The following subsections briefly summarize the site-specific methods applied in Zone B.

3.2.4.1 Groundwater Sampling Locations

Groundwater samples were collected from well locations based on the approved locations identified in the *Final Zones A and B RFI Work Plan* (E/A&H, September 1995). None of the proposed locations were adjusted during field activities.

3.2.4.2 Groundwater Sample Collection

Groundwater sample collection followed these steps:

1. Wells were allowed to recover for at least two weeks after being developed.
2. Decontaminated sampling equipment and supplies were transported to the monitoring well.

3. A temporary work area was established around each well by placing plastic sheeting around the well. Personal protective equipment (PPE) was donned in accordance with the approved health and safety plan (HASP) for the monitoring well to be sampled.
4. The condition and security of the monitoring well were recorded in the field logbook. The security casing was unlocked and the well cap removed. Headspace was immediately measured for VOCs using an organic vapor analyzer (OVA), which was also used to continuously monitor the breathing zone before and during sampling.
5. Depth to water and total depth of the well were measured using an oil/water interface probe if OVA readings exceeding background, odor, or other indicators suggested a light nonaqueous phase liquid (LNAPL) on the water surface. A water level meter was used if no LNAPL was suspected. All measurements were recorded to the nearest 1/100th of a foot. Static water level measurements were taken from the top of casing at a permanent datum point etched in the well casing. Well volumes were calculated and all measurements and observations recorded in the field logbook. All equipment was decontaminated before reuse.
6. New decontaminated Teflon tubing was installed in the well. The tubing extended into the well and, if water level was sufficient, positioned above the screened interval. A peristaltic pump was positioned at the surface, and the tubing mounted through the pump. Groundwater was purged into graduated buckets or containers to measure volume, which was recorded in the field logbook.
7. Each well was purged of at least three well casing volumes of water. Temperature, pH, specific conductance, and turbidity were measured after each volume of water was removed from the well casing. A well was considered stabilized for sampling when three consecutive temperature, specific conductance, and pH readings met the criteria

outlined for well development as described in Section 3.2.3.4. Turbidity was monitored until the reading was less than 10 NTUs or it was lowered as much as practical and no more than five well casing volumes of water were removed. Wells that were purged dry due to slow recovery were sampled after 12 hours of recovery. Lithologic variabilities prevented purging some wells to achieve turbidity of less than 10 NTUs. For example, it was difficult to achieve a turbidity of less than 10 NTUs in wells installed in areas with increased silt content.

8. After purging, groundwater samples were collected according to the analytical parameters proposed for each groundwater sample. Samples for VOC analyses were collected first by capping the tubing and raising it from the well and then allowing the contents to drain into the sample containers. A precleaned transfer bottle equipped with an airtight cap containing an inlet and outlet was then assembled to collect all other sample containers. Once this system was established, the vacuum created allowed collection of groundwater which was carefully poured directly into the respective sample container. Where additional volumes were needed, the transfer bottle was filled repeatedly. Samples for organic analyses were poured prior to inorganics. Samples were collected for: pesticides/PCBs, herbicides, metals, cyanide, sulfates, chlorides, TDS, and SVOC analyses.

Groundwater samples were identified according to the scheme described in Section 3.2.1 of this report and Section 11.4 of the CSAP.

3.2.4.3 Groundwater Sample Preparation, Packaging, and Shipment

Guidelines in Section 11 of the CSAP were followed for preparing, packaging, and shipping groundwater samples collected during the Zone B RFI. The following briefly summarizes those activities.

Groundwater samples were preserved according to laboratory criteria for parameters being collected. Appropriate labels and custody seals were completed and affixed to each sample bottle. Immediately after sample collection and identification, sample containers were placed on ice in coolers. Records of sampling were entered into a dedicated field logbook and a master logbook placed in a fireproof safe in the site trailer.

Groundwater sample containers were individually custody-sealed, encased in protective bubble wrap, double-bagged in waterproof resealable plastic bags, and placed on ice in a cooler to ensure proper preservation at 4°C during shipment. All sample information was entered on a preprinted chain-of-custody form which was then affixed to the top, inside surface of the sample cooler. Temperature blanks were included with each shipment to monitor sample temperature upon arrival.

After entering sample numbers, analyses, times, and an air-bill shipping number into an official shipping log, the coolers were shipped priority overnight to Lockheed Analytical Services, the SC-certified laboratory.

3.2.4.4 Groundwater Sample Analysis

Groundwater samples were analyzed per USEPA SW-846 methods at DQO Level III unless otherwise noted, as follows:

- VOCs USEPA Method 8240
- SVOCs USEPA Method 8270
- Pesticides/PCBs USEPA Method 8080
- Cyanide USEPA Method 9010
- Appendix IX Metals USEPA Methods 6010/7000 Series
- Total Petroleum Hydrocarbons (TPH)
 - (diesel range organics — DRO) USEPA Method 3550/Modified 8015
 - (gasoline range organics — GRO) USEPA Method 5030/Modified 8015

Approximately 10% (one sample) of the groundwater samples collected in Zone B were duplicated and submitted for Appendix IX analytical parameters at DQO Level IV. These additional 10% of samples were collected to fulfill QA/QC requirements while cost-effectively analyzing sites for additional parameters.

In addition to the analyses listed above, Appendix IX parameters include:

- Hexavalent chromium USEPA Method 218.4
- Dioxins USEPA Method 8290
- Herbicides USEPA Method 8150
- OP pesticides USEPA Method 8140

3.2.5 Sediment and Surface Water Sampling

No sediment or surface water samples were collected during the RFI in Zone B.

3.2.6 Wipe Sampling

No wipe samples were collected during the RFI in Zone B.

3.2.7 Vertical and Horizontal Surveying

Monitoring well locations and elevations were determined by conventional plane surveying techniques. The horizontal and vertical control were established from existing monumentation on NAVBASE with horizontal datum of North American Datum 1983 and vertical datum of National Geodetic Vertical Datum 1929. All traverse closures exceeded 1/20,000. No data corrections were required as part of the monitoring well survey. Soil boring and monitoring well locations were surveyed using Global Positioning System (GPS) equipment.

3.2.8 Aquifer Characterization

Rising and falling head slug tests were conducted according to Section 10.6.1 of the CSAP on four shallow and two deep monitoring wells to enhance aquifer characteristic estimates. Before a slug test was initiated, the static water level in each well was measured using an electronic water-level indicator. A "slug" was then abruptly introduced into the well, at which time the water level and the start time were recorded. Periodically, water level/elapsed-time measurements were recorded using an electronic data logger. Similarly, each rising head slug test was performed by removing the "slug" and recording water level/elapsed-time measurements as the head returned to normal. The time required for a slug test to be completed and the water level rate of change are functions of the hydraulic conductivity of the aquifer.

The slugs consisted of 3-foot long and 1.5-inch diameter solid Teflon cylinders with stainless-steel eyebolts attached at one end. A nylon rope tethered to the eyebolt suspended the slug in the well just above or below the water level. At the beginning of each test, the data logger was activated the instant the slug was either lowered into or removed from the water.

For each slug test, In-Situ pressure transducers and 2-channel Hermit 1000C data loggers were used to record water level/elapsed-time measurements. To facilitate graphing of the data, the data loggers were programmed to measure and record water level on a logarithmic time scale. Raw data from the data loggers were downloaded to a personal computer for data reduction and manipulation.

3.2.9 Decontamination Procedures

Decontamination procedures were performed in accordance with Section 15 of the CSAP and Appendix B, Section B-8 of the ESDSOPQAM for sampling equipment and in accordance with Appendix E, Section E-9 of the ESDSOPQAM for drilling equipment. The detergent used on this project was Liquinox, which contains powerful chelating agents to bind and remove trace metals from sampling equipment. PVC well construction materials were not solvent-rinsed or

washed with hot water. Field reagent-grade water was produced onsite to meet the specifications of ASTM Type III water (D 1193-77 re-approved 1983, federal test method 7916). The high-pressure, hot water washer was capable of generating adequate pressure and producing hot water and/or steam. All wastes generated during decontamination were containerized in a tanker for disposal by the Navy in accordance with Section 16 of the CSAP.

3.2.9.1 Decontamination Area Setup

The decontamination area is a concrete pad sloped to direct wash runoff into a catch basin, from which liquids were pumped regularly into the tanker. Equipment was cleaned on sawhorses or auger racks above the concrete surface. When field cleaning of equipment (i.e., hand augers) was necessary, plastic sheeting was placed on the ground to contain any spills.

3.2.9.2 Cross-Contamination Prevention

The following procedures were implemented during sampling activities to reduce cross-contamination risk.

- Fresh disposable outer gloves were donned before handling sampling equipment.
- Only Teflon, glass, or stainless-steel spray bottles/pressurized containers were used to apply decontamination fluids. Each solution was kept in a separate container.
- All necessary decontaminated field equipment was transported to the sampling location to minimize the need for field cleaning.

3.2.9.3 Nonsampling Equipment

Nonsampling equipment includes drill rigs, and backhoes. Nonsampling equipment was decontaminated using the following procedures:

1. Decontaminate equipment with high-pressure hot water and/or steam.

2. Portions of the equipment coming in contact with material to be sampled were scrubbed with a laboratory-grade detergent and clean water wash solution.
3. Rinse with clean water as necessary.

3.2.9.4 Sampling Equipment

Sampling equipment includes any downhole equipment (e.g., augers, drill pipe, and split-barrel samplers) and any sampling utensils (e.g., pumps and stainless-steel spoons, spatulas, bowls, etc.) not dedicated to the sample location. Hollow downhole equipment or equipment with holes potentially transmitting water or drilling fluids were cleaned on the inside and outside. The decontamination procedure is as follows:

1. Protective gloves were donned before decontaminating the equipment.
2. Items were washed and scrubbed with a laboratory-grade detergent and clean water wash solution or sprayed with high-pressure hot water and/or steam.
3. Rinsed with ASTM Type III water.
4. Rinsed twice with pesticide-grade isopropyl alcohol.
5. Rinsed with ASTM Type III water.
6. Air dried. If weather prohibited air drying, the isopropyl alcohol rinse was repeated and the item was rinsed with ASTM Type III water twice.
7. Items were wrapped in aluminum foil or plastic sheeting if the sampling equipment was stored or transported.
8. Augers and drill rods were covered in clean plastic after decontamination.

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4.0 DATA VALIDATION

4.1 Introduction

DQOs are qualitative and quantitative statements specifying the quality of data required to support decisions during environmental response actions. The level of certainty regarding the precision of the data varies with their intended end use. According to USEPA guidance, *Data Quality Objectives for Remedial Response Activities, Development Process*, EPA/540/G-87/003 (USEPA, March 1987), the levels of analytical data are as follows:

- Level I — Field screening or analysis using portable instruments. Results are often not compound-specific and not quantitative, but results are available in real-time. It is the least costly analytical option.
- Level II — Field analyses using more sophisticated portable analytical instruments. In some cases the instruments may be set up in a mobile laboratory onsite. The quality of the data generated depends on the use of suitable calibration standards, reference materials, and sample preparation equipment in addition to operator training. Results are available in real-time or in several hours.
- Level III — All analyses performed in an offsite analytical laboratory. Level III analyses may use Contract Laboratory Program (CLP) procedures, but do not usually use the validation or documentation procedures required of CLP Level IV analysis. The laboratory need not be a CLP laboratory.
- Level IV — All analyses are performed in an offsite analytical laboratory following rigorous QA/QC protocols and documentation meeting or exceeding CLP requirements.
- Level V — Analysis by nonstandard methods. All analyses are performed by an offsite analytical laboratory which need not be a CLP laboratory. Method development or

method modification may be required for specific constituents or detection limits. CLP special analytical services (SAS) are Level V.

For the RFI at NAVBASE, analytical Level III data with 10% analyses for Appendix IX at Level IV were deemed appropriate for the intended data uses: site characterization, risk assessment, and corrective measure determinations/design.

It should be noted that in September 1993, USEPA replaced this guidance with an updated manual, *Data Quality Objectives Process for Superfund, Interim Final Guidance*, EPA/540/G-93/071 (USEPA, September 1993) which stated, "This guidance replaces the earlier guidance EPA 540/G-87/003, Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-7B and the five analytical levels introduced in that document." As a result, the five analytical data levels were reduced to two — screening data and definitive data.

Definitive data (formerly Levels III and IV) are defined as analytical data generated using rigorous analytical methods, such as approved USEPA reference methods. These data are analyte-specific, with confirmation of analyte identity and concentration. These approved methods produce tangible raw data (e.g., chromatograms, spectra, digital values, etc.) in paper printouts or computer-generated electronic files. Analytical or total measurement error (precision) must be determined for data to be definitive (USEPA, September 1993). As a result, the data collected at NAVBASE are now defined as definitive data per the most recent USEPA guidance but will still be referred to as Level III and Level IV throughout the report to avoid confusion.

4.2 Validation Summary

This section presents the QA/QC evaluation of the data produced from the analysis of environmental media samples collected in Zone B during the RFI. This evaluation will verify that the appropriate QA/QC elements were followed and/or completed (e.g., method

requirements, documentation, etc.) to identify and/or characterize any problems with the data set, and ultimately to determine the usability of the analytical data for site characterization, risk assessment, and corrective measure determinations.

Examples of definitive data (formerly Level III and IV) QA/QC elements are as follows:

- Sample documentation (verified time of sample receipt, extraction and holding times)
- Chain of custody
- Initial and continuing calibration
- Determination and documentation of detection limits
- Analyte(s) identification
- Analyte(s) quantification
- QC blanks (trip, method, rinsate)
- Matrix spike recoveries
- Performance evaluation (PE) samples (when specified)
- Analytical method precision
- Total measurement error determination

RFI environmental samples were collected at Zone B from October to December 1995. All samples were analyzed by either Lockheed Analytical Services (first round samples) or Southwest Laboratory (second and third round samples), which are the SC-certified laboratories, except for the dioxin analyses. Another SC-certified laboratory, Triangle Laboratories of Research Triangle Park, North Carolina, analyzed the samples for dioxins and dibenzofurans. In accordance with the approved CSAP, sample analyses followed the guidance in the *USEPA Test Methods for Evaluating Solid Waste, SW-846* (USEPA, 1992) and Title 40 CFR Part 264. Table 4.1 summarizes the analytical methods and DQO laboratory deliverables.

Table 4.1
NAVBASE Analytical Program

Full Scan/Appendix IX Analytical Methods	Data Quality Level	Method Reference
VOCs	III/IV	SW-846 8240
SVOCs	III/IV	SW-846 8270
Pesticides/PCBs	III/IV	SW-846 8080
Chlorinated Herbicides	III/IV	SW-846 8150
OP Pesticides	III/IV	SW-846 8140
TPH	III/IV	USEPA 3550 & 5030/Modified 8015
Cyanide	III/IV	USEPA 9012
Appendix IX Metals	III/IV	SW-846 6010/7060/7421/7470/7740/7841
Hexavalent Chromium	III/IV	USEPA 218.4
Polychlorinated dibenzo-p-dioxins	III/IV	USEPA 8290
Organotins	III/IV	Triangle Laboratories SOP

Notes:

SOP = Standard Operating Procedures

Full Scan parameters include: VOCs, SVOCs, pesticides/PCBs, metals, and cyanide (Level III). Appendix IX parameters include: VOCs, SVOCs, pesticides/PCBs, herbicides, OP pesticides, metals, cyanide, hexavalent chromium, and dioxins (Level IV). TPH was analyzed on the water field duplicate sample and the groundwater rinsate blank as an additional QA/QC measure.

The methods listed in Table 4.1 are from:

- USEPA OSWER, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846), Third Edition, revised July 1992.
- USEPA Environmental Monitoring and Support Laboratory, *Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-020, revised March 1983.

- *Title 40 Code of Federal Regulations Part 264, Appendix IX (52 Federal Register 25947), July 1987.*

Third-party independent data validation of all analytical work performed under the CSAP was conducted by Heartland Environmental Services, Inc., St. Peters, Missouri based on the QC criteria developed for CLP. The third-party validator's function was to assess and summarize the quality and reliability of the data to determine their usability and to document any factors affecting data usability, such as compliance with methods, possible matrix interferences, and laboratory blank contamination.

4.2.1 Organic Evaluation Criteria

The USEPA methods in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, and *Methods for Chemical Analysis of Water and Wastes* define QC criteria that the laboratory must meet. However, the methods do not address data evaluation from a user's perspective. Data evaluation criteria for the user are available in *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (February 1994) (Organic Functional Guidelines). For Zone B, these guidelines were used throughout the data evaluation process for this purpose.

Data evaluation included the following parameters:

- Holding times
- Gas Chromatography/Mass Spectroscopy (GC/MS) instrument performance checks
- Surrogate spike recoveries
- Instrument calibration
- Matrix spike and matrix spike duplicates (MS/MSD)
- Blank analysis
- Internal standard (IS) performance

- Compound quantitation
- Field duplicate precision
- Calculations

When the QC parameters did not fall within the specific method guidelines, the data evaluator annotated or *flagged* the corresponding compounds where deficiencies were found. The following validation flags were used to annotate data exhibiting laboratory and/or field deficiencies or problems:

U **Undetected** — The analyte was analyzed for but not detected or was also found in an associated blank, but at a concentration less than 10 times the blank concentration for common constituents (acetone, methylene chloride) or five times the blank concentration for other constituents (benzene, toluene). The associated value shown is the quantitation or reporting limit.

J **Estimated Value** — One or more QC parameters were outside control limits.

UJ **Undetected and Estimated** — The analyte was analyzed for but not detected above the estimated quantitation limit. The quantitation limit is estimated because one or more QC parameters were outside control limits.

R/UR **Unusable Data** — One or more QC parameters grossly exceeded control limits.

EMPC **Estimated Maximum Possible Concentration** — The dioxin analyte was analyzed for, but due to possible instrument carryover that cannot be verified, results may actually be lower.

These validation flags were applied to data where deficiencies were noted. The EMPC validation flag used by the validator is unique to the dioxin validation reports. Appendix D includes the complete analytical dataset for Zone B.

4.2.1.1 Holding Times

Acceptable technical holding times are specified in the CSAP. The sample holding time depends on the type of analysis. For water and soil samples, the holding time for VOC analysis is 14 days from the collection date. SVOC, pesticide/PCB, OP pesticide, and chlorinated herbicide water samples must be extracted within seven days from the collection date and analyzed within 40 days after extraction. Soil samples must be extracted within 14 days of sample collection and analyzed within 40 days of collection. Dioxin water and soil samples require extraction within 30 days from date of collection and analysis within 45 days of collection. The holding time for TPH analysis is 28 days from the date of collection for both water and soil samples that are preserved and refrigerated.

4.2.1.2 GC/MS Instrument Performance Checks

Performance standards for VOC and SVOC analyses are analyzed to determine if the data produced by the instrument may be correctly interpreted according to the requirements of the method being used. Performance standards must be analyzed within 12 hours of sample analysis, and the results must be within the established criteria.

4.2.1.3 Surrogate Spike Recoveries

Surrogate compounds are added to samples and laboratory blanks before extraction and sample preparation to evaluate the effect of the sample matrix on extraction and measurement procedures. Surrogates are organic compounds chemically similar to analytes of interest but not normally found in environmental samples. Three surrogate compounds are added to samples for VOC analysis, eight are added to samples for SVOC analysis, two are added to pesticide/PCB and dioxin samples, and one is added to both OP pesticide and chlorinated herbicide samples.

Percent recovery (%R) of the surrogates is calculated by comparing the amount of the compound recovered by the analysis to the amount added to the sample.

The surrogate compounds recommended by the SW-846 methods are listed below in Table 4.2.

Table 4.2
Surrogate Compound Summary

VOC Surrogates	SVOC Surrogates	Pesticide/PCB Surrogates	Herbicide Surrogate	OP Pesticide Surrogate
Toluene-d8	Nitrobenzene-d5 (NBZ)	Tetrachloro-m-xylene	2,4-Dichloro-phenylacetic acid (DCAA)	Tributyl phosphate
Bromofluorobenzene (BFB)	2-Fluorobiphenyl (FBP)	(TCMX)		
1,2-Dichloroethane (DCA)	Terphenyl-d14 (TPH)	Decachlorobiphenyl (DCB)		
	2,4,6-Tribromophenol (TBP)			
	Phenol-d5 (PHL)			
	2-Fluorophenol (2FP)			
Dioxin Surrogates				
¹³ C ₁₂ - 1,2,3,4 -Tetrachlorodibenzo-p-dioxin (TCDD)				
¹³ C ₁₂ - 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)				

4.2.1.4 Instrument Calibration

Instruments are initially and continually calibrated with standard solutions to verify that they can produce acceptable quantitative data for the compounds.

Initial calibration (GC/MS): The instrument is initially calibrated at the beginning of the analytical run to check its performance and to establish a linear five-point calibration curve. The initial calibration is verified by calculating the relative response factor (RRF) and the percent relative standard deviation (%RSD) for each compound. An RRF less than 0.05 or a %RSD greater than 30% is outside the QC limits for the initial calibration.

Continuing calibration (GC/MS): Standard solutions are run periodically to check the daily performance of the instrument and to establish the 12-hour RRF on which the sample quantitations are based. The continuing calibration is verified by calculating the RRF and the

percent difference (%D) for each compound. An RRF less than 0.05 or a %D greater than 25 % is outside the QC limits for the continuing calibration.

Initial calibration (GC): For single-component pesticides, five-point calibrations are analyzed, and calibration factors (CF) are established. The CF for single-component pesticides must be less than or equal to 20%.

The multicomponent pesticide toxaphene and all PCBs (or Aroclors) are analyzed separately. Retention times and CFs are determined for three to five primary peaks. The only review criteria for multicomponent compounds are to verify these steps were taken.

A five-point initial calibration is analyzed for herbicides, OP pesticides, and TPH. Two calibration methods may be used: external or linear regression methods. For the external method, the initial calibration may be verified by calculating the RRF and the %RSD for each compound. An RRF less than 0.05 or a %RSD greater than 20% is outside the QC limits for the initial calibration. If linear regression is used, the correlation coefficient must meet or exceed 0.995 before samples can be analyzed.

Continuing calibration (GC): The calibration verification is to confirm the calibration and evaluate instrument performance for single-component pesticides. The calibration verification consists of an instrument blank, performance evaluation mixtures (PEMs), and the midpoint concentration of the two standard mixes. The continuing calibration is run on two GC columns (a primary and a secondary) for analyte confirmation. The %D between the calculated amount and the true amount must not exceed 15% on the primary column. Multicomponent compounds do not require continuing calibration.

For herbicides and OP pesticides, the continuing calibration is verified by calculating the RRF and the %D for each compound. An RRF less than 0.05 or a %D greater than 15% is outside the QC limits for the continuing calibration.

For NAVBASE Charleston, only positive results were flagged when the %RSDs and %D were outside control limits but less than 50%. If the %RSD or %D exceeded 50%, both the positive and nondetected results were flagged. Based on professional judgment, the results were flagged in this manner because the risk would be in reporting results with a high bias rather than a low bias.

4.2.1.5 Matrix Spike/Matrix Spike Duplicate

An MS, used to determine the accuracy of the analysis for a given matrix, consists of a known quantity of stock solution added to the sample before its preparation and analysis. Evaluating the MS data involves two calculations. First, the %R is calculated by comparing the amount of the compound recovered by the analysis to the amount added to the sample. In addition, the relative percent difference (RPD) between the MS and the MSD samples is calculated and assessed. No specific requirements have been established for qualifying MS/MSD data. However, guidelines to aid in applying professional judgment are discussed in the Organic Functional Guidelines.

4.2.1.6 Laboratory Control Samples and Laboratory Duplicates

TPH and other GC methods may require laboratory control samples (LCSs) and laboratory duplicates with each Sample Delivery Group (SDG). The LCS monitors the overall performance of each step during analysis, including sample preparation. All aqueous LCS %R results must fall within the control limits established by the laboratory. Laboratory duplicate samples are used to demonstrate acceptable method precision at the time of analysis. The RPD between the sample and the duplicate sample is calculated. Although no guidelines are established for organic laboratory duplicates, sample qualification is left up to professional judgment.

4.2.1.7 Blank Analysis

Laboratory method blanks are used to assess the existence and magnitude of potential contamination introduced during analysis. Additionally, field blanks may be collected to assess any contamination introduced while collecting samples. When chemicals are found both in samples and laboratory blanks analyzed within the same 12-hour period and/or field-derived blanks, the usability of the data depends on the reviewer's judgment and the blank's origin. According to the Organic Functional Guidelines, a sample result should not be considered positive unless the concentration of the compound in the sample exceeds 10 times the amount in any blank for common laboratory contaminants (i.e., methylene chloride, acetone, 2-butanone, and phthalate esters), or five times the amount for other constituents. These amounts are referred to as action levels (ALs). Because blank samples may not be prepared using the same weight of sample, volume of sample, or dilution, these variables should also be considered when using these blank criteria. The specific actions to be taken are as follows:

- If a chemical is found in the blank but not the sample, no action is taken.
- If the sample concentration is less than the quantitation limit and less than the AL, the quantitation limit is reported.
- If the sample concentration is between the quantitation limit and the AL, the concentration is reported as nondetect *U*.
- If the sample concentration is greater than the AL, the concentration may be used unqualified.

4.2.1.8 Field-Derived Blanks

For this project, four types of field-derived blanks were collected: the field blank, the rinsate blank, the equipment blank, and the trip blank. The field blank is a sample of the source water

used onsite, primarily to decontaminate equipment. The rinsate blank is a sample of runoff water from one or more pieces of the decontaminated equipment used to collect samples. The equipment blank is a sample of each filter pack, grout, bentonite pellets, or powder used in well construction. The trip blank is a 40-milliliter (ml) VOA vial filled with certifiable water in the laboratory before the containers are shipped to the field. It is used to assess cross-contamination during VOC sample container handling, storage, and shipment.

The frequencies for collecting these QC samples were defined in Section 13 of the NAVBASE CSAP as follows:

- Field blank — one per sampling event (week) per source.
- Rinsate blank — one per week per media.
- Equipment blank — one sample of each well construction material per source.
- Trip blank — one per sample shipping cooler containing VOA samples.

Each trip blank is associated only with the samples from the same shipment or cooler. The field blanks and the rinsate blanks apply to a larger number of samples because only one is collected per sampling event. Because field-derived blanks are used with method blanks to assess potential cross-contamination of field investigative samples, no action was taken if the same contaminants were detected in the method blanks and the associated field-derived blanks but not in the investigative samples.

4.2.1.9 Internal Standard Performance

GC/MS ISs are added to samples to check the stability of the instrument's sensitivity and response during each analytical VOC and SVOC run. IS area counts for samples and blanks must not vary more than a factor of two (-50% to +100%) from the associated calibration standard. If IS concentration results are outside this window, the sample would be flagged as estimated.

Listed below are the IS compounds recommended by the methods.

VOC IS Compounds	SVOC IS Compounds	Dioxin
Bromochloromethane (BCM)	1,4-Dichlorobenzene-d4 (DCB)	¹³ C ₁₂ - 2,3,7,8-TCDD
1,4-Difluorobenzene (DFB)	Naphthalene-d8 (NPT)	¹³ C ₁₂ - 2,3,7,8-TCDF
Chlorobenzene-d5 (CBZ)	Acenaphthene-d10 (ANT)	¹³ C ₁₂ - 1,2,3,7,8-PeCDD
	Phenanthrene-d10 (PHN)	¹³ C ₁₂ - 1,2,3,7,8-PeCDF
	Chrysene-d12 (CRY)	¹³ C ₁₂ - 1,2,3,6,7,8-HxCDD
	Perylene-d12 (PRY)	¹³ C ₁₂ -1,2,3,4,7,8-HxCDF
		¹³ C ₁₂ -1,2,3,4,6,7,8-HpCDD
		¹³ C ₁₂ -1,2,3,4,6,7,8-HpCDF
		¹³ C ₁₂ -OCDD

Notes:

TCDD (Tetrachlorodibenzo-p-dioxin)	HpCDF (Heptachlorodibenzofuran)
TCDF (Tetrachlorodibenzofuran)	HxCDD (Hexachlorodibenzo-p-dioxin)
PeCDD (Pentachlorodibenzo-p-dioxin)	HxCDF (Hexachlorodibenzofuran)
PeCDF (Pentachlorodibenzofuran)	OCDD (Octachlorodibenzo-p-dioxin)
HpCDD (Heptachlorodibenzo-p-dioxin)	

4.2.1.10 Diluted Samples

A special evaluation was performed for diluted samples to determine if method detection limits were sufficiently low to be compared with reference concentrations (e.g., Maximum Contaminant Levels [MCLs], Risk-Based Concentrations [RBCs], etc.). Table 4.3 lists all diluted samples from Zone B.

4.2.2 Inorganic Evaluation Criteria

The USEPA methods described in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846)*, and 40 CFR Part 264, Appendix IX define QC criteria that the laboratory must meet, but the methods do not address data evaluation from a user's perspective. Evaluation criteria are available in *USEPA Contract Laboratory Program National Functional Guidelines*

for *Inorganic Data Review*, (February 1994) (Inorganic Functional Guidelines). The guidelines were used throughout the data evaluation process to address data usability.

Table 4.3
Diluted Samples

Sample ID	Sample Delivery Group	Parameter	Dilution Factor	Results ($\mu\text{g}/\text{kg}$)
GDBSB00501	L5540(PEST)	4,4'-DDE	15	390
GDBSB01001	L5540(PEST)	4,4'-DDE	15.5	420
GDBSB01301	L5540(PEST)	4,4'-DDE	10	470

Note:

$\mu\text{g}/\text{kg}$ = micrograms per kilogram

Data evaluation for samples collected at NAVBASE included:

- Holding times
- Instrument calibration
- MS results
- Laboratory duplicates
- Blank analysis
- Inductively Coupled Argon Plasma (ICAP) interference check samples
- ICAP serial dilutions
- LCS results
- Atomic Absorption (AA) duplicate injections and postdigestion spike recoveries
- Field duplicate precision

According to the Inorganic Functional Guidelines, when the QC parameters do not fall within the specific method guidelines, the data evaluator annotates or flags the corresponding compounds where deficiencies were found. The data from NAVBASE Charleston sites were

evaluated using this approach. The following flags were used to annotate data exhibiting laboratory and/or field deficiencies or problems:

U Undetected — The analyte was analyzed for but not detected above the instrument detection limit (IDL) or was also found in an associated blank at a concentration less than five times the blank concentration.

J Estimated Value — One or more QC parameters were outside control limits.

UJ Undetected and Estimated — The analyte was analyzed for but not detected above the listed estimated IDL; the IDL is estimated because one or more QC parameters were outside control limits.

R/UR Unusable Data — One or more QC parameters grossly exceeded control limits.

4.2.2.1 Holding Times

Acceptable technical holding times are specified in the CSAP. For aqueous and soil samples, the holding time for metals analysis is six months, except for mercury, which is 28 days from the date of collection. For aqueous and soil samples, cyanide analysis has a sample holding time of 14 days from the date of collection.

4.2.2.2 Instrument Calibration

Instruments are initially and continually calibrated with standard solutions used to check that they are capable of producing acceptable qualitative and quantitative data for the analytes on the inorganics list.

An initial calibration is performed to check the performance of the instrument at the beginning of the analytical run and to establish a linear calibration curve. Calibration standard solutions

are run periodically to check the performance of the instrument and confirm that the initial calibration curve is still valid. Calibrations are verified by calculating the %R and comparing the amount of the analyte recovered by analysis to the known amount of standard. The %R for metals, except mercury and cyanide, should fall between 90% and 110%. The %R for mercury and cyanide should fall between 80% and 120% and 85% and 115%, respectively.

4.2.2.3 Blank Analysis

Laboratory method blanks are used to assess the existence and magnitude of potential contamination introduced during analysis. Additionally, field blanks may be collected to assess the potential contamination introduced during sample collection. When chemicals are found in samples and laboratory blanks, the data's usability depends on the reviewer's judgment and the blank's origin. According to the Inorganic Functional Guidelines, a sample result should not be considered positive unless the sample concentration exceeds five times the amount in any blank (the AL). Because blank samples may not be prepared using the same weight of sample, volume of sample, or dilution, these variables should also be considered when using these blank criteria. The specific actions to be taken are as follows:

- If a chemical is found in the blank but not the sample, no action is taken.
- If the sample concentration is between the IDL and less than five times the amount found in any blank, the concentration is reported as *U*.
- If the sample concentration is greater than five times the amount in any blank, the concentration may be used unqualified.

4.2.2.4 Inductively Coupled Argon Plasma Interference Check Samples

The ICAP interference check sample is used to confirm the laboratory instrument's inter-element and background correction factors. Interference samples should be analyzed at the beginning

and end of each sample analysis or at least twice per 8-hour working shift. The %Rs for the interference check sample should fall between 80% and 120%.

4.2.2.5 Laboratory Control Samples

LCSs are used to monitor the overall performance of steps in the analysis, including the sample preparation. All aqueous LCS %R results must fall within the control limits of 80% to 120%, except for antimony and silver, for which control limits have not been established. Soil LCS standards are provided by the USEPA. Control limits are established for each soil LCS standard prepared.

4.2.2.6 Spike Sample Analysis

Samples are spiked with known quantities of analytes to evaluate the effect of the sample matrix on digestion and measurement procedures. The %R should be within 75% to 125%. However, when the sample concentration exceeds the spike concentration by a factor of four or more, spike recovery criteria are not applicable.

4.2.2.7 Laboratory Duplicates

Laboratory duplicate samples are analyzed to evaluate data precision, a measure of reproducibility. The RPD between the sample and the duplicate sample is calculated. A control limit of 20% RPD should not be exceeded for analyte values greater than 100 times the IDL.

4.2.2.8 ICAP Serial Dilutions

ICAP serial dilutions assess whether matrix interference is present. One sample from each set of similar matrix type is diluted by a factor of five. For an analyte concentration that is at least a factor of 100 times above the IDL, the measured concentrations of the undiluted sample and of the diluted sample should agree within 10%.

4.2.2.9 AA Duplicate Injections and Postdigestion Spike Recoveries

During AA analysis, duplicate injections and postdigestion spikes are used to assess precision and accuracy of the laboratory analysis. The %RSD of duplicate injections must agree within 20%. Percent recovery of the post-digestion spike sample should fall between 85% and 115%.

4.3 Zone B Data Validation Reports

A complete copy of the Zone B Data Validation Reports are included as Appendix E for review. These reports are the outcome of the evaluations described above and are specific to the analytical data collected during the Zone B RFI.

5.0 DETERMINATION OF NATURE AND EXTENT OF CONTAMINATION

This section describes the approach and technical methods employed to determine types (nature) and a real extent of all chemicals present in site samples (CPSS) in soil and groundwater at Zone B. Nature and extent were evaluated to determine the overall distribution of constituents detected on micro (site-specific), and macro (zone-wide) scales. In addition, these data will be used to assess basewide conditions and the relationship of contaminants between zones across NAVBASE.

Types of compounds detected in Zone B include: VOCs, SVOCs, pesticides, dioxins, and inorganics. Concentrations of detected compounds were compared to concentrations in the USEPA Region III RBC Table (January - June 1996, dated April 19, 1996), in order to evaluate the potential for detected compounds to impact protection of human health, to determine where additional sampling (if any) should be conducted to define the extent of contamination, and to develop investigative endpoints. Inorganic chemical concentrations were also compared to calculated background concentrations.

The site-specific nature and extent evaluation for AOC 507 is detailed in Section 10 of this report.

5.1 Organic Compound Analytical Results Evaluation

Organic compounds detected in Zone B soil were compared to RBCs. The RBCs listed in the site-specific evaluation in Section 10 are taken from the USEPA Region III RBC Table (April 1996). Information on each compound's frequency of detection and its average and range of detected concentrations was also compiled (see Section 10). The comparison of detected organic and inorganic chemical concentrations to the USEPA Region III RBC Table pertains only to the protection of human health, and does not address protection of ecological receptors which is evaluated in Section 8.

Dioxin data reflect summations of the tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) equivalency quotient (TEQ) values computed using the procedure identified in *Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated dibenzo-p-dioxins and dibenzofurans* (CDDs and CDFs), the 1989 update (USEPA, 1989d), and the USEPA *Interim Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment*, Bulletin No. 2, November 1995. For screening purposes, dioxin data were compared to the dioxin TEQ of 1.0 microgram per kilogram ($\mu\text{g}/\text{kg}$) based on a peer-reviewed scientific paper (Kimbrough et al., 1984). This dioxin concentration was used as the cleanup level at the Times Beach, Missouri, Superfund site.

In accordance with recent carcinogenic polynuclear aromatic hydrocarbons (cPAH) guidance (USEPA, Region IV, November 1995a), benzo(a)pyrene equivalents (BEQs) were computed, where appropriate, by multiplying the reported concentration of each cPAH by its corresponding toxicity equivalency factor (TEF). The BEQ values were then summed for each sample, and the total was compared to the BaP RBC value during the screening process.

5.2 Inorganic Analytical Results Evaluation

Sample results for inorganics are more difficult to evaluate because they are naturally occurring and ubiquitous in soil. Further compounding this difficulty is the fact that NAVBASE is predominantly dredge-fill material that has been artificially placed onsite. The following describes the step-by-step procedures used to determine background for inorganics within Zone B and the statistical approach for comparing background data to site data.

Many compounds, particularly carcinogenic metals such as arsenic and beryllium, are typically detected at much higher concentrations than their risk-based screening levels. It is usually necessary to supplement site-specific sampling efforts with an attempt to determine the non-site-related concentrations of these compounds. The problem is to determine these reference (or background) concentrations, and how much higher a parameter must be than this level before

it is of concern at a site. USEPA Region IV guidance recommends using twice the mean level of the background sample concentrations as an upper bound and to consider any site-related sample higher than this bound to be contaminated. Although this method is appropriate with small datasets, it would be inappropriate to use with the large grid-based dataset developed for soil at Zone B. E/A&H used a dual testing procedure to compare AOC inorganic parameters to this grid-based dataset. Parametric or nonparametric upper tolerance limits (UTLs) or reference concentrations were used in combination with Wilcoxon rank sum tests to make the comparisons for soil. Background tests for groundwater were not necessary because no groundwater samples were collected at AOC 507, the sole AOC/SWMU in Zone B.

5.2.1 Grid-Based Background Dataset

The background dataset for Zone B soil collected from the upper interval came from 15 sample locations (GDBSB00101 to GDBSB01501). One of 15 corresponding lower interval soil samples (GDBSB00302) was not collected because the soil was saturated. The background dataset for shallow groundwater was derived from four well locations (NBCB-GDB-001 to NBCB-GDB-004).

Descriptive statistics were compiled for the original soil data values, including frequency distribution histograms and normal probability plots. Results were examined and, where appropriate (i.e., histogram positively skewed; normal probability plot concave upward; high skewness and kurtosis), data were transformed into natural logarithms (LN) or square roots of their original values to more closely approximate normal distribution. Descriptive statistics of the transformed data were compared to those of the originals. Half (eight of 16) of the upper interval soil datasets for inorganics required transformation before parametric analysis, while only two of 15 lower interval soil datasets required transformation.

It has been suggested that lognormal data indicate the presence of contamination in the samples at the high end of the range. However, "EPA's experience with environmental concentration

data ... suggests that a lognormal distribution is generally more appropriate as a default statistical model than the normal distribution, a conclusion shared by researchers at the United States Geological Survey" (USEPA, 1992b).

Most of the background datasets examined were more nearly lognormal than normal. It is more reasonable to assume that lognormal background distributions of chemical concentrations are the norm for NAVBASE than to assume that the datasets document a background that is contaminated in comparable fashion by numerous chemicals at different depths in both soil and groundwater. Nevertheless, a few potential data outliers did appear at the high end of some of the datasets, and it was important to eliminate them to preserve the integrity and utility of the background data. Normally, outliers should be removed from a dataset only in unusual circumstances and for a specific reason. In lognormal or square-root distributions, even apparently extreme values may fit a straight line on a normal probability plot of transformed data. Statistical rules of thumb for outlier removal generally are based on the variance of the sample, and include methods such as the "rule of the huge error" (Taylor, 1990), in which all values greater than four standard deviations above the mean are discarded, as well as Rosner's test, Dixon's test, the Shapiro-Wilk test, and others (Gibbons, 1994).

Because of concerns about inadvertently including contaminated samples in the background datasets, outliers were eliminated more readily than many standard statistical guidelines would suggest. A cutoff of "mean + k (standard deviation)" was applied to the transformed data values for each chemical. This is the same standard used in Section 5.2.5, where it is discussed; the value of k depends on the sample size. Outliers were removed on a chemical-by-chemical basis, descriptive statistics were recalculated for each chemical's dataset, and the resulting modified datasets were used for all further comparisons to background.

5.2.2 Nondetect Data

Following guidelines presented in various USEPA documents, one-half of the sample quantitation limit (SQL) was used to represent nondetect values. In practice, this meant using one-half of the *U* values reported by the analytical laboratory and confirmed by the validator.

5.2.3 Developing Datasets for Sites

Results of laboratory analyses of soil samples from AOC 507 were assembled into datasets for each chemical of interest from upper and lower interval soils, for comparison to background.

5.2.4 Comparing Site Values to Background

The comparison of site to background can best be understood within the context of statistical hypothesis testing. A hypothesis test involves the creation of two hypotheses, a *null* and an *alternative* hypothesis. "In the context of background contamination at hazardous waste sites, the null hypothesis can be expressed as 'there is no difference between contaminant concentrations in background areas and onsite,' and the alternative hypothesis can be expressed as 'concentrations are higher onsite'" (USEPA RAGS, 1989a). Assuming there is no contamination, the likelihood of any observed difference between site and background can be calculated. If the probability of the observed difference is smaller than some predetermined level, a decision is made that since the observed site samples are not likely to be from the same population as the background samples, the site is considered contaminated for a particular chemical.

Two possible errors can be made in this situation. The first is that a site will be considered contaminated when in fact it is clean, which is called a false positive. The probability of this error, α , is controlled by specifying the level at which the null hypothesis is considered unlikely. The other possible error, the false-negative rate, β , can be seen as the probability of concluding from a test that no difference exists when in reality such a difference does exist; the site will be considered clean when in fact it is contaminated. The *power* of the test ($1-\beta$), which is the

complement of the false-negative rate, is a measure of the strength of the conclusion that a difference does exist; it can be thought of as the probability of correctly identifying a contaminated site (Table 5.1). Calculating of β and power is somewhat more difficult and depends upon the magnitude of the actual concentration differences, the size of the sample, and the form of the probability distribution for the measurement process.

Table 5.1
Probability of Possible Conclusions of a Hypothesis Test

Test Results	Reality	
	Same as Background (clean)	Greater than Background (contaminated)
Same as Background	$1-\alpha$	β
Greater than Background	α	$1-\beta$

There is a trade-off, in general, between the false-positive and false-negative rate, given a certain sample size. A test that rarely rejects the hypothesis of "no contamination" will be more prone to miss an actual difference. A test that frequently concludes contamination is present, on the other hand, will be more likely to make the mistake of concluding that a difference arising by chance is a real difference. The total amount of error can be minimized in two ways: by increasing the sample size or by using a test that is "most powerful." The choice of the form of the hypothesis test is crucial to minimizing the total error.

USEPA Region IV often suggests a "two-times background" test: If the maximum detected concentration of a chemical at a site exceeds twice the mean background concentration, the chemical should be considered a chemical of potential concern (COPC) and should be subjected to detailed risk analysis (i.e., the chemical is a contaminant onsite). What is often not recognized is that this procedure is a statistical one and is subject to the same errors as a hypothesis test. The problem with this approach is that background concentrations are never

level; that is, the nature of the background data greatly affects the result of applying the "two-times background" criterion. For a normally distributed variable with a coefficient of variation (CV) of 0.25, less than 0.01% of the population is expected to be greater than twice the mean; if the CV is 1.00, 15.9% of the population exceeds the standard. In the latter case, 15.9% of the presumably uncontaminated background population would be rated contaminated by the test (false positive rate = 15.9%). The "two-times background" test neglects the valuable information about variation that is present in the background samples and, therefore, cannot be the most statistically powerful test since it does not use the available data most effectively.

Hypothesis tests should be suited to the type of decision that needs to be made, as well as to the type of data available. Any method for comparing site to background must be capable of detecting two different kinds of site contamination. The first type involves localized "hot spots" within the site; for example, one or two site samples out of nine or 10 might test well above the highest background samples, while the rest are low or even nondetect. This situation was modeled as a mixture of two distributions — some of the samples from a given site come from a distribution similar to the background samples while others from the same site come from a second distribution with a higher mean/median. The other type of contamination occurs when most or all of the site samples are above the mean of background samples, but none is necessarily above the high end of the background range. This situation was modeled assuming that the distribution of site samples is similar to background, but with a higher mean/median. The first scenario is referred to as the mixture scenario and the second as the shift scenario. Two complementary tests were employed for these two situations respectively — a tolerance-interval test and a Wilcoxon rank sum test.

5.2.5 Tolerance-Interval or Reference Concentration Test

Individual data values from a site can be compared to a high percentile (95th, 98th, 99th) of background values. This operation can be done parametrically by comparing it to a specified percentile of the distribution of background values, obtained either from a normal probability

chart of transformed values or by using standard methods of estimating quantiles (e.g., Gilbert, 1987). It can also be done nonparametrically by comparing it to a percentile of the background data values themselves, rather than to an assumed distribution of the values.

Rather than comparing site values to specific percentiles of the background data, they can be compared to estimated tolerance intervals that enclose a specified percentage of the background population. A one-sided tolerance interval with 95% coverage and 95% confidence signifies that approximately 95% of individual population values fall below the upper limit of the interval, with 95% confidence. Once the interval is constructed, each site sample is compared to the UTL, or reference concentration (USEPA, 1992b). Any value that exceeds the limit is considered evidence of contamination at that point.

A roughly lognormal distribution of background values allows the use of parametric tolerance intervals, using LN-transformed values, when the nondetect percentage is low. This is the approach favored by both the Ohio Environmental Protection Agency and the Texas Natural Resource Conservation Commission to determine whether onsite contamination is greater than background. Individual sample values are compared to a UTL or reference concentration that is calculated using the expression:

$$\exp[X + k (s)]$$

Where:

- X = mean of LN-transformed background values
- s = standard deviation of LN-transformed values
- k = tolerance factor (Ohio EPA, 1991)

When a square-root data transformation is used, the comparable expression is:

$$[X + k (s)]^2$$

For original (untransformed) data values, the expression reduces to:

$$X + k (s)$$

The tolerance factor, k , is obtained from tables with specified levels of α and P_0 , where $(1 - P_0)$ equals the proportion of the population contained within the tolerance intervals. For a given set of α and P_0 , k depends on the sample size, n . For $n = 15$ (the background sample size for upper interval soil in Zone B), $k = 2.566$ when $\alpha = 0.05$ and $P_0 = 0.05$ (confidence = 95%, coverage = 95%). Based on these numbers, the UTL for original (untransformed) background concentration values of a given element is therefore:

$$\text{UTL} = \text{mean} + 2.566 (\text{standard deviation})$$

According to a USEPA statistical training course manual (USEPA, 1992c), reference concentrations "can be computed with as few as three data values; however, to have a passable estimate of the standard deviation, one should probably have at least eight to 10 samples." The tolerance-interval calculations were first performed on the original soil datasets (15 samples at the upper level; 14 samples at the lower level) to identify and remove outliers, as explained in Section 5.2.1. A UTL, or reference concentration, was then recalculated for the revised dataset of each chemical. This "second generation" UTL was the one used for background comparisons. Shallow groundwater background datasets for Zone B contain only four samples. If reference concentrations had been needed for comparisons to site samples, they would have been computed as twice the means of these four samples.

Where a significant proportion of the samples were nondetect ($> 50\%$), or where transformed values could not be made to approximate a normal distribution, means and standard deviations could not be computed accurately, and it was necessary to employ nonparametric tolerance intervals. The UTLs or reference concentrations were taken directly from the sample sets, rather than from calculations based on the presumed data distributions. In practice, this meant using the largest observed background value as the standard of comparison (USEPA, 1992b) when data reported as not detected (ND) are greater than 50%. As with the parametric calculations, the method was first applied to the background datasets to eliminate presumed outliers, then re-applied to the remaining data values to obtain the reference concentrations.

The following decision rule was applied to the background datasets for soil:

- Where NDs $\leq 50\%$, use parametric UTL (where justified by data distribution).
- Where $50\% < \text{NDs} < 90\%$, use nonparametric UTL: highest value in data set.
- Where NDs $\geq 90\%$, no valid UTL can be determined.

The power of a tolerance-limit test varies based on several factors, such as the number of samples that are assumed to have come from the distribution with the larger mean, and the distribution of the background samples. It also depends upon the sample size at each site and the sample size of the background.

5.2.6 Wilcoxon Rank Sum Test

When values for the majority of a site's samples are higher than the mean background value, but none is dramatically higher, the site samples, as a group, must be shown to be significantly higher than the background samples, as a group, for contamination to be identified onsite.

The most commonly prescribed method for comparing two populations is the Student's *t*-test, which determines whether the two population means differ significantly. The *t*-test was not used

in this report to compare site values to background because it is parametric. Although the background data values are approximately normally distributed after being transformed (by LN or square root), there is no reason to expect that the site values will be. In addition, the presence of estimated values for the nondetects calls into question the accuracy of the calculated means that are compared within the *t*-test.

A nonparametric counterpart to the *t*-test is the Wilcoxon rank sum test, also known as the Mann-Whitney U test. Since it is nonparametric, the two datasets that are compared need not be drawn from normal or even symmetric distributions, and the test can accommodate a moderate number of nondetect values by treating them as ties (Gilbert, 1987). The method for handling nondetect and qualified values is important because it affects their ranks. Detected but not quantified values (*J*s) should receive higher ranks than nondetects (*U*s). Since the *ranks* of the data values are evaluated and compared rather than the values themselves, the test is not sensitive to minor inaccuracies in estimated values and does not require an estimate of the mean, nor do the data values need to be transformed. The Wilcoxon test is superior to some other nonparametric tests, such as the sign test or the test of proportions, because it accounts for differences in concentrations and, therefore, has more statistical power to detect differences in those concentrations.

The Wilcoxon rank sum test operates by combining the site and background data values and ranking them by concentration. The ranks of the site samples are then compared to the background ranks. If the site ranks, as a group, are significantly higher than those of the background, the null hypothesis that the site and background values came from the same population is rejected at a chosen confidence level (USEPA, 1992b). Each group should contain at least four data values.

The Wilcoxon test is very similar in power to the *t*-test when samples are normally distributed and is more powerful when the distribution is skewed. The power of this test varies based on

several variables, such as the magnitude of the shift in the median, the distribution of the background samples, the sample size at each site, and the sample size of the background.

5.2.7 Summary of Statistical Techniques Used

Techniques that allow the use of statistical inference were chosen. Methods used are capable of detecting situations where (a) a small number of site values are much higher than background, or (b) site values are generally higher than background. For situation (a), all data values were transformed where appropriate to approximate normal distributions, then site values were compared to a UTL, mean plus k standard deviations of the background data, where k depends on sample size. Where the percentage of nondetects is high, nonparametric UTLs were used; above 90% nondetects, no reliable tolerance limits can be determined. For situation (b), the Wilcoxon rank sum test was applied to compare each group of site values to background.

5.2.8 Combined Results of the UTL (Reference Concentration) and the Wilcoxon Rank Sum Tests

Methods described in Section 5.2.5 identify individual samples with concentrations that are significantly higher than background, while the method in Section 5.2.6 identifies entire sites. If the results from either test were positive (i.e., significantly higher than background), the sample values exceeding background were compared to the corresponding USEPA RBCs for soil and, where appropriate, carried forward into detailed human health risk assessment.

5.2.9 Conclusion

The overall approach documented here is conservative for a number of reasons: (1) the number of background samples for soil is generally above the minimum recommended in various guideline documents (USEPA RAGS, 1989a; Ohio EPA, 1991), producing greater confidence in the ability to characterize background and to distinguish background concentrations from those onsite; (2) following methodology developed in Section 5.2.1, high values were removed from the background datasets whether or not they were true outliers in the conventional sense, thereby

lowering the total background concentrations to which the site values were compared; and (3) the use of two complementary tests increased the likelihood that any contamination would be identified and addressed further, since a positive result from either test triggered a detailed human health risk assessment whenever site concentrations exceeded corresponding USEPA RBC values.

5.2.10 Statistical Test Results for AOC 507

Surface Soil

Sixteen inorganic chemicals were carried forward for statistical comparison using the UTL test and the Wilcoxon rank sum test. Valid background comparisons could not be made for cadmium, thallium, or cyanide (no detections in background samples), nor for antimony (one detection in 15 background samples). According to the UTL test, concentrations of lead in two samples at AOC 507 exceed background reference concentrations. According to the Wilcoxon test, none of the inorganics at AOC 507 reported concentrations significantly higher than background. The two concentrations of lead that exceed its UTL are below lead's corresponding treatment technique action level (equivalent to an RBC), while concentrations of the three chemicals (aluminum, arsenic, and manganese) that exceed their respective RBCs are below their corresponding UTLs. Consequently, no inorganic COPCs were identified in upper level soil at AOC 507. Table 5.2 summarizes these test results.

Table 5.2
Zone B Surface Soil
General Summary of Positive and Negative Background Test Results

	Wilcoxon Positive	Wilcoxon Negative	Total
UTL Positive	0	1	1
UTL Negative	0	15	15
Total	0	16	16

The comparison of detected organic and inorganic chemical concentrations to the USEPA Region III RBC Table pertains only to the protection of human health and does not address protection of ecological receptors.

Table 5.3 summarizes the steps taken in calculating UTL or reference concentrations for surface soil in Zone B. UTLs were calculated for 16 chemicals.

Table 5.3
 Charleston Zone B Surface Soils
 Characteristics of Background Datasets

Chemical	n	Mean mg/kg	Data Transformation	Type of UTL	UTL mg/kg
Aluminum	12 ^a	9,714	none	parametric	15,500
Antimony	15	6.80	no valid UTL; NDs > 90%		
Arsenic	15	8.54	ln	parametric	90.0
Barium	15	47.09	none	parametric	98.7
Beryllium	15	0.549	sqrt	parametric	1.34
Cadmium	15		(no detections)		
Chromium	15	23.33	ln	parametric	80.2
Cobalt	15	3.27	ln	parametric	21.9
Copper	15	30.62	ln	parametric	225
Lead	15	51.89	none	parametric	114
Manganese	15	218.6	none	parametric	589
Mercury	15	0.342	none	nonparametric	1.55
Nickel	15	11.42	ln	parametric	43.6
Selenium	15	0.816	none	nonparametric	2.80
Silver	15	0.717	none	nonparametric	1.70
Thallium	15		(no detections)		
Tin	15	7.53	none	nonparametric	14.8

Table 5.3
Charleston Zone B Surface Soils
Characteristics of Background Datasets

Chemical	n	Mean mg/kg	Data Transformation	Type of UTL	UTL mg/kg
Vanadium	15	25.73	ln	parametric	156
Zinc	15	105.6	none	parametric	293
Cyanide	15		(no detections)		

Notes:

- n = number of samples
- mg/kg = milligrams per kilogram
- sqrt = square root
- ^a = Three data points were removed from the dataset as outliers (aluminum concentrations were greater than 20,000 mg/kg).

Subsurface Soil

Sixteen inorganic chemicals were carried forward for statistical comparison using the UTL test. Valid background comparisons could not be made for cadmium, thallium, or cyanide (no detections in background samples), nor for antimony (one detection in 14 background samples). According to the UTL test, no inorganic chemicals at AOC 507 reported concentrations exceeding background reference concentrations. The Wilcoxon test was not run on subsurface soil results because it was not needed for the risk assessments, and its output is not relevant to evaluation of individual sample concentrations.

Table 5.4 summarizes the steps taken in calculating UTL or reference concentrations for subsurface soil in Zone B. UTLs were calculated for 16 inorganic chemicals.

Table 5.4
 Charleston Zone B Subsurface Soils
 Characteristics of Background Datasets

Chemical	n	Mean mg/kg	Data Transformation	Type of UTL	UTL mg/kg
Aluminum	12 ^a	7,395	none	parametric	17,700
Antimony	14	7.72	no valid UTL; NDs > 90%		
Arsenic	14	6.46	ln	parametric	48.9
Barium	14	28.04	none	nonparametric	65.0
Beryllium	14	0.40	sqrt	parametric	1.61
Cadmium	14	(no detections)			
Chromium	14	19.53	none	nonparametric	75.7
Cobalt	14	4.47	none	nonparametric	10.6
Copper	14	9.39	none	parametric	47
Lead	14	21.0	none	parametric	145
Manganese	14	129.5	none	nonparametric	288
Mercury	14	0.255	none	nonparametric	2.0
Nickel	14	8.25	none	nonparametric	29.9
Selenium	14	0.874	none	nonparametric	3.8
Silver	14	0.949	none	nonparametric	1.8
Tin	14	NA	none	nonparametric	1.3
Thallium	14	(no detections)			
Vanadium	14	22.04	none	nonparametric	102
Zinc	14	47.19	none	nonparametric	238
Cyanide	14	(no detections)			

Notes:

- n = number of samples
- mg/kg = milligrams per kilogram
- sqrt = square root
- a = Two data points were removed from the dataset as outliers (aluminum concentrations were greater than 20,000 mg/kg).

Shallow Groundwater

Because no site-specific groundwater sampling was conducted during the Zone B RFI, there was no need for comparison to background.

6.0 FATE AND TRANSPORT

The objective of fate and transport assessments is to evaluate what is known regarding the constituents in the environment based on inherent characteristics of both the constituents and the environmental media in which they have been found. Specifically, fate and transport assessment evaluates a constituent's ability to become mobile or change in the environment. To accomplish this, a general understanding of the chemical and physical properties that govern the interaction of a constituent within environmental media is required. From a macroscopic viewpoint, the characteristics of the site — such as topography, weather, geography, and geology — play a role in the erosional transport process. From a microscopic viewpoint, the characteristics of site soil, sediment, and water, as well as the chemical and physical properties of the constituent, play a role in evaluating the processes of advection, diffusion, and dispersion that move a constituent between media or from place to place within a medium. A discussion of fate and transport will help to identify potential receptors resulting from the constituent movement in the environment.

Potential routes of constituent migration identified for Zone B include:

- Air emissions resulting from VOCs released from surface soil
- The leaching of constituents from soil to groundwater.
- The migration of constituents from shallow groundwater into surface water bodies.

As mentioned above, significant processes of constituent migration include erosion, advection, diffusion, and dispersion and are defined as follows:

Erosion

Erosion is the process by which particles are suspended and subsequently moved by the physical action of water. Compounds adsorbed to particulate material are thereby moved along with the particulates.

Advection

Advection is the process by which dissolved substances migrate with flowing groundwater. Hydraulic conductivity, effective porosity, average linear velocity, and hydraulic gradient are characteristics that determine a chemical's rate of movement by advection.

Diffusion

Diffusion is the hydrodynamic process by which solutes are transported from a region of high concentration to a region of low concentration. In very fine sediments with very slow hydraulic conductivities, diffusive transport may be the dominant mode of migration.

Dispersion

Dispersion is the hydrodynamic process by which solutes are mixed with uncontaminated water, diluted, and transported preferentially due to heterogeneous properties of the aquifer.

6.1 Properties Affecting Fate and Transport

Numerous chemical and physical properties of both the constituent and the surrounding media are used to evaluate fate and transport mechanisms.

6.1.1 Chemical and Physical Properties Affecting Fate and Transport

Chemical and physical properties used to evaluate fate and transport include vapor pressure, density, solubility, half-life, Henry's law constant, organic carbon/water partitioning coefficient, and molecular weight. Table 6.1 provides an overview of chemical property behavior based on these properties.

Table 6.1
Chemical and Physical Properties

Chemical Property	Critical Value	High (>)	Low (<)
Vapor Pressure (VP)	10 ⁻³ mm Hg	volatile	nonvolatile
Density ^a (D)	0.75 to 1.25 g/cm ³	sink/fall	float/rise
Solubility ^a (S)	0 to 100 mg/L	leaches from soil, mobile in water, does not readily volatilize from water	absorbs to soil, immobile in water, volatilizes from water
Henry's Law Constant (HL)	5x10 ⁻⁶ to 5x10 ⁻³ atm-m ³ /mole	resistance to mass transfer in the aqueous phase	resistance to mass transfer in the gas phase
Half-life (T _{1/2})	biologically dependent	does not degrade readily	degrades readily
Organic Carbon/Water Partitioning Coefficient ^a (K _{oc})	10 to 10000 kg _{oc} /L _{water}	tends to adsorb to organic material in soil; immobile in the soil matrix	tends not to adsorb to organic material in soil; mobile in the soil matrix
Molecular Weight (MW)	400 g/mole	parts of the above may hold true, more detailed evaluation necessary	all of the above hold true

Notes:

- ^a = Determinations for the Critical Ranges were based on literature review and professional judgment.
- g/cm³ = grams per cubic centimeter
- mg/L = milligrams per liter
- atm-m³/mole = atmosphere cubic meters per mole
- g/mole = grams per mole
- mmHg = millimeters of mercury

Table 6.2 summarizes the chemical and physical property data for all of the constituents detected in Zone B environmental media.

Compounds with similar chemical and physical properties also display similar fate and transport mechanisms. This facilitates the general grouping of contaminants based on chemical and physical properties into these categories: VOCs, SVOCs, pesticides/PCBs, chlorinated herbicides, chlorinated dibenzodioxins/dibenzofurans, and inorganics.

Table 6.2
 Soil to Groundwater Soil Screening Levels
 NAVBASE-Charleston, Zone B
 Charleston, South Carolina

Default Soil Parameters*:								
Fraction Organic Carbon (--):	0.002							
Dilution Attenuation Factor (--):	20							
Dry Soil Bulk Density (kg/L):	1.5							
Water-filled Soil Porosity (--):	0.3							
Air-filled Soil Porosity (--):	0.13							
Soil Porosity (--):	0.43							
			Henry's	Organic	Tap	Unadjusted	Target	Soil to
			Law	Carbon	Water	Target	Target	Groundwater
			Constant	Water	Part.	Leachate	Leachate	SSL
			(--)	Coeff.	RBC	Conc.	Conc.	
			(--)	(L/kg)	(mg/L)	(mg/L)	(mg/L)	
			Kd (pH 6.8)					
Inorganics								
Aluminum	mg/kg	NA	NA	37	NA	37	740	Background
Arsenic	mg/kg	NA	2.90E+01	4.5E-05	0.05	0.05	1	2.9E+01
Barium	mg/kg	NA	4.10E+01	2.6	2	2	40	1.6E+03
Beryllium	mg/kg	NA	7.90E+02	1.6E-05	0.004	0.004	0.08	6.3E+01
Chromium (hexavalent)	mg/kg	NA	1.80E+06	37	0.1	0.1	2	3.6E+06
Chromium (total)	mg/kg	NA	1.90E+01	0.18	0.1	0.1	2	3.8E+01
Cobalt	mg/kg	NA	NA	2.2	NA	2.2	44	Background
Copper	mg/kg	NA	NA	1.5	1.3	1.3	26	Background
Lead	mg/kg	NA	NA	0.015	NA	0.015	0.3	Background
Manganese	mg/kg	NA	NA	0.84	NA	0.84	16.8	Background
Mercury	mg/kg	NA	5.20E+01	0.011	0.002	0.002	0.04	2.1E+00
Nickel	mg/kg	NA	6.50E+01	0.73	0.1	0.1	2	1.3E+07
Selenium	mg/kg	NA	5.00E+00	0.18	0.05	0.05	1	5.2E+00
Silver	mg/kg	NA	8.30E+00	0.18	NA	0.18	3.6	3.1E+01
Vanadium	mg/kg	NA	NA	0.26	NA	0.26	5.2	Background
Zinc	mg/kg	NA	6.20E+01	11	NA	11	220	1.4E+04
Carcinogenic PAHs								
Benzo(a)pyrene Equivalents								
Benzo(a)anthracene	ug/kg	1.37E-04	3.98E+05	9.2E-05	NA	9.2E-05	0.00184	1.5E+03
Benzo(a)pyrene	ug/kg	4.63E-05	1.02E+06	9.2E-06	0.002	0.002	0.04	8.2E+04
Benzo(b)fluoranthene	ug/kg	4.55E-03	1.23E+06	9.2E-05	NA	9.2E-05	0.00184	4.5E+03
Benzo(k)fluoranthene	ug/kg	3.40E-05	1.23E+06	0.00092	NA	0.00092	0.0184	4.5E+04
Chrysene	ug/kg	3.88E-03	3.98E+05	0.0092	NA	0.0092	0.184	1.5E+05
Dibenz(a,h)anthracene	ug/kg	6.03E-07	3.80E+06	9.2E-06	NA	9.2E-06	0.000184	1.4E+03
Indeno(1,2,3-cd)pyrene	ug/kg	6.56E-05	3.47E+06	9.2E-05	NA	9.2E-05	0.00184	1.3E+04
Chlorinated Pesticides								
4,4'-DDD	ug/kg	1.64E-04	1.00E+06	0.00028	NA	0.00028	0.0056	1.1E+04
4,4'-DDE	ug/kg	8.61E-04	4.47E+06	0.0002	NA	0.0002	0.004	3.6E+04
4,4'-DDT	ug/kg	3.32E-04	2.63E+06	0.0002	NA	0.0002	0.004	2.1E+04
Semivolatile Organics								
Acenaphthylene	ug/kg	8.20E-03	4.79E+03	0.15	NA	0.15	3	2.9E+04
Anthracene	ug/kg	2.67E-03	2.95E+04	1.1	NA	1.1	22	1.3E+06
Benzo(ghi)perylene	ug/kg	5.74E-06	7.76E+06	0.15	NA	0.15	3	4.7E+07
Benzoic acid	ug/kg	6.31E-05	5.76E-01	15	NA	15	300	6.0E+00
Fluoranthene	ug/kg	6.60E-04	1.07E+05	0.15	NA	0.15	3	6.4E+00

Table 6.2
 Soil to Groundwater Soil Screening Levels
 NAVBASE-Charleston, Zone B
 Charleston, South Carolina

Default Soil Parameters*:								
Fraction Organic Carbon (--):	0.002							
Dilution Attenuation Factor (--):	20							
Dry Soil Bulk Density (kg/L):	1.5							
Water-filled Soil Porosity (--):	0.3							
Air-filled Soil Porosity (--):	0.13							
Soil Porosity (--):	0.43							
		Henry's	Organic	Tap	Unadjusted	Target	Target	Soil to
		Law	Carbon	Water	Target	Leachate	Leachate	Groundwater
		Constant	Water	RBC	MCL/	Conc.	Conc.	SSL
		(--)	Coeff.	(mg/L)	MCLG	(mg/L)	(mg/L)	
			(L/kg)		(mg/L)			
Phenanthrene	ug/kg	1.60E-03	2.29E+04	0.15	NA	0.15	3	1.4E+05
Pyrene	ug/kg	4.51E-04	1.05E+05	0.11	NA	0.11	2.2	4.6E+05
2,3,7,8-TCDD Equivalents	ng/kg	NA	3.30E+06	4E-10	3E-08	3E-08	6E-07	4.0E+03
Volatile Organics								
Acetone	ug/kg	1.59E-03	5.75E-01	0.37	NA	0.37	7.4	1.5E+03
Benzene	ug/kg	2.28E-01	5.89E+01	0.00036	0.005	0.005	0.10	3.4E+01
2-Butanone	ug/kg	1.90E-03	3.88E+00	0.19	NA	0.19	4	7.9E+02
Carbon disulfide	ug/kg	1.24E+00	4.57E+01	0.1	NA	0.1	2	8.0E+02
Toluene	ug/kg	2.72E-01	1.82E+02	0.075	1	1	20	1.2E+04
Trichloroethene	ug/kg	4.22E-01	1.66E+02	0.0016	0.005	0.005	0.1	5.7E+01

* Default soil parameters from USEPA Soil Screening Guidance

NA - Not Applicable/Not Available

L/kg - Liters per kilogram

mg/L - milligrams per liter

mg/kg - milligrams per kilogram

ug/kg - micrograms per kilogram

VOCs

The chemical and physical properties with the greatest influence on the fate and transport of VOCs are solubility, Henry's law constant, and vapor pressure. Typical fate and transport characteristics are:

- VOCs can leach from soils into groundwater.
- VOCs tend to be highly mobile in both soil and groundwater.
- VOCs tend to volatilize from both soil and groundwater.
- VOCs tend to dissipate relatively quickly.

The VOCs have low molecular weights, moderate densities, and Henry's law constants, varying organic carbon/water partitioning coefficients, and high solubilities and vapor pressures. Overall, VOCs are expected to be moderately to highly mobile in the environment and to be relatively quick in attenuating from soil and groundwater.

SVOCs

The chemical and physical properties with the greatest influence on the fate and transport of SVOCs are solubility, vapor pressure, and organic carbon/water partitioning coefficient. Typical fate and transport characteristics are:

- SVOCs tend to adsorb to soil particles.
- SVOCs tend to be immobile in the environment.
- SVOC movement tends to occur more often by colloidal suspension than by diffusion (i.e., greater mobility occurs when coupled with "carrier" compounds).

SVOCs have high molecular weights; wide-ranging vapor pressures, solubilities, and Henry's law constants; moderate to high densities; and generally high organic carbon/water partitioning coefficients. Overall, SVOCs are expected to be relatively immobile in soil and diffuse only slightly to groundwater. The most notable exception to the anticipated SVOC immobility in the environment are the phenols, and substituted phenols, which have higher solubilities.

Pesticides/PCBs

The chemical and physical properties with the greatest influence on the fate and transport of pesticides/PCBs are solubility, Henry's law constant, and organic carbon/water partitioning coefficient. Typical fate and transport characteristics are:

- Pesticides/PCBs tend to adsorb to soil particles.
- Pesticides/PCBs tend to be hydrophobic (avoid water).
- Pesticides/PCBs tend to be immobile in the environment.
- Pesticides/PCBs tend to degrade relatively slowly.

Pesticides/PCBs have moderate molecular weights, generally high densities and organic carbon/water partitioning coefficients, and generally low solubilities, vapor pressures, and Henry's law constants. Overall, pesticides/PCBs are anticipated to be immobile and persistent in the environment, not readily diffusing into groundwater.

Chlorinated Herbicides

Solubility has the greatest influence on the fate and transport of chlorinated herbicides. Typical fate and transport characteristics are:

- Chlorinated herbicides can leach from soil particles to groundwater.
- Chlorinated herbicides tend to be mobile in both soil and groundwater.
- Chlorinated herbicides tend to degrade relatively slowly.

Chlorinated herbicides have low Henry's law constants and vapor pressures, and moderate molecular weights, organic carbon/water partitioning coefficients, and solubilities. Overall, chlorinated herbicides are expected to be moderately mobile in groundwater with some retention in soil.

Chlorinated Dibenzodioxins/Dibenzofurans

The chemical and physical properties with the greatest influence on the fate and transport of chlorinated dibenzodioxins/dibenzofurans are solubility, Henry's law constant, and organic carbon/water partitioning coefficient. Typical fate and transport characteristics are:

- Chlorinated dibenzodioxins/dibenzofurans tend to adsorb to soil particles.
- Chlorinated dibenzodioxins/dibenzofurans tend to be hydrophobic (avoid water).
- Chlorinated dibenzodioxins/dibenzofurans tend to be immobile in the environment.
- Chlorinated dibenzodioxins/dibenzofurans tend to degrade relatively slowly.

Chlorinated dibenzodioxins/dibenzofurans exhibit limited mobility in most environmental settings, have a strong affinity for soil particles and organic matter, and are not expected to leach to groundwater.

Inorganics

Solubility has the greatest influence on the fate and transport of inorganics. Typical fate and transport characteristics are:

- Inorganics tend to adsorb to soil particles.
- Inorganics are not degradable.
- Inorganics tend to have moderate to low mobility; however, in environments where there is a low pH (i.e., acidic conditions [pH <5]), inorganics can become mobile.

Properties of the surrounding environmental media tend to dictate the fate and transport mechanisms of inorganic elements. Overall, inorganics are anticipated to be immobile and to remain adsorbed to soil particles, not readily diffusing into groundwater.

6.1.2 Media Properties Affecting Fate and Transport

The properties of environmental media used to evaluate fate and transport are total organic carbon (TOC), cation exchange capacity (CEC), redox conditions, pH, soil type, and retardation rate. The following briefly discusses these properties.

Total Organic Carbon

TOC indicates the soil's adsorptive capabilities. The higher the TOC, the higher the potential for a chemical to adsorb to soil particles. The soil/water partition coefficient (K_d) is based on the TOC of the soil and is used to predict the capacity for a constituent to partition between soil and water. To estimate K_d , the constituent's organic carbon/water partitioning coefficient (k_{oc}) is adjusted by the soil's TOC. Higher K_d values indicate a tendency for chemicals to adsorb to the soil matrix.

Cation Exchange Capacity

CEC reflects the soil's capacity to adsorb ions neutralizing an ionic deficiency on its surface. Generally, trivalent ions are preferentially adsorbed to soil over divalent ions, and divalent ions are preferentially adsorbed over monovalent ions. Although this is generally the case, the process also depends on soil pH. Soil with high CEC values has the potential to adsorb inorganic ions and organic compounds with dipole moments.

Redox Conditions

Redox is the process which includes oxidation (the loss of electrons) and reduction (the gain of electrons). The resultant change in oxidation state generates products that are different from the reactants in their solubilities, toxicities, reactivities, and mobilities. Primarily, redox reactions

influence the mobility of inorganic chemicals. Extreme redox conditions tend to mobilize chemicals, especially inorganics.

pH

The pH value is a logarithmic measure of hydrogen ions in the soil or groundwater, indicating the acidity or alkalinity of the medium. Chemicals react significantly different under changing pHs. Low pH conditions tend to mobilize chemicals, especially inorganics, while high pH conditions may lead to the formation of immobile metal hydroxides.

Soil Type

Soil's mineralogical composition, particle size distribution, and organic content influence chemical fate and transport. Soil type dictates hydraulic conductivity, effective porosity, average linear velocity, and hydraulic gradient which, in turn, affect groundwater flow.

Retardation Factor (R)

The retardation factor is used to evaluate the ability for a soil or groundwater to inhibit the movement of a chemical by preferentially binding to contaminants with high organic carbon/water partitioning coefficients.

6.2 Fate and Transport Approach for Zone B

Fate and transport discussion for each SWMU/AOC begins with a description of site characteristics that can affect constituent migration. Three potential routes of constituent migration have been identified for Zone B. AOC 507 has been evaluated with respect to site characteristics that will influence these migration pathways.

An evaluation of an individual constituent's ability to migrate is based on three cross-media transfer mechanisms: soil to groundwater, groundwater to surface water, and/or surface soil to air. Transfers of constituents from soil to groundwater and soil to air have been evaluated by

comparison to soil screening levels (SSLs) that are presented in *USEPA Region III RBC Table*, (April 1996), or *USEPA Soil Screening Guidance* (December 1994). Although these documents do not provide an equation appropriate for evaluating groundwater migration, SSLs have been used in conjunction with travel time analysis to assess the potential significance of this pathway. The following subsections describe the methods used to evaluate the potential migration of constituents identified at AOC 507. Fate and transport were not evaluated for essential nutrients (calcium, iron, magnesium, potassium, and sodium), or chlorides, which are abundant in shallow coastal/estuarine environments.

6.2.1 Soil-to-Groundwater Cross-Media Transport

Soil-to-groundwater migration of constituents has been evaluated based on the screening process described below.

Quantitative Screening Process

Maximum soil concentrations for AOC 507 were compared to the greater of leachability-based soil-to-groundwater screening levels, assuming a dilution attenuation factor of 20, as presented in the *USEPA Soil Screening Guidance* (April 1996), and background concentrations.

The quantitative assessment refines the list of chemicals considered for formal fate and transport evaluation. It was assumed that if soil concentrations do not exceed leachability-based screening levels or background concentrations, no significant migration potential exists relative to human health.

Detailed Assessment

Upon completion of the quantitative screening processes, detailed analyses were performed to delineate the areal extent of leachable soil impacts. The outcome of the detailed assessment was used to determine the significance of soil impacts relative to deeper soil and/or the shallow aquifer. In some instances, isolated areas of soil contamination above leachability-based

concentrations may have the potential for localized subsurface soil or shallow groundwater impacts, but not of a magnitude that would pose a long-term or widespread threat. The detailed assessment was used to identify these cases, as well as to make conclusions as to what areas of soil contamination may require supplemental investigation and/or modeling applications during the CMS as part of the remedial alternatives development process.

6.2.2 Groundwater-to-Surface Water Cross-Media Transport

The approach used to evaluate the groundwater migration mechanism is based on the following screening process.

Qualitative Screening

Since groundwater was not sampled for AOC 507 the evaluation of this transfer mechanism focuses on compounds identified during the soil-to-groundwater screening as having the potential to impact the shallow aquifer.

Travel Time Analysis

For constituents identified through qualitative screening, travel time analysis was used to identify chemicals with the potential to disperse within the aquifer, increasing the areal extent of groundwater concentrations that exceed human health-based standards, or impact surface water via groundwater migration and discharge.

The outcome of the travel time analysis was used to determine the significance of any shallow groundwater or surface water impacts. Because no surface water data were collected as part of the Zone B RFI, the potential for significant surface water impacts was determined preliminarily. The Zone J RFI results will be used to confirm or refute preliminary conclusions. The detailed assessment was used to render conclusions regarding what areas of shallow groundwater and/or surface water contamination may require supplemental investigation and/or modeling applications during the CMS as part of the remedial alternatives development process.

6.2.3 Soil-to-Air Cross-Media Transport

To evaluate the potential for soil-to-air migration of volatile contaminants, a screening approach was used to focus attention on chemicals that have the greatest potential to volatilize in sufficient quantities to create a human health threat in ambient air. The screening process may be summarized as follows:

Quantitative Screening Process

The maximum concentrations of volatile CPSSs detected in surface soil at AOC 507 were compared to soil-to-air screening concentrations as presented in the *USEPA Soil Screening Guidance* (April 1996).

The quantitative assessment further refines the list of chemicals considered for formal fate and transport evaluation. If soil concentrations do not exceed soil-to-air volatilization screening concentrations, no significant migration potential exists, and current soil conditions are protective of human health relative to potential inhalation exposure pathways.

Detailed Assessment

After completing the quantitative screening process, detailed analyses were performed to delineate the areal extent of surface soil impacts potentially affecting ambient air.

The outcome of the detailed assessments was used to determine the significance of soil impacts relative to ambient air. In some instances, isolated areas of soil contamination above the soil-to-air volatilization-based concentration may have the potential for localized ambient air impacts but not be of a magnitude to pose a long-term or widespread threat through inhalation pathways. The detailed assessment was used to identify these cases as well as to make conclusions as to what areas of soil contamination may require supplemental investigation and/or modeling applications during the CMS as part of the remedial alternatives development process.

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7.0 HUMAN HEALTH RISK ASSESSMENT

7.1 Introduction

A BRA analyzes the potential adverse effects on actual or hypothetical human and ecological receptors that could arise from exposures to hazardous substances released from a site if no remedial actions are taken to reduce the extent of present environmental contamination. Generally, a BRA is divided into two subsections; one addresses human health risk, and the second assesses ecological risk. Ecological concerns are discussed in Section 8, Ecological Risk Assessment. The following subsections describe general methods, procedures, considerations, toxicological information, and related uncertainties affecting the AOC-specific human health risk assessment (HHRA). As a result, the HHRA in Section 10, Site-Specific Evaluation, includes only the basic mechanistic and evaluative elements applicable to AOC 507.

The HHRA within Section 10 was prepared generally in accordance with the guidelines set forth in:

- *Risk Assessment Guidance for Superfund (RAGS), Volume I — Human Health Evaluation Manual (Part A)* (USEPA, 1989a), (RAGS Part A).
- *RAGS, Volume I — Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals)* (USEPA, 1991a), (RAGS Part B).
- *RAGS, Volume I — Human Health Evaluation Manual, Supplemental Guidance — Standard Default Exposure Factors — Interim Final* (USEPA, 1991b), (RAGS Supplement).
- *Dermal Exposure Assessment: Principles and Applications — Interim Report*, ORD, EPA/600/8-91/011B, January 1992.

- Supplemental Guidance to RAGS: Region IV Bulletin, *Human Health Risk Assessment — Interim* (USEPA Region IV, 1995a).
- Supplemental Guidance to RAGS: Region IV Bulletin, *Development of Health-Based Preliminary Remediation Goals, Remedial Goal Options (RGO) and Remediation Levels — Draft* (USEPA Region IV, 1994b) (Supplemental RGO Guidance).
- Supplemental Guidance to RAGS: Region IV Bulletin, *Provisional Guidance of Quantitative Risk Assessment of PAHs* (USEPA Region IV, 1993), (PAH Guidance).
- *Exposure Factors Handbook* (USEPA, 1989e).
- USEPA Region III *Risk-Based Concentration Table, January-June 1996* (USEPA Region III, April 1996), (RBC Screening Tables).

These references are identified fully in Section 12, References.

7.2 Objectives

The objectives of the HHRA are to:

- Characterize the source media and determine the COPCs for affected environmental media;
- Identify potential receptors and quantify potential exposures for those receptors under current and future conditions for all affected environmental media;
- Qualitatively and quantitatively evaluate the adverse effects associated with the site-specific COPCs in each medium;

- Characterize the potential baseline carcinogenic risk and noncarcinogenic hazards associated with exposure to impacted environmental media at Zone B under current and future conditions;
- Evaluate the uncertainties related to exposure predictions, toxicological data, and resultant carcinogenic risk and noncarcinogenic hazard predictions; and
- Establish RGOs for chemicals of concern (COCs) in each environmental medium based on risk/hazard to facilitate risk management decision-making.

Chemical contamination at the site must be characterized adequately before risk assessment can determine whether detected concentrations have the potential for toxic effects or increased cancer incidences and before it can serve as a basis for making remedial decisions. Variables considered in characterizing the study area are the amount, type, and location of contaminant sources. Variables considered for risk characterization are the pathways of exposure (media type and migration routes); the type, sensitivities, exposure duration, and dynamics of the exposed populations (receptors); and the toxicological properties of identified contaminants.

The focus of the AOC-specific investigation is detailed in Section 10.1, Site Background and Investigative Approach. Comprehensive tables show the sample identification numbers and analytical methods applied for each sample. Zone B sampling activities consisted of collecting surface (upper interval) and subsurface (lower interval) soil samples. Analytical results from surface soils were used to assess possible exposure to environmental contaminants.

Organization

A human health risk assessment, as defined by RAGS Part A, includes the following steps:

- *Site characterization:* evaluation of data regarding site geography, geology, hydrogeology, climate, and demographics.

- *Data collection:* analysis of environmental media samples, including background/reference samples.
- *Data evaluation:* statistical analysis of analytical data to identify the nature and extent of contamination and to establish a preliminary list of COPCs based on risk-based and background screening. This list will subsequently be refined to identify COCs.
- *Exposure assessment:* identification of potential receptors under current and predicted conditions and potential exposure pathways, and calculation/quantitation of exposure point concentrations (EPCs) and chemical intakes.
- *Toxicity assessment:* qualitative evaluation of the adverse effects of the COPCs, and quantitative estimate of the relationship between exposure and severity or probability of effect.
- *Risk characterization:* a combination of the outputs of the exposure assessment and the toxicity assessment to quantify the total noncancer and cancer risk to the hypothetical receptors.
- *Uncertainty:* discussion and evaluation of the areas of recognized uncertainty in human health risk assessments in addition to medium- and exposure pathway-specific influences.
- *Risk/Hazard Summary:* presentation and discussion of the results of the quantification of exposure (risk and hazard) for the potential receptors and their exposure pathways identified under the current and future conditions.
- *Remedial Goal Options:* computation of exposure concentrations corresponding to risk projections within the USEPA target risk range of 10^{-6} to 10^{-4} for carcinogenic COCs and Hazard Quotient (HQ) goals of 0.1, 1, and 3 for noncarcinogenic COCs.

This general process was followed in preparing the HHRA for Zone B at NAVBASE.

7.3 Site Characterization

When performing an HHRA, environmental media data are compiled to determine potential site-related chemicals and exposures for each medium as outlined in RAGS Part A. The steps for identifying COPCs are discussed below.

7.3.1 Data Sources

Surface soil and subsurface soil samples were collected and analyzed to delineate the sources, nature, magnitude, and extent of any contamination associated with current or past site operations. The data used in the HHRA for Zone B were obtained from the results of the RFI and associated sampling activities.

7.3.2 Data Validation

Data validation is an after-the-fact, independent, systematic process of evaluating data and comparing them to established criteria to confirm that they are of the technical quality necessary to support the RFI decisions. Parameters specific to the data are reviewed to determine whether they meet the stipulated DQOs. The quality objectives address five principal parameters: precision, accuracy, completeness, comparability, and representativeness. To verify that these objectives are met, field measurements, sampling and handling procedures, laboratory analysis and reporting, and nonconformances and discrepancies in the data are examined to determine compliance with appropriate and applicable procedures.

Data for Zone B were validated in accordance with the USEPA CLP Functional Guidelines and are discussed in Section 4, Data Validation, of this report. Complete data validation reports for the Zone B dataset are included in Appendix E. In its validated form, the Zone B dataset was deemed usable for assessing risk.

7.3.3 Management of Site-Related Data

All environmental sampling data were evaluated for suitability for use in the quantitative HHRA. Data obtained via the following methods were not appropriate for the quantitative HHRA:

- Analytical methods that are not specific for a particular chemical, such as TOC or total organic halogen.
- Field screening instruments including total organic vapor monitoring units and organic vapor analyzers.

Because duplicate samples were collected for QA/QC, in some instances more than one analytical result existed for a single sample location. One objective of data management was to provide one result per sample location per analyte. The mean of duplicate sample results was used as the applicable value, unless the analyte was detected in only one duplicate. In such cases, the detection results were used.

In addition, the HHRA's addressed limitations of analytical results by including estimated concentrations for nondetected parameters. A nondetect indicates that the analyte was not detected above the quantitation limit of the sample (*U*-qualified results), which is determined by the analytical method, the instrument used, and possible matrix interferences. However, a nondetected analyte could be present at any concentration between zero and the quantitation limit. For this reason, one-half the *U* value could serve as an unbiased estimate of the nondetect. Because the estimated values of *J*-qualified hits were frequently much lower than the sample quantitation limits of *U*-qualified nondetects for organic compounds, one-half of each *U* value was compared to the lowest hit (normally *J*-qualified) at the same site. The lesser of these two values was used as the best estimate of the concentration that was potentially present below the sample quantitation limit, and was inserted into the adjusted dataset.

For inorganic chemicals, the decision rule was less complex: one-half of each *U* value represented the concentration of the corresponding sample when compiling the adjusted dataset. If two nondetects were reported for any one location (a result of QA/QC samples), one-half the lesser of the *U* values was compared to the lowest hit at the site (for organics, as above) or applied directly (for inorganics) to estimate a concentration value to be used in the Zone B RFI risk calculations. If a parameter was not detected, neither data management method was applied, and the parameter was not considered in screening or formal assessment.

Once the dataset was complete (i.e., after elimination of faulty data, consolidation of duplicate data values, and quantification of censored values), statistical methods were used to evaluate the RFI analytical results to (1) identify COPCs and (2) establish EPCs at potential receptor locations. The statistical methods used in data evaluation are discussed below. The rationale used to develop this methodology and the statistical techniques to implement it are based on the following sources:

- RAGS Part A
- *Statistical Methods for Environmental Pollution Monitoring* (Gilbert, 1987)
- *Supplemental Guidance to RAGS: Calculating the Concentration Term* (USEPA, 1992e)

Microsoft FoxPro, Borland Quattro Pro, and Minitab for Windows¹ were used to manage data and calculate statistics. For each set of data describing the concentration of chemicals in a contaminated area, the following information was tabulated: frequency of detection, range of detected values, average of detected concentrations, and the calculated 95th percentile upper confidence limit (UCL) on the mean of log transformed values of the concentration. In accordance with RAGS, the lesser of either the maximum concentration detected or the UCL was

¹ Reference to specific software products are not to be construed as an endorsement by the U.S. Navy or E/A&H.

used to quantify potential exposure. This procedure is detailed in Section 7.3.6 of this document.

7.3.4 Selection of Chemicals of Potential Concern

The objective of this section of the HHRA was to screen the available information on the CPSSs in order to develop a list or group of COPCs. COPCs are those chemicals selected by comparison with screening concentrations (risk-based and reference), intrinsic toxicological properties, persistence, fate and transport characteristics, and cross-media transport potential. In order for any COPC to be considered a COC, and thus warranting assessment relative to corrective measures, it must meet two criteria. First, the COPC must contribute to an exposure pathway with an incremental lifetime excess cancer risk (ILCR) in excess of 10^{-6} or hazard index (HI) greater than 1 for any of the exposure scenarios evaluated in the risk assessment. Secondly, the COPC must have an individual risk projection greater than 10^{-6} or an HQ greater than 0.1. ILCR, HQ, and HI are detailed in Section 7.6.1 of this report.

Before evaluating the potential risks/hazards associated with site media, it was first necessary to delineate the contamination onsite. This was accomplished by noting the chemicals detected in environmental media (CPSSs). The nature and general extent of CPSSs at AOC 507 are discussed in detail in Section 10 of the RFI. Because human health risk and hazard will ultimately direct remedial action, detailed discussions of COC extent were deferred to the site-specific HHRA. In order to reduce the list of CPSSs and thereby focus the risk assessment on COPCs, two comparisons were performed as described below.

7.3.4.1 Comparison of Site-Related Data to Risk-Based Screening Concentrations

The maximum concentrations of CPSSs detected in samples were compared to risk-based screening values. These values were obtained from *Determination of COCs by Risk-Based Screening* (USEPA Region III, March 1994), and subsequent versions. As stated in the USEPA Region III document, a target HQ of 0.1 and a risk goal of 10^{-6} were used by USEPA to

calculate screening concentrations for noncarcinogens and carcinogens, respectively. In instances where use of a more recent version of USEPA Region III's RBC tables was necessary, noncarcinogenic chemical values were adjusted to equate with an HQ of 0.1. Reported soil concentrations were compared to residential soil ingestion screening values. The soil screening value for lead was set equal to 400 milligrams per kilogram (mg/kg), consistent with recent OSWER directives considering protection of a hypothetical child resident.

In accordance with recent cPAH guidance (USEPA Region IV, 1993), BEQs were computed, where appropriate, by multiplying the reported concentration of each cPAH by its corresponding TEF. The BEQ values were then summed for each sample, and the total was compared to the benzo(a)pyrene RBC value during the screening process. Subsequent exposure quantification and risk/hazard projections for cPAHs in soil and groundwater were performed using total BEQ values for each sampling location rather than individual compound concentrations.

CPSSs with maximum detected concentrations exceeding their corresponding concentrations, goals, levels, and/or standards were retained for further evaluation and reference screening in the risk assessment. Screening values based on surrogate compounds were used if no screening values were available in USEPA Region III's table. Surrogate compounds were selected based on structural, chemical, or toxicological similarities.

7.3.4.2 Comparison of Site-Related Data to Background Concentrations

Soil background concentrations were determined on a zone-wide basis in Zone B, using results from the grid-based soil background sampling locations. Statistical methods and rationale for determining background concentrations and comparing site data to background were proposed in the technical memorandum *Proposed Method for Comparing Site Sample Values to Background Values for Surface and Subsurface Soils I: Inorganics* (E/A&H, May 1995). This technical approach was approved for NAVBASE by USEPA Region IV and SCDHEC. After risk- and hazard-based screening values were compared, COPCs whose maximum detected

concentrations exceeded corresponding background reference concentrations, or whose overall site concentrations were significantly greater than corresponding overall background concentrations as determined by Wilcoxon rank sum test procedures, were retained for further consideration as COPCs in the HHRA. The two statistical background comparisons were conducted as parallel analyses. If either method suggested that site-specific concentrations deviated from naturally occurring levels, the chemical was formally assessed. These comparisons help account for chemicals that are common in nature, such as aluminum, manganese, and arsenic. By virtue of this process, risk and/or hazard associated with naturally occurring chemicals is not addressed where their concentrations are not above corresponding background concentrations.

The background reference concentration or UTL is a fixed value determined to represent the upper bound of naturally occurring concentrations for a chemical in a specific matrix. Comparisons using reference concentrations are most effective in identifying "hot spots", or limited areas with pronounced impacts. Population tests, in this case performed using the Wilcoxon rank sum method, are used to determine whether values from one population (the site samples) are consistently higher or lower than those from another (the entire background dataset). Ideally, population tests identify general elevations in chemical concentrations absent definable hot spots. Statistical methods, UTL calculations, Wilcoxon rank sum test outputs, and general background sample details are discussed in Section 5. In the RFI, if the maximum concentration of a CPSS was determined to be less than either background (via reference concentration comparison *and* population test) or the risk-based screening value, the CPSS was not considered further in the risk assessments unless deemed appropriate based on chemical-specific characteristics (e.g., degradation product with greater toxicity).

7.3.4.3 Elimination of Essential Elements: Calcium, Iron, Magnesium, Potassium, and Sodium

In accordance with RAGS Part A, essential elements that are potentially toxic only at extremely high concentrations may be eliminated from further consideration as COPCs in a risk assessment. Specifically, an essential nutrient may be screened out of a risk assessment if it is present at concentrations that are not associated with adverse health effects. Based on RAGS, the lack of risk-related data, and USEPA Region IV's recommendations, the following essential nutrients were eliminated from the human health risk assessment: calcium, iron, magnesium, potassium, and sodium.

7.3.4.4 Summary of COPCs

The results of the screening evaluations are presented on a medium-specific basis in the HHRA in Section 10. In summary, the risk information usually obtained from the Integrated Risk Information System (IRIS) or Health Effects Assessment Summary Tables (HEAST) is necessary to calculate risk and hazard estimates (and risk-based screening values). This information is based on toxicological and epidemiological data which are critiqued and approved by the scientific and regulatory community (i.e., listed in IRIS and/or HEAST). Risk information was not available for some CPSSs; therefore, it was not possible to calculate risk and/or hazard for those chemicals. For each environmental medium sampled at AOC 507, the data were screened using risk-based and background values. The results of the screening process are tabulated in the HHRA. Those chemicals determined to be COPCs through the screening process are designated with an asterisk. No risk-based screening values are available for the generic group, TPH. As a result, TPH assessment was handled consistent with state underground storage tank (UST) regulations and the NAVBASE soil action level of 100 mg/kg. If no groundwater impacts were identified, the existing soil concentrations were considered sufficiently protective of the underlying aquifer.

7.3.5 Calculation of Risk and Hazard

As previously discussed, CPSSs that exceed their respective screening values are considered COPCs. The subsequent identification of COCs is a two-phase process. First, exposure pathways exceeding the screening criteria established by USEPA and SCDHEC are identified. Identifying COCs from the refined list of COPCs involves calculating chemical-specific cancer risks and HQs for COPCs, estimating exposure-pathway risk/hazard, evaluating frequency and consistency of detection and relative chemical toxicity, and comparing them to background concentrations. In the next step, COPCs which individually exceed 10^{-6} ILCR or an HQ greater than 0.1 in a pathway of concern (i.e., an exposure pathway having ILCR greater than 10^{-6} or HI greater than 1) are retained as COCs. Section 7.3.7 discusses cancer risk thresholds and noncancer toxicity.

7.4 Exposure Assessment

This section of the HHRA determines the magnitude of contact that a potential receptor may have with site-related COPCs. Exposure assessment involves four stages:

- Characterizing the site's physical setting and land use;
- Identifying COPC release and migration pathway(s);
- Identifying the potential receptors, under various land use or site condition scenarios, and the pathways through which they might be exposed; and
- Quantifying the intake rates, or contact rates, of COPCs.

7.4.1 Exposure Setting and Land Use

This section of the HHRA describes the basic layout of the AOC as well as the suspected source(s) of contamination. In addition, the projected future use of the site is discussed if

information was available. Present land use in Zone B is comparable to recreational and residential uses. Current base reuse plans call for continued recreational and residential use, or the re-development of the residential property for additional recreational use.

7.4.2 Potentially Exposed Populations

For a site-specific HHRA, this section describes who may be exposed to contaminants in environmental media. For the Zone B HHRA, the potentially exposed populations addressed were current and future site workers, as well as hypothetical future site residents. Because current site workers at most sites within Zone B would be expected to have limited contact with contaminated media, worker-related exposure was addressed exclusively for maximally exposed future site workers. This approach, while providing a reasonably conservative assessment of future site worker risk/hazard, also renders a highly conservative approximation of risk/hazard for current site workers. It also accounts for the fact that the specific nature of future industrial use cannot be definitively stated.

7.4.3 Exposure Pathways

This section of the HHRA summarizes how potential receptors (site workers, residents, etc.) may be exposed to contaminated media. In general, soil matrix-related pathways include incidental ingestion and dermal contact.

7.4.4 Exposure Point Concentrations

The EPC is the concentration of a contaminant in an exposure medium that will be contacted by a real or hypothetical receptor. Determining the EPC depends on factors such as:

- Availability of data
- Amount of data available to perform statistical analysis
- Reference concentrations (RfCs) not attributed to site impacts
- Location of the potential receptor

USEPA Region IV guidance calls for assuming lognormal distributions for environmental data and calculating the 95th percentile UCL on the mean to quantify exposure. Applying the UCL is generally inappropriate with fewer than 10 samples. The maximum concentrations detected were used for all datasets with less than 10 samples. In general, outliers have been included when calculating the UCL because high values seldom appear as outliers for a lognormal distribution. Including outliers increases the overall uncertainty of the calculated risks and conservatively increases the estimate of the human health threat.

For sample sets of 10 and greater, the UCL was calculated for a lognormal distribution as follows:

$$\left(\bar{a} + 0.5s_a^2 + \frac{H_{0.95} \times s_a}{\sqrt{n-1}} \right)$$

UCL = e

Where:

- \bar{a} = $\Sigma a/n$ = sample arithmetic mean of the log-transformed data
- a = $\ln(x)$
- s_a = sample standard deviation of the log-transformed data
- n = number of samples in the dataset
- $H_{0.95}$ = value for computing the one-sided upper 95% confidence limit on a lognormal mean from standard statistical tables (Gilbert, 1987)

The calculated values for the 95% UCL are tabulated (where applicable) in the HHRA. The tables statistically summarize COPCs identified in each environmental medium. Included for each COPC are the number of samples analyzed, mean and standard deviation of the natural log-transformed data (including the nondetect values), the H-statistic, the maximum of detected concentrations, and background concentrations (where available). For media from which fewer than 10 samples were collected, the maximum of positive detections of each COPC identified

was used as the EPC to compute exposure. In some instances, factors were derived to modify the EPC to account for the fraction ingested/fraction contacted (FI/FC) from the contaminated source. This approach was used where impacts were found to be extremely limited in areal extent (hot spots). Where this approach was taken, the basis for the decision is discussed in the site-specific HHRA.

As previously discussed in the data management subsection (Section 7.3.3) of this document, analytical results are presented as "nondetects" whenever chemical concentrations in samples do not exceed the detection or quantitation limits for the analytical procedures as applied to each sample. Generally, the quantitation limit is the lowest concentration of a chemical that can be reliably quantified above the normal, random noise of an analytical instrument or method. To apply the above-mentioned statistical procedures to a dataset with reported nondetects for organic compounds, the lesser of one-half of the nondetect value for the sample or the lowest *J*-qualified value at the site was assumed to be the applicable default concentration. For inorganic chemicals, one-half of the nondetect value was assumed to be the applicable concentration. Using this method is a reasonable compromise between use of zero and using the sample quantitation limit, to reduce the bias (positive or negative) in the calculated UCL.

Quantification of Exposure

This section describes the models, equations, and input parameter values used to quantify doses or intakes of the COPCs for the surface soil and groundwater exposure pathways. The models are designed to estimate route- and medium-specific factors, which are multiplied by the EPC to estimate chronic daily doses. The intake model variables generally reflect 50th or 95th percentile values which, when applied to the EPC, ensure that the estimated intakes represent the reasonable maximum exposure (RME). Formulae were derived from RAGS, Part A unless otherwise indicated. Table 7.1 lists input parameters used to compute chronic daily intake (CDI) for potential receptors exposed to surface soil contaminants. These soil pathway assumptions were applied for Zone B. Where other exposure routes/pathways were

found (or predicted) to exist, additional exposure quantification formulae are presented. Because Zone B is part of BRAC III, future site use cannot be assumed with any certainty. Therefore, the conservative assumptions were used to account for any reasonable future use. Zone B media analytical results and exposure methods have been formatted to allow for fine-tuning of exposure estimates based on actual conditions as base reuse plans materialize. Age-adjusted ingestion factors were derived for the potential future residential receptors (resident adult and resident child combined) for carcinogenic endpoints. These factors consider the difference in daily ingestion rates for soil, body weights, and exposure durations for children (ages 1 to 6) and adults (ages 7 to 30). The exposure frequency is assumed to be identical for the adult and child exposure groups.

Table 7.1
Parameters Used to Estimate CDI at RME

Pathway Parameters	Resident Adult	Resident Child	Adult Worker	Units
Surface Soil Ingestion and Dermal Contact				
Ingestion Rate (soil)	100 ^a	200 ^a	50 ^a	mg/day
Exposure Frequency	350 ^b	350 ^b	250 ^b	days/year
Exposure Duration	24 ^c	6 ^c	25 ^c	years
Dermal Contact Area	4,100 ^d	2,900 ^d	4,100 ^d	cm ²
Skin Adherence Factor	1	1	1	mg/cm ²
Absorbance Factor	0.01 (organics) 0.001 (inorganics)	0.01 (organics) 0.001 (inorganics)	0.01 (organics) 0.001 (inorganics)	unitless
Dermal Adjustment Factor	0.8 (VOCs) 0.5 (other organic compounds) 0.2 (inorganics)	0.8 (VOCs) 0.5 (other organic compounds) 0.2 (inorganics)	0.8 (VOCs) 0.5 (other organic compounds) 0.2 (inorganics)	unitless
Conversion Factor	1E-6	1E-6	1E-6	kg/mg
Body Weight	70 ^a	15 ^a	70 ^a	kg

Table 7.1
Parameters Used to Estimate CDI at RME

Pathway Parameters	Resident Adult	Resident Child	Adult Worker	Units
Surface Soil Ingestion and Dermal Contact				
Averaging Time, Noncancer	8,760 ^e	2,190 ^e	9125 ^e	days
Averaging Time, Cancer	25,550 ^f	25,550 ^f	25,550 ^f	days

Notes:

- a = USEPA (1989a) "Risk Assessment Guidance for Superfund Vol. I, Human Health Evaluation Manual (Part A)."
- b = USEPA (1991b) "Risk Assessment Guidance for Superfund Vol. I: Human Health Evaluation Manual Supplemental Guidance, Standard Default Exposure Factors," Interim Final, OSWER Directive: 9285.6-03.EPA/600/8-89/043.
- c = USEPA (1991a), "Risk Assessment Guidance for Superfund: Vol. I — Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals)," OSWER Directive 9285.7-01B.
- d = Resident Adult accounts for head, hands, and forearms at 90th percentile values from Table 4B.1, Exposure Factors Handbook; assumes individual is clothed with shoes, long pants, and short sleeves; rounded up from 4,090 cm².
 Resident Child accounts for head, hands, forearms, lower leg, and feet using 90th percentile total body surface area values for male children 1 to 6 years old (6,000 cm² assumed for 1 to 2 years old); because individual body part information is not available for 5 to 6 year olds, mean of other groups was assumed. Forearm surface area set equal to 46% of full arm; lower leg set equal to 41% of full leg measurement.
- e = Calculated as the product of exposure duration (years) x 365 days/year.
- f = Calculated as the product of 70 years (assumed lifetime) x 365 days per year.
- NA = Not applicable.
- mg/cm² = milligrams per square centimeter

Surface Soil Pathway Exposure

Ingestion of COPCs in Surface Soil

The following equation is used to estimate the ingestion of COPCs in soil:

$$CDI_s = (C_s)(IR)(EF)(ED)(F)(FI)/(BW)(AT)$$

Where:

- CDI_s = ingested dose (mg/kg-day)
- C_s = concentration of contaminant in soil (mg/kg)
- IR = ingestion rate (mg/day)
- EF = exposure frequency (days/year)
- ED = exposure duration (years)

- F = conversion factor (10^{-6} kg/mg)
FI = fraction ingested from contaminated source (unitless)
BW = body weight (kg)
AT = averaging time (days)

Dermal Contact with COPCs in Surface Soil

The following equation is used to estimate intake due to dermal contact with COPCs in soil:

$$CDI_{sd} = (C_s)(DCA)(EF)(ED)(F)(FC)(ABS)(AF)/(BW)(AT)$$

Where:

- CDI_{sd} = dermal dose (mg/kg-day)
 C_s = concentration of contaminant in soil (mg/kg)
DCA = dermal contact area (cm²)
EF = exposure frequency (days/year)
ED = exposure duration (years)
F = conversion factor (10^{-6} kg/mg)
FC = fraction contacted from contaminated source (unitless)
ABS = absorption factor (unitless value, specific to organic versus inorganic compounds)
AF = adherence factor (mg/cm²)
BW = body weight (kg)
AT = averaging time (days)

Figure 7.1 provides the formulae for calculating the CDI for soil. Tables provided in the HHRA quantify exposure to environmental media through all applicable pathways. Future site worker and hypothetical site resident exposure projections are provided separately.

Figure 7.1
Formulae for Calculating CDI for Soil

SOIL INGESTION PATHWAY

Residential Scenario:

Noncarcinogens — Child — Residential Scenario:

$$CDI_{NC-C} = \frac{C_s \times IR_{soil/child} \times EF_{res} \times F \times FI \times ED_{child}}{AT_{NC-C} \times BW_{child}}$$

Noncarcinogens — Adult — Residential Scenario:

$$CDI_{NC-A} = \frac{C_s \times IR_{soil/adult} \times EF_{res} \times F \times FI \times ED_{adult}}{AT_{NC-A} \times BW_{adult}}$$

Carcinogens (based on a lifetime weighted average):

$$CDI_C = \frac{C_s}{AT_C} \left[\frac{IR_{soil/child} \times EF_{res} \times F \times FI \times ED_{child}}{BW_{child}} + \frac{IR_{soil/adult} \times EF_{res} \times F \times FI \times ED_{adult}}{BW_{adult}} \right]$$

SOIL DERMAL CONTACT PATHWAY

Residential Scenario:

Noncarcinogens — Child — Residential Scenario:

$$CDI_{NC-C} = \frac{C_s \times DCA_{soil/child} \times EF_{res} \times F \times FC \times AF \times ABS \times ED_{child}}{AT_{NC-C} \times BW_{child}}$$

Noncarcinogens — Adult — Residential Scenario:

$$CDI_{NC-A} = \frac{C_s \times DCA_{soil/adult} \times EF_{res} \times F \times FC \times AF \times ABS \times Ed_{adult}}{AT_{NC-A} \times BW_{adult}}$$

Carcinogens (based on a lifetime weighted average):

$$CDI_C = \frac{C_s}{AT_C} \times \left[\frac{DCA_{soil/child} \times EF_{res} \times F \times FC \times AF \times ABS \times Ed_{child}}{Bw_{child}} + \frac{DCA_{soil/adult} \times EF_{res} \times F \times FC \times AF \times ABS \times ED_{adult}}{Bw_{adult}} \right]$$

Formulae for Calculating CDI for Surface Soil

Variable	Description
BW_{child}	average child body weight (ages 1-6) (kg)
BW_{adult}	average adult body weight (kg)
ABS	absorbance factor (unitless value specific to organic versus inorganic compounds)
AF	adherence factor (1 mg/cm ²)
ED_{child}	child exposure duration during (ages 1-6) (yr)
ED_{adult}	adult exposure duration during (ages 7-30) (yr)
$ED_{\text{adult-w}}$	adult worker exposure duration during (yr)
EF_{res}	residential exposure frequency (days/year)
EF_{w}	worker exposure frequency (days/year)
$IR_{\text{soil/child}}$	child soil intake rate (mg/day)
$IR_{\text{soil/adult}}$	adult soil intake rate (mg/day)
FC	fraction contacted from contaminated source (unitless)
$DCA_{\text{soil/child}}$	child soil dermal contact area (cm ² /day)
$DCA_{\text{soil/adult}}$	adult soil dermal contact area (cm ² /day)
AT_{C}	averaging time (carcinogen)
$AT_{\text{NC-A}}$	averaging time (noncarcinogen adult)
$AT_{\text{NC-C}}$	averaging time (noncarcinogen child)
C_{s}	chemical concentration in surface soil (mg/kg)
FI	fraction ingested from contaminated source (unitless)
F	conversion factor (10 ⁻⁶ kg/mg)

Notes:

CDI indicates Chronic Daily Intake.

The worker scenario risk and hazard were calculated by substituting worker-specific assumptions into the adult portions of the formulae and then deleting the child portions of the formulae.

7.5 Toxicity Assessment

7.5.1 Carcinogenicity and Noncancer Effects

The USEPA has established a classification system for rating the potential carcinogenicity of environmental contaminants based on the weight of scientific evidence. The cancer classes are described below. Cancer weight-of-evidence class "A" (human carcinogens) means that human toxicological data have shown a proven correlation between exposure and the onset of cancer (in varying forms). The "B1" classification indicates some human exposure studies have implicated the compound as a probable carcinogen. Weight-of-evidence class "B2" indicates a possible human carcinogen, a description based on positive laboratory animal data (for carcinogenicity) in the absence of human data. Weight-of-evidence class "C" identifies possible human carcinogens, and class "D" indicates a compound not classifiable for its carcinogenic potential. The USEPA has established slope factors (SFs) for carcinogenic compounds. The SF is defined as a "plausible upper-bound estimate of the probability of a response (cancer) per unit intake of a chemical over a lifetime" (RAGS, Part A).

In addition to potential carcinogenic effects, most substances also can produce other toxic responses at doses greater than experimentally derived threshold concentrations. The USEPA has derived reference dose (RfD) values for these substances. A chronic RfD is defined as *an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure concentration for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime*. These toxicological values are used in risk formulae to assess the upper-bound level of cancer risk and noncancer hazard associated with exposure to a given contaminant concentration.

For carcinogens, the potential risk posed by a chemical is computed by multiplying the CDI (as mg/kg-day) by the SF (in reciprocal mg/kg-day). The HQ (for noncarcinogens) is computed by dividing the CDI by the RfD. The USEPA has set standard limits (or points of departure) for carcinogens and noncarcinogens to evaluate whether significant risk is posed by a chemical

(or combination of chemicals). For carcinogens, the point-of-departure range is 10^{-6} , with a generally accepted range of 10^{-6} to 10^{-4} . These risk values correlate with a 1 in 1 million and a 1 in 10,000 excess incidence of cancer resulting from exposure to xenobiotics (all pathways).

For noncarcinogens, other toxic effects are generally considered possible if the HQ (or sum of HQs for a pathway, HI) exceeds unity (a value of 1). Although both cancer risk and noncancer hazard are generally additive (within each group) only if the target organ is common to multiple chemicals, a most conservative estimate of each may be obtained by summing the individual risks or hazards, regardless of target organ. The following HHRAs have taken the universal summation approach for each class of toxicant. Additional details regarding the risk formulae applied to site data are provided in Section 7.6.1, Risk Characterization Methodology.

Critical studies used in establishing toxicity classifications by USEPA are shown in the IRIS database (primary source) and/or HEAST, Fiscal Year 1995 (secondary source). If toxicological information is unavailable in IRIS or HEAST, values were obtained from reports issued by the Environmental Criteria and Assessment Office (ECAO)/National Center for Environmental Assessment (NCEA). Where applicable, these values were also included in the database for the HHRA. The HHRA for sites with identified COPCs includes a table summarizing toxicological data in the form of RfDs and SFs obtained for the relevant COPCs, as well as uncertainty/modifying factors, target organs, and cancer classes (where available).

7.5.2 Toxicity Profiles for COPCs

In accordance with RAGS, the HHRA includes brief toxicological profiles for all COPCs. Most information for the profiles was gleaned from IRIS and HEAST, as mentioned in the preceding text, and toxicological database information table. Any additional references are noted specifically in the profiles. The profiles summarize adverse effects of COPCs and the amounts associated with such effects.

7.6 Risk Characterization

Risk characterization combines the results of the exposure assessment and toxicity assessment to yield qualitative and quantitative expressions of risk and/or hazard for the exposed receptors. The quantitative component expresses the probability of developing cancer, or a nonprobabilistic comparison of the estimated dose with a reference dose for noncancer effects. These quantitative estimates are developed for individual chemicals, exposure pathways, transfer media, and source media, and for each receptor for all media to which one may be exposed. The qualitative component usually involves comparing COC concentrations in media with established criteria or standards for chemicals for which there are no corresponding toxicity values. The risk characterization is used to guide risk management decisions.

Generally, the risk characterization follows the methodology prescribed by RAGS Part A, as modified by more recent information and supplemental guidance cited earlier. The USEPA methods are, appropriately, designed to be health-protective, and tend to overestimate, rather than underestimate, risk. The risk results, therefore, are generally overly conservative, because risk characterization involves multiplying the conservative assumptions built into the exposure and toxicity assessments.

This section of the HHRA characterizes the potential health risks associated with the intake of chemicals originating from the site. The USEPA methods used to estimate the types and magnitudes of health effects associated with exposure to chemicals have been supplemented, where appropriate, by graphical representations of risk and hazard. The objective of presenting this supplemental information is to more clearly depict the problem areas at the relevant sites on scales specific to individual sampling points.

7.6.1 Risk Characterization Methodology

Potential risks to humans following exposure to COPCs are estimated using methods established by USEPA, when available. These health-protective methods are likely to overestimate risk.

Risks from hazardous chemicals are calculated for either carcinogenic or noncarcinogenic effects. Some carcinogenic chemicals may also pose a noncarcinogenic hazard. The potential human health effects associated with chemicals that produce systemic toxic and carcinogenic influences are characterized for both types of health effects.

Unlike the methods for estimating ingested dose of COPCs, which quantify the dose presented to the barrier membranes (the pulmonary or gastrointestinal mucosa, respectively), dermal dose is estimated as that which crosses the skin and is systemically absorbed. For this reason, oral toxicity values must be adjusted to reflect the dermally absorbed dose.

Dermal RfD values and SFs are derived from the corresponding oral values. In deriving a dermal RfD, the oral RfD is multiplied by an oral absorption factor (ABF), expressed as a decimal fraction. The resulting dermal RfD is based on the absorbed dose, the appropriate value with which to compare a dermal dose, because dermal doses are expressed as absorbed rather than administered (intake) doses. For the same reasons, a dermal SF is derived by dividing the oral SF by the ABF. The oral SF is divided rather than multiplied because SFs are expressed as reciprocal doses.

Appendix A of RAGS, Part A, states that in the absence of specific data, an assumption of 5% oral absorption efficiency would be relatively conservative. Supplemental Guidance to RAGS: Region IV Bulletin (USEPA Region IV, 1994a), indicates that in the absence of specific data, USEPA Region IV suggests an oral to dermal absorption factor of 80% for VOCs, 50% for SVOCs, and 20% for inorganics. These percentages (or associated fractions) were used in the HHRA and are reflected in the applicable risk/hazard results.

Carcinogenic Effects of Chemicals

The risk attributed to exposure to carcinogens is estimated as the probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. In the

low-dose range, which would be expected for most environmental exposures, cancer risk is estimated from the following linear equation (RAGS, Part A):

$$\text{ILCR} = (\text{CDI})(\text{SF})$$

Where:

ILCR = incremental lifetime excess cancer risk, a unitless expression of the probability of developing cancer, adjusted for reference incidence

CDI = chronic daily intake, averaged over 70 years (mg/kg-day)

SF = cancer slope factor (mg/kg-day)⁻¹

For a given pathway with simultaneous exposure of a receptor to several carcinogens, the following equation is used to sum cancer risks:

$$\text{Risk}_p = \text{ILCR}(\text{chem}_1) + \text{ILCR}(\text{chem}_2) + \dots \text{ILCR}(\text{chem}_i)$$

Where:

Risk_p = total pathway risk of cancer incidence

ILCR(chem_i) = incremental lifetime excess cancer risk for a specific chemical

Cancer risk for a given receptor across pathways and across media is summed in the same manner.

Noncarcinogenic Effects of Chemicals

The risks associated with the noncarcinogenic effects of chemicals are evaluated by comparing an exposure level or intake with a reference dose. The HQ, defined as the ratio of intake to RfD, is defined as (RAGS, Part A):

$$HQ = CDI/RfD$$

Where:

- HQ = hazard quotient (unitless)
- CDI = intake of chemical (mg/kg-day)
- RfD = reference dose (mg/kg-day)

Chemical noncarcinogenic effects are evaluated on a chronic basis, using chronic RfD values. An HQ of unity or 1 indicates that the estimated intake equals the RfD. If the HQ is greater than unity, there may be a concern for potential adverse health effects.

For simultaneous exposure of a receptor to several chemicals, an HI will be calculated as the sum of the HQs by:

$$HI = HQ_1 + HQ_2 + \dots HQ_i$$

Where:

- HI = Hazard Index (unitless)
- HQ = Hazard Quotient (unitless)

Risk and hazard projections are tabulated for each medium following the general discussions of risk and hazard quantification methods.

7.6.2 Pathway-Related Risk

This section of each HHRA summarizes estimated risk/hazard for each receptor group based on exposure pathways identified during the exposure assessment. In addition, the primary contributors to carcinogenic risk and/or noncarcinogenic hazard are discussed.

7.6.3 COCs Identified

This section summarizes the outcome of risk/hazard projections by identifying COCs for each impacted environmental medium. COCs are identified for each medium based on cumulative (all pathway) risk and hazard projected for each site, and are shown in tabular form (where necessary). USEPA has established a generally acceptable risk range of 10^{-4} to 10^{-6} , and an HI threshold of 1.0 (unity). In the Zone B HHRA, a COC was considered to be any chemical contributing to a cumulative risk level of 10^{-6} or greater and/or a cumulative HI above 1.0, and whose individual ILCR exceeds 10^{-6} or whose HQ exceeds 0.1. For carcinogens, this approach is relatively conservative, as a cumulative risk of 10^{-4} (and individual ILCR of 10^{-6}) is generally recognized by USEPA Region IV as the actionable trigger for establishing COCs. The COC selection method presented was used to provide a more comprehensive evaluation of chemicals contributing to carcinogenic risk or noncarcinogenic hazard during the RGOs development process.

7.6.4 Risk/Hazard Maps

In addition to the standard tabular presentation of risk/hazard, summary risk and hazard maps were plotted for applicable environmental media to provide a visual supplement. Point risk/hazard maps are generally developed to show the distribution and concentration of individual chemicals or groups of chemicals, or the risk/hazard associated with potential exposure through applicable pathways.

As an extension of conventional risk/hazard determinations, risk and hazard were calculated based on each COC's concentration at each sample location. ArcView², a standard geographic information system package, was used to plot the risk/hazard projections for each sample point on AOC 507 maps. The risk/hazard for individual locations were based exclusively on chemicals detected. Tables summarize the data used to generate graphical presentations. This

² Reference to specific software products are not to be construed as an endorsement by the U. S. Navy or E/A&H.

information allows the reviewer to make determinations regarding the nature of the contaminants identified, and also facilitates remedial alternatives screening as part of the CMS.

7.7 Risk Uncertainty

This section of the HHRA presents and discusses the uncertainty and/or variability inherent in the risk assessment process in addition to medium-specific and exposure pathway-specific influences. Risk assessment sections are discussed separately below, and specific examples of uncertainty sources are included where appropriate.

7.7.1 General

Uncertainty is a factor in each step of the exposure and toxicity assessments summarized above. Overall, uncertainties associated with the initial stages of the risk assessment process become magnified when they are combined with other uncertainties. Together, the use of high-end estimates of potential exposure concentrations, frequencies, durations, and rates leads to conservative estimates of CDI. Toxicological values for chemicals derived from USEPA databases and other sources are generally derived from animal studies. Uncertainty and modifying factors are applied to extrapolate the results of these studies to predict potential human responses, providing a margin of safety based upon confidence in the studies. During the risk characterization process, individual chemical risk is added to determine the incremental excess cancer risk for each exposure pathway. If the individual exposure predictions were calculated based on the upper limit estimates of exposure to each chemical, the margin of safety of the cumulative incremental risk is the sum of all the individual safety margins applied throughout the process. Use of these safety margins during all exposure and risk/hazard computations provides an extremely conservative means of predicting potential human health effects. The margins of safety or "conservatisms" inherent in each step of the human health risk assessment are addressed in the risk uncertainty discussion. It is not possible to eliminate all uncertainties or potential variability in the risk assessment process; however, recognizing the influences of these factors is fundamental to understanding and subsequently using risk assessment results.

Assumptions are made as part of the risk assessment process based on population studies and USEPA guidance. This guidance divides the assumptions into two basic categories: the upper bound (90 to 95th percentile) and the mean or 50th percentile CT exposure assumptions. As discussed in the Exposure Assessment section, the RME exposure is based on the upper-bound assumptions, and CT exposure is based on mean assumptions. Therefore, risk and hazard calculated using RME exposure assumptions are generally overestimates rather than underestimates. The following paragraphs discuss sources of uncertainty and variability pertinent to each exposure pathway evaluated.

7.7.2 Quality of Data

Data collected during the investigation of Zone B are presented in Section 10 of this RFI, which includes results from the AOC site and the QA/QC of those data. The purpose of the data evaluation is to verify that the QC requirements of the dataset have been met and to characterize the weakness of questionable data.

Most analytical results for environmental samples have inherent uncertainty. This uncertainty is a function of the matrix characteristics and heterogeneity, the precision and accuracy of sampling, and preparation and analysis methods employed. Although data are typically considered to be exact values, they are in reality the laboratory's best estimate within a range defined by method control limits. As a result, reported concentrations for any chemical can be under or overestimates of actual concentrations.

7.7.3 Identification of COPCs

Rather than addressing risk/hazard for all chemicals detected, screening values were used to focus the HHRA on pathways of concern and COPCs which individually exceed 10^{-6} risk or an HQ of 0.1.

Exposure Pathways and Contaminants

As discussed in Section 7.3.4, a comparison was made using the most conservative screening value (residential land use) provided by USEPA for each exposure medium. Many CPSSs were eliminated from the formal assessment on this basis. Although potential cumulative effects associated with multiple chemicals dismissed through this process are a valid concern, the fact that maximum detected concentrations were used in the screening comparison in concert with low range hazard goals alleviates much uncertainty. A large number (i.e., greater than 10) of constituents would have to be present at near-RBC concentrations to substantiate a concern for cumulative effects. Although the screening method is highly conservative, inhalation and dermal exposure are not incorporated into the soil screening values calculated by USEPA. If these pathways were the primary concern (as opposed to ingestion), the screening method could eliminate contaminants that should be considered COPCs. An evaluation of Zone B surface soil data determined that VOCs were not widespread. Therefore, soil-to-air cross-media transport (via volatilization) was not identified as a concern, and omitting the indirect air pathway from the process of developing the risk-based screening concentrations did not adversely affect their use. Section 10.5.3 of the site-specific fate and transport assessment discusses the results of soil-to-air cross-media transport screening.

Comparison to Reference Concentrations (Background)

Because the intent of the HHRA is to estimate the excess cancer risk or health hazard posed by COPCs, data values of inorganic chemicals were compared to background reference concentrations in the RFI for Zone B subsequent to comparing the data to screening values. As a corollary background screening method, the Wilcoxon rank sum test was used to compare inorganic COPC data populations at individual sites with corresponding reference data populations. The outcomes of the fixed point and Wilcoxon tests were used to determine whether the concentrations differed significantly between onsite and background locations, as detailed in Section 7.3.4.

Additional uncertainty is introduced by comparing site data to nonspecific screening reference data. Although the background concentrations are specific to Zone B, they are not AOC-specific. The dual approach to background screening reduces the probability that a COPC would be improperly dismissed from formal assessment.

Elimination of Essential Nutrients

In accordance with RAGS, the following nutrients were eliminated from Zone B HHRA: calcium, sodium, potassium, magnesium, and iron. Toxicity from overexposure to the nutrients listed above is possible only if human receptors are exposed to extremely high doses. USEPA recommends eliminating these compounds from formal risk assessment. Because no screening comparison was performed, the HIs calculated in the HHRA could be positively influenced by the nutrient concentrations detected onsite. Therefore, the HIs are possibly underestimates.

7.7.4 Characterization of Exposure Setting and Identification of Exposure Pathways

The potential for high bias is introduced through the exposure setting and pathway selection due to the highly conservative assumptions (i.e., future residential use) recommended by USEPA Region IV when assessing potential future and current exposure. The exposure assumptions made in the site worker scenario are highly conservative and would tend to overestimate exposure. Current site workers are infrequently exposed to surface soil when walking across the site, using commercial facilities, or mowing the grass. Site workers would not be expected to work onsite in contact with affected media for eight hours per day, 250 days per year as assumed in the exposure assessment. Mowing grass 52 days per year would result in one-fifth the projected risk/hazard for site workers.

Residential use of the sites in Zone B is possible, based on current site uses, the nature of surrounding buildings, and potential reuse plans. If this area were redeveloped as residential sites, present structures would be demolished and the surface soil conditions would likely change — the existing soil could be covered with roads, paved driveways, landscaping soil,

and/or houses, or they could be made into playgrounds. Consequently, exposure to current surface soil conditions would not be likely under a true future residential scenario. These factors indicate that exposure pathways assessed in the HHRA would generally overestimate the risk and hazard posed to current site workers and future site residents.

Determination of Exposure Point Concentrations

Based on the guidance provided by USEPA, EPCs are concentrations used to estimate CDI. The uncertainty associated with EPCs stems primarily from their statistical determination or the imposition of maximum concentrations, described below.

Statistical Estimation of Exposure Point Concentrations

USEPA's *Supplemental Guidance to RAGS: Calculating the Concentration Term* (USEPA, 1992e) outlines a statistical estimation of EPC. These calculated concentrations are 95th percentile UCLs on the mean which are based on certain assumptions. USEPA assumes that most (if not all) environmental data are lognormally distributed. This assumption can lead to over- or underestimation of the concentration term because many environmental data are neither normally nor lognormally distributed.

The UCL calculation method is provided in the *Supplemental Guidance to RAGS: Calculating the Concentration Term*, (USEPA, 1992e). This calculation includes a statistical value, the H-statistic, which is based on the number of samples analyzed for each COPC and the standard deviation of the results. To obtain this number, a table must be referenced, and the value must be interpolated (an estimation) from the table. The equation for the H-statistic has not been provided in the supplemental guidance, nor does the document referred to in the guidance provide the equation. Although the statistic appears to be nonlinear, linearity was assumed to facilitate interpolation of the statistic for each COPC addressed in the HHRAs.

Linear interpolation is a good estimate of H; however, the UCL formula and H are natural log values. The effect of multiplying natural log numbers is not equivalent to multiplying untransformed values. When data are log transformed, adding two numbers is the equivalent of multiplying the two numbers if they were not transformed. The effect of multiplying a number while in log form is exponential; and here, H is applied as a multiplier. In summary, using this method to calculate the UCL has the effect of overestimating, and often provides concentrations greater than the maximum detected onsite. The limited number of samples used to assess site conditions often resulted in considerable variability between data points, and thus relatively high standard deviations about the mean. The high standard deviation elevates UCL projections.

7.7.5 Toxicity Assessment Information

There is a generally recognized uncertainty in human toxicological risk values developed from experimental data primarily due to the uncertainty of data extrapolation in the areas of: (1) high-to low-dose exposure and (2) animal data to human experience. The site-specific uncertainty is mainly in the degree of accuracy of the exposure assumptions. Most of the assumptions used in this and any risk assessment have not been verified. For example, the degree of chemical absorption from the gut or through the skin or the amount of soil contact is not known with certainty.

The uncertainty of toxicological values from the IRIS and HEAST databases provided by USEPA is summarized (where available) in the HHRA. The uncertainty factors assigned to these values account for acute-to-chronic dose extrapolation, study inadequacies, and sensitive subpopulations, among other factors. Although uncertainty factors for a specific compound may be 1,000 or higher, these safety factors are applied by USEPA to help guarantee that the overall assessment of risk/hazard is conservative toward human health concerns. In the presence of such uncertainty, the USEPA and the risk assessor are obligated to make conservative assumptions so that the chance is very small for the actual health risk to be greater than what is determined

through the risk assessment process. On the other hand, the process is not intended to yield overly conservative risk values that have no basis in actual conditions. This balance was kept in mind in developing exposure assumptions and pathways and in interpreting data and guidance for the Zone B HHRA.

Evaluation of Chemicals for Which No Toxicity Values Are Available

In addition to the typical uncertainties inherent in toxicity values, parameters that do not have corresponding RBCs due to the lack of approved toxicological values were not included in the CDI calculation data. This does not indicate that chemicals lacking approved toxicological values pose no risk/hazard. As stated previously, essential nutrients were eliminated based on their low potential for toxicity. Therefore, these chemicals were not assessed further in the HHRA.

7.7.6 Quantification of Risk/Hazard

This section of each HHRA is reserved for discussion of potential sources of uncertainty or variability identified in the quantification of risk and hazard that are not covered in preceding sections. Each exposure medium addressed in the formal risk assessment process is discussed briefly.

7.7.7 Mapping Risk/Hazard

Risk and hazard maps developed to present site-specific HHRA results are included in Section 10 of this report. Risk and hazard projection mapping is useful in risk assessment for determining whether hot spots (or isolated areas of gross contamination) exist within an otherwise unimpacted area. This is important, as the lack of homogeneous contaminant concentrations can affect the manner in which receptors are exposed to the affected media. These maps also support preliminary scoping of remedial requirements as well as assessment of potential cleanup alternatives in the CMS.

7.8 Risk Summary

In the HHRA, this section summarizes the risk and hazard projected for each receptor group, exposure medium, and exposure pathway.

7.9 Remedial Goal Options

RGOs are chemical concentrations computed to equate with specific risk and/or hazard goals that may be established for a particular site. As previously discussed, COCs are identified as any COPC that significantly contributes to a pathway of concern. A pathway having an ILCR greater than 10^{-6} or an HI greater than 1 is defined as a pathway of concern, and an individual chemical which contributes either 10^{-6} ILCR or 0.1 HI is considered to significantly contribute to the pathway ILCR or HI. Based on this method, COCs were identified which required calculating RGOs. These are listed in the risk characterization section of the HHRA for AOC 507. RGOs were calculated for all COPCs contributing to a pathway risk of 10^{-6} or greater. Inclusion in the RGO table does not necessarily indicate that remedial action will be required to address a specific chemical. Instead, RGOs are provided to facilitate risk management decisions.

In accordance with USEPA Region IV Supplemental RGO Guidance, RGOs were calculated at 10^{-4} , 10^{-5} , and 10^{-6} risk levels for carcinogenic COCs and HQ goals of 3, 1, and 0.1 for noncarcinogenic COCs. RGOs for carcinogens were based on the lifetime weighted average and the adult site worker. Hazard-based RGOs were calculated based on either the hypothetical child resident or the adult site worker, as noted in the each of the corresponding tables.

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8.0 ECOLOGICAL RISK ASSESSMENT

The ecological risk assessment (ERA) is a key component of the BRA. Its purpose is to develop a qualitative and/or quantitative ecological appraisal of the actual or potential effects on the ecosystem from contamination found in Zone B. The assessment considers environmental media and exposure pathways that could result in unacceptable levels of exposure to flora and fauna now or in the foreseeable future. The approach to assessing risk components at Zone B was based on *Ecological Risk Assessment — Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (USEPA, September 1994), *Risk Assessment Guidance for Superfund, Volume II — Environmental Evaluation Manual* (USEPA, 1989b), and *Framework for Ecological Risk Assessment* (USEPA, 1992a).

Zone Rationale

Basewide, eight Ecological Study Areas (ESAs) were designated to assist in appropriately qualifying geographic boundaries which have contiguous habitats or similar ecosystem distributions (Figure 8.1). Within these ESAs, Areas of Ecological Concern (AECs) were further specified to focus the investigation relative to potential SWMU/AOC contribution and consequent receptor exposure.

Zone configurations for the basewide RFIs at NAVBASE were based on SWMU or AOC locations and, therefore, do not necessarily parallel ESA boundaries. Zone B contained portions of ESA II and AEC II-1 (Noisette Creek), but is predominantly covered by a golf course and officers' housing. All terrestrial area in Zone B was designated as a "Non-Ecological Area" during the basewide survey and is not considered relevant to this ERA based on the lack of habitat and receptors. These areas will not be discussed relative to ecological risk. Furthermore, Zone B contains only one AOC, limiting the ERA to the potentially impacted site and its surrounding area. The risk of contaminant migration from the Zone B AOC to either Noisette Creek, the golf course pond, or aquatic areas out of the Zone B perimeter appears to

be low based on soil and groundwater data. Any risk to receptors within Zone J water bodies will be evaluated during that investigation.

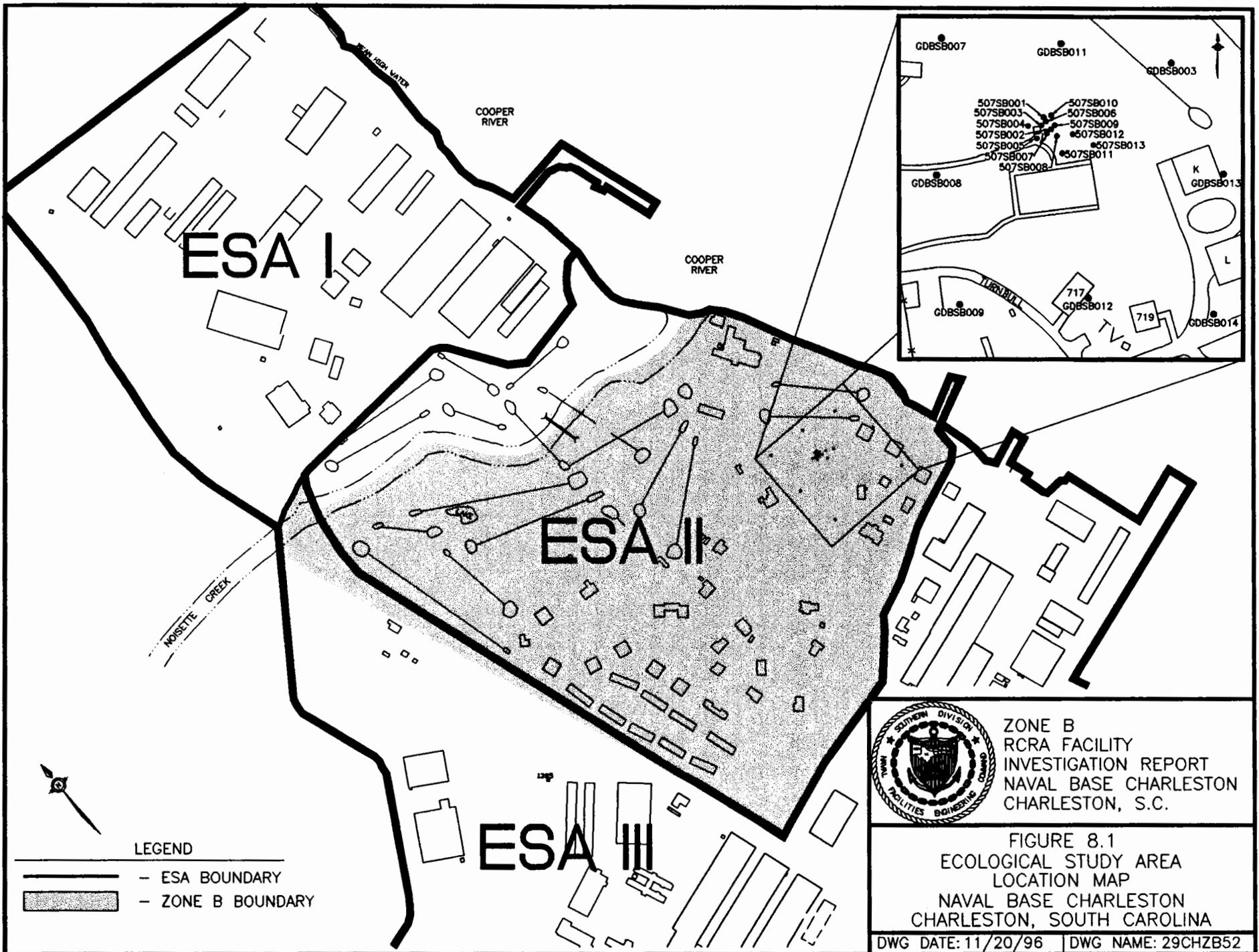
Only AOC 507 and the surrounding area will be addressed in this risk assessment. Therefore, the total number of detections and concentrations of contaminants reported in this section refers to the 13 samples collected at AOC 507 and the eight nearby Zone B grid-based samples.

8.1 Problem Formulation

Environmental Setting

Land use in Zone B is primarily residential and recreational. Vegetation in the residential portion includes well-maintained lawns landscaped with both native and exotic trees and shrubs. Tree species include oaks (*Quercus* spp.) draped in Spanish moss (*Tillandsia usneoides*), pines (*Pinus* spp.), maples (*Acer* spp.), and magnolias (*Magnolia* spp.). Planted shrubs include privet (*Ligustrum* spp.), laurel, and azalea (both *Rhododendron* spp.). These trees and shrubs provide suitable nesting and/or foraging habitat for avian species such as mourning doves (*Zenaidura macroura*), yellow-rumped warblers (*Dendroica coronata*), and American robin (*Turdus migratorius*). Terrestrial faunal species that may occur in this residential area likely include Eastern cottontail rabbit (*Sylvilagus floridanus*), Eastern gray squirrel (*Sciurus carolinensis*), and raccoon (*Procyon lotor*), along with other small mammals.

The remainder of Zone B is a golf course dominated by moderately maintained fairways. The habitat associated with the golf course is essentially open lawn with few mature trees and only a few isolated young ornamental trees. Undeveloped sections of the course which border Noisette Creek and a small pond south of the sixth fairway contain narrow coastal habitats which likely support a variety of aquatic and semiaquatic species. These aquatic and wetland communities will be addressed in the Zone J RFI.



ZONE B
 RCRA FACILITY
 INVESTIGATION REPORT
 NAVAL BASE CHARLESTON
 CHARLESTON, S.C.

FIGURE 8.1
 ECOLOGICAL STUDY AREA
 LOCATION MAP
 NAVAL BASE CHARLESTON
 CHARLESTON, SOUTH CAROLINA
 DWG DATE: 11/20/96 | DWG NAME: 29CHZB52

Final Zone B RFI Report — NAVBASE Charleston
Section 8 — Ecological Risk Assessment
Revision: 0
November 21, 1996

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AOC 507 and Vicinity

Lacking an identified AEC near AOC 507, the scope of the Zone B ERA was limited to the approximately 0.5-acre grassy area surrounding the AOC. Located on the margin of the golf course and the residential area, this site is essentially a mowed lawn adjacent to a maintained fairway. No significant habitat features are present which could provide shelter, substantive food or water, or a mixture of cover types.

Preliminary Risk Characterization

The ERA's Phase II Contamination Assessment was conducted by collecting surface soil from 13 AOC-specific sample locations. Eight of these 13 were collected during second and third round sampling events and were only analyzed for SVOCs. Also, eight nearby grid-based sampling locations (NBCB/GDBSB/003, -007, -008, -009, -011, -012, -013 and -014) were included in this dataset to characterize the open areas surrounding the AOC. Subsequent second and third round sampling events have also provided supplemental data to assess risk to the larger area. The analytical results for these samples are presented in Tables 8.1 and 8.2. Calcium, magnesium, potassium, and sodium were not assessed as they are naturally occurring nutrients.

**Table 8.1
 Zone B ERA
 Organic Constituents in Surface Soil**

Compound Name	Number of Detections	Range of Concentrations ($\mu\text{g}/\text{kg}$)
Volatile Organic Compounds (N = 13)		
Acetone	3	9.5 - 12.0
2-Butanone	1	4.9
Carbon disulfide	1	1.2
Toluene	3	1.4 - 2.4
Trichloroethene	6	1.3 - 3.3

Table 8.1
Zone B ERA
Organic Constituents in Surface Soil

Compound Name	Number of Detections	Range of Concentrations ($\mu\text{g}/\text{kg}$)
Semivolatile Organic Compounds (N = 13)		
Acenaphthylene	1	140
Anthracene	1	200
Benzo(a)anthracene	9	160 - 1,500
Benzo(a)pyrene	9	150 - 1,200
Benzo(b)fluoranthene	8	220 - 1,200
Benzo(g,h,i)perlyene	5	130 - 610
Benzo(k)fluoranthene	5	200 - 950
Benzoic acid	1	82
Chrysene	8	180 - 1,400
Dibenz(a,h)anthracene	1	240
Fluoranthene	8	210 - 2,300
Indeno(1,2,3-cd)pyrene	6	120 - 630
Phenanthrene	6	150 - 1,100
Pyrene	8	150 - 2,500
Pesticides (N = 13)		
Dieldrin	1	1.3
Heptachlor	4	0.77 - 5.9
4,4'-DDD	4	1.7 - 4.1
4,4'-DDE	8	3.6 - 470
4,4'-DDT	7	13 - 70
gamma-Chlordane	1	1.6

Table 8.1
Zone B ERA
Organic Constituents in Surface Soil

Compound Name	Number of Detections	Range of Concentrations ($\mu\text{g}/\text{kg}$)
Dioxins (N = 2)		(ng/kg)
1,2,3,6,7,8-HxCDD	1	0.52
1,2,3,7,8,9-HxCDD	1	0.43
1,2,3,4,6,7,8-HpCDD	2	4.6 - 11.1
1,2,3,4,6,7,8-HpCDF	2	3.0 - 17.3
1,2,3,4,7,8-HxCDF	1	0.37
1,2,3,6,7,8-HxCDF	2	0.16 - 0.31
2,3,4,6,7,8-HxCDF	1	0.57
2,3,7,8-TCDF	2	0.68 - 0.91
OCDD	2	47.4 - 132
OCDF	2	3.7 - 21.9
Total tetra-dioxins	1	0.55
Total hexa-dioxins	1	4.9
Total hepta-dioxins	2	11.2 - 21.4
Total Hepta-Furans	2	5.3 - 33.4
Total Penta-Furans	2	0.89 - 1.6

Notes:

N = Number of samples
 $\mu\text{g}/\text{kg}$ = micrograms per kilogram
 ng/kg = nanograms per kilogram

Table 8.2
Zone B ERA
Inorganic Constituents in Surface Soil

Inorganic Elements	Number of Samples	Number of Detections	Range of Concentrations (mg/kg)
Aluminum	13	13	6,600 - 24,000
Arsenic	13	13	1.7 - 28.7
Barium	13	13	14.9 - 76
Beryllium	13	12	0.25 - 0.88
Chromium	13	13	6 - 38.9
Cobalt	13	7	1.5 - 5.3
Copper	13	13	3 - 89.2
Iron	13	13	2,760 - 115,000
Lead	13	13	9.2 - 194
Manganese	13	13	27.2 - 37
Mercury	13	7	0.12 - 1.5
Nickel	13	13	4.3 - 16.4
Selenium	13	1	0.77
Tin	13	4	9.4 - 12.5
Vanadium	13	13	5.4 - 51.6
Zinc	13	13	9.8 - 182

Note:
 mg/kg = milligrams per kilogram

8.2 Risk Summary

Although some contaminant concentrations (inorganics, pesticides) were above levels that might suggest risk to certain terrestrial groups (i.e. small mammals), the absence of natural habitat features in the vicinity of the AOC makes exposure unlikely. Lacking this key component, and the absence of contaminant migration routes to other ecologically sensitive areas, the ERA for Zone B was deemed complete after the Phase II Preliminary Risk Characterization, concluding that very low ecological risk exists from exposure to contaminants in Zone B surface soil.

9.0 CORRECTIVE MEASURES

According to Permit Condition IV.E. Corrective Action Plan, SCDHEC will review the final RFI report and notify NAVBASE of the need for further investigations, corrective actions, corrective action studies, or plans to meet the requirements of South Carolina regulation R.61-79.264.101, *Corrective Action for SWMUs*. This section and Section 11, Conclusions, have been prepared based on SCDHEC's comment that "the RFI report should discuss whether the extent of contamination has been defined, and proposed recommended actions for the SWMUs and AOCs, such as collection of additional samples, No Further Action, or proceed into a Corrective Measures Study, whichever is appropriate."

Section 11 summarizes site-specific information including whether AOC 507 been proposed for further action such as the collection of additional samples and/or inclusion in the CMS process. In addition, Section 10 includes figures that delineate the extent of contamination as defined by the formal risk assessment process.

The NAVBASE Project Team initially established ALs for assessing whether to conduct a CMS at 10^{-6} residential risk and/or 100 ppm TPH. However, according to the SCDHEC, industrial cleanup levels will be acceptable if such an agreement has been reached and approved by SCDHEC, and NAVBASE can demonstrate that appropriate and effective institutional controls can be maintained at the site. Ecological risk, if found to be at an unacceptable level as presented by the ERA and as defined by SCDHEC, may also be used to initiate and drive certain CMS efforts.

The following discussions, in conjunction with Sections 10 and 11, address AOC 507 relative to the established ALs, the need for additional investigation, corrective actions, or a corrective action study and/or treatability study. The potential remedies listed are based on current collected data and the presumptive remedies presented in the RFI work plan. The steps to be conducted during a typical CMS are also reviewed.

9.1 Introduction

Any CMS at NAVBASE will be conducted according to standard methods presented in the USEPA guidance document, *RCRA Corrective Action Plan* (USEPA, 1994). The standard methodology will be presented in the CMS Work Plan, and will facilitate collecting necessary data, identifying and evaluating potential alternatives, and presenting the final remedial alternative(s) by establishing a set procedure for evaluation and assessment.

The results of risk management decisions will determine which sites become candidates for the CMS process. Cleanup objectives, reuse scenarios, and risk management issues will be instrumental in defining the course of the CMS.

For those sites that may require remedial action, it will be the SCDHEC's responsibility, in conjunction with public involvement/support via the Restoration Advisory Board, to select the final cleanup method from the options presented in the CMS. The outcome of a CMS can also result in a "single" or a "no action" alternative.

To establish this procedure, the CMS Work Plan will outline the CMS report, discussing basic elements. The overall structure of the plan will be explained to illustrate the decision-making process. Briefly, the report outline is:

CMS Report Outline

- A. Introduction/Purpose
- B. Description of Current Conditions
- C. Corrective Action Objectives
- D. Identification, Screening, and Development of Corrective Measure Alternatives
- E. Evaluation of a Final Corrective Measure Alternative
- F. Recommendation by a Permittee/Respondent for a Final Corrective Measure Alternative
- G. Public Involvement Plan

Each required element will be discussed in detail in the CMS Work Plan. The discussion will achieve the following:

- Identify minimum requirements for CMS reports.
- Define the base *pool* of technologies which will be evaluated for each medium.
- Define the evaluation process.
- Identify selection criteria for the final corrective measure alternative.

Issues to be discussed under each element are identified below:

- An activity-specific description of the overall purpose of the CMS for NAVBASE.

SWMUs and AOCs at NAVBASE will be discussed in the CMS Work Plan on a zone-wide basis. Activities, contaminants, and issues specific to Zone B will be discussed. The CMS Work Plan will identify: specific sites to be addressed in the CMS, any focused approach (such as naming a primary technology in lieu of the full screening), and the subsequent cleanup goals.

- A description of the corrective action objectives for NAVBASE, including how target media cleanup standards, points of compliance, or risk assessments will be established and performed for each site, zone, and activity.

Cleanup standards will be developed for each site, zone, or activity using the designated exposure scenario (residential, commercial, or industrial) for that area and relative to receptor type, human or ecological. BRAs, conducted in conjunction with the RFI for each zone, will be used to identify areas with unacceptable risk/hazard as per the designated exposure scenario. During the CMS, areas with unacceptable risk to human

and ecological receptors will be evaluated according to media, primary contaminants contributing to risk, and the potential for groundwater contamination.

- Identification, screening, and development of corrective measures alternatives.

Tables similar to those presented in the NAVBASE RFI Work Plans will be used in the CMS Work Plan to present the “pool” of technologies initially evaluated in the CMS. These tables represent a range of technologies with different applications; each technology must be screened and evaluated before it is discarded from further consideration. The tables, therefore, preclude any bias toward a particular technology through full-scale screening techniques.

Technologies will be screened using site- and waste-specific characteristics. The CMS Work Plan will identify factors to be considered, including type of media, depth of contamination, areal extent of contamination, number and type of contaminants, remedial goals, future land use scenarios, and adjacent remedial activities. In addition, the CMS Work Plan will present the requirements for implementing Corrective Action Management Units (CAMUs).

Once technologies have been screened, they will be assembled into corrective action alternatives. These alternatives will be evaluated according to criteria discussed below.

- A description of the general approach to investigating and evaluating potential corrective action measures.

Corrective measures alternatives will be evaluated using four primary and five secondary criteria, listed below:

Primary

- 1. Protect human health and the environment.*
- 2. Attain media cleanup standards set by the implementing agency.*
- 3. Control the source of releases so as to reduce or eliminate, to the extent practicable, further releases that may pose a threat to human health and the environment.*
- 4. Comply with any applicable standards for management of wastes.*

Secondary

- 1. Long-term reliability and effectiveness*
- 2. Reduction in the toxicity, mobility, or volume of waste.*
- 3. Short-term effectiveness*
- 4. Implementability*
- 5. Cost*

Alternatives will be discussed and compared according to these criteria, which are used to gauge their relative effectiveness and implementability.

- A detailed description of how pilot, laboratory, and/or bench-scale studies will be selected, performed, evaluated, reported, and transferred to full scale.

Treatability studies will be implemented when more involved treatment units are being considered. For example, air stripping technologies usually do not require treatability studies to determine optimal processes for treating groundwater. However, ultraviolet

(UV)/oxidation, an innovative technology, may require extensive treatability testing to determine oxidant dosages and retention times.

The basic structure and objectives of a treatability study will be discussed. Objectives may include: dosages, percent reduction in contaminant, treatment cost per unit volume, and implementation constraints. Study results will be used to assess the alternatives presented in the CMS and determine the optimal remedial approach for each site, zone, or activity.

- A description of how statement of basis/response to comments or permit modifications are to be processed.

Statement of basis/response to comments will be handled through NAVBASE and Southern Division, Naval Facilities Engineering Command (SOUTHDIV). The Comprehensive Long-Term Environmental Action Navy (CLEAN) contractor, E/A&H, will assist the Navy in preparing statement of basis/response to comments. Permit modifications will be managed through SOUTHDIV and NAVBASE's caretaker. According to the existing RCRA permit issued May 4, 1990, Appendix C, Facility Submission Summary, a permit modification is required to prepare and conduct a Corrective Action Study/Plan.

- A description of the overall project management approach, including levels of authority (i.e., organizational charts), lines of communication, project schedules, budgets, and personnel.

The overall project management is the responsibility of SOUTHDIV for the NAVBASE. The lines of authority, communication, and project schedules have been developed and agreed upon and are provided in the Comprehensive Project Management Plan dated August 30, 1994, and amendments. In general, NAVBASE is responsible for ensuring

conditions of the permit are satisfied with the ultimate responsibility held by the Commander of SOUTHDIV.

The budget for conducting a CMS is defined by SOUTHDIV and funds are provided by the U.S. Congress. Personnel to conduct the CMS will be assigned by E/A&H on an as-needed basis for project-specific items. E/A&H will manage the CMS effort through the EnSafe Charleston, South Carolina, office.

- Qualifications of personnel to direct or perform the work will be described.

E/A&H will use trained qualified and/or registered geologists and engineers of South Carolina where required.

9.2 Remedy Selection Approach

As agreed in the *Final Comprehensive Project Management Plan*, (E/A&H, August 1994) remedies will be selected in accordance with statutory and RCRA CMS criteria. Particular attention will be given to the following items when evaluating alternatives:

- Background concentrations, particularly of inorganic compounds
- Land use/risk assessment
- Basewide treatment facilities
- Presumptive remedies
- Remedies for petroleum, oils, lubricants, and other contaminants of this type

The use of CAMUs and temporary units (TUs) will be used where necessary to facilitate storage and treatment during remediation activities.

9.3 Proposed Remedy

Before selecting and implementing corrective measures for releases, environmental and cost-effectiveness goals must be established. Typically, the environmental goal is to reduce exposure via direct contact with air, groundwater, and surface water pathways to some level of acceptability. The cost-effectiveness goal is usually to achieve the environmental goals using the least costly alternative that is both technically feasible and reliable.

9.4 Development of Target Media Cleanup Goals

Cleanup goals will be developed by the SCDHEC for each site at NAVBASE where risk exceeds acceptable levels as specified in the Part B permit. Sites requiring further remediation (defined as those sites exceeding unacceptable risk levels) will undergo CMSs. During the CMS, alternatives will be developed for future residential and/or future worker uses. Two sets of alternatives may be presented for each site; they may differ due to the media cleanup standards required under residential versus site worker scenarios.

The USEPA guidance document, *RCRA Corrective Action Plan* (USEPA, 1994) outlines issues to be considered in developing cleanup goals for groundwater, soil, surface water, sediment, and air. These recommendations are outlined as follows.

9.4.1 Soil Cleanup Goals

The CMS will provide information to support the development of soil cleanup goals. The following information may be required:

- The volume, physical, and chemical characteristics of the wastes in the unit;
- The effectiveness and reliability of containing, confining, and collecting systems and structures in preventing contaminant migration;

- The hydrologic characteristics of the unit and the surrounding area, including the topography of the surrounding land;
- Regional precipitation patterns;
- The existing quality of surface soil, including other sources of contamination and their cumulative impacts on surface soil;
- The potential for contaminant migration and impact to the underlying groundwater;
- The land use patterns in the region;
- The potential for health risks caused by human exposure to waste constituents; and
- The potential for damage to domestic animals, wildlife, food chains, crops, vegetation, and physical structures caused by exposure to waste constituents.

Damage potential to domestic animals and crops (not applicable at NAVBASE), and to physical structures caused by exposure to waste constituents was not assessed during this RFI and therefore, these three elements will not assist in determining soil cleanup goals. Additional information which may be considered includes background soil concentrations and regulatory guidance (e.g., UST guidance documents), among others.

9.5 Identification, Screening, and Development of Corrective Measures Technologies

The initial step in assembling corrective measures alternatives is to identify, screen, and develop corrective measure technologies which apply to the site. Technologies are typically screened using waste-, media-, and site-specific characteristics. This section addresses the range of technologies which may be assessed for each site, the screening process, and screening criteria.

9.5.1 Identification of Corrective Measure Technologies

Sites requiring corrective measures will be assessed using the cleanup standard methodology described in Section 9.2. An initial list of impacted media and contaminants of concern have been identified in the RFI. The BRA identified soil as the contaminated media. For AOC 507, the major contaminants present have been grouped into the following category:

- Nonchlorinated SVOCs

Remedial technologies are described in Section 9.5.2 of this document. Table 9.1 lists nontreatment options for soil, groundwater/leachate, sediment, surface water, and air. These options include removal, containment, and disposal. Table 9.2 lists types of compounds and the recommended types of treatment for each medium. These tables supply general waste management options for various situations.

As discussed in previous sections, because each site may be evaluated under both residential and site worker scenarios, COCs may vary between scenarios. Two lists of applicable technologies may be developed for each site, one for each scenario.

9.5.2 Description of Prescreened Technologies

The following paragraphs describe technologies that appear to be the most feasible for the initial CMS. These technologies are divided into four categories: in-situ soil, ex-situ soil, in-situ groundwater, and ex-situ groundwater.

In-Situ Soil

Bioremediation

This technology uses microorganisms to biologically oxidize contaminants into harmless chemicals such as carbon dioxide and water. The organisms can be naturally occurring or they can be added to the soil. In many circumstances, nutrients can be supplemented to enhance this

**Table 9.1
 Removal/Containment/Disposal Options**

Action	Soil	Groundwater/ Leachate	Sediment	Surface Water	Air
Removal	Excavation	Groundwater extraction Leachate collection	Dredging	Diversions Pumping	NA
Containment	Institutional controls Capping Storm water controls Long-term monitoring Intrinsic (natural) bioremediation/attenuation	Slurry wall Gradient controls Long-term monitoring Intrinsic (natural) bioremediation/attenuation	Berms/diversion Storm water controls	Diversions	NA
Disposal	Landfill	POTW NPDES discharge Land application	Landfill	POTW NPDES discharge	Discharge via air permit

Notes:

- POTW = Publicly Owned Treatment Works
- NPDES = National Pollutant Discharge Elimination System
- NA = Not Applicable

**Table 9.2
 Treatment Technology Options**

	Soil	Groundwater/ Leachate	Sediment	Air
Nonchlorinated SVOCs	Soil washing Incineration Thermal desorption Bioremediation Solidification/stabilization	Oxidation Bioremediation Sorption	Same as soil	Oxidation Adsorption

process. Nitrate and phosphate are often the limited nutrients at a site. However, insufficient electron acceptors is the greatest variable limiting bioremediation. The most common electron acceptor is oxygen for aerobic biodegradation. For these sites, it is likely that bioremediation via natural attenuation is a good candidate for some of the compounds. Nonchlorinated VOCs and SVOCs typically are good candidates for this technology.

Solidification/Stabilization

This technology consists of mixing reagents with soil to prevent contaminants from leaching to the groundwater below. This technology immobilizes contaminants, preventing migration. However, this technology does not remove the contaminant.

Ex-Situ Treatment of Soil

All ex-situ soil treatments require excavation to another location or at least bringing the material to the surface. Typically, heavy equipment is used to move the soil. If contaminated soil is limited in volume and considered nonhazardous, it may be feasible to dispose of it in a landfill. If sites have a limited area of contaminated soil, it may be feasible to remove the soil with heavy equipment and treat it ex-situ or, if nonhazardous, it could be disposed in the SWMU 9 landfill.

Soil Washing

Soil washing physically separates soil particles by size, then treats the smaller grains with solutions which desorb the contaminants. The resulting solution containing contaminants is then treated by another technology. In general, small soil particles such as clay and silt have a higher TOC content which tends to absorb hydrophobic compounds such as chlorinated contaminants. Essentially the technology compacts contaminated soil, then washes it with a solvent to remove the contaminants.

Thermal Desorption

Thermal desorption technologies are performed at high or low temperatures depending on the contaminant. Both of these technologies are used in combination with incineration or some other type of offgas treatment. Soil is excavated and put in the treatment systems for both high- and low-temperature desorption to separate the contaminants from the soil, not to destroy the chemicals. The volatilized contaminants enter an air stream and travel to some type of gas treatment for the contaminant destruction. Low-temperature (200°F to 600°F) thermal desorption (LTTD) is only applicable for VOCs, while high-temperature (600°F to 1000 °F) thermal desorption (HTTD) is applicable for SVOCs, PAHs, PCBs, and pesticides.

Thermal Destruction/Incineration

This technology is used in conjunction with ex-situ soil technologies. Typically, the contaminant is removed from the soil matrix and transferred to an air stream. The air stream is treated with the thermal destruction on a catalyst or burned in an incinerator or a combination of the two. High temperatures (1800°F to 2000°F) are required to destroy organics such as PCBs, dioxins, furans, pesticides, and others.

Solidification/Stabilization

This technology is similar to the in-situ methods; however, the soil is first excavated before being mixed with the chemical reagents or concrete.

9.5.3 Screening Criteria

When more than one technology applies to a specific site, it is necessary to evaluate their limitations to show why certain CMS technologies may prove infeasible to implement because of waste- and/or site-specific conditions. Therefore, for each technology, the following criteria will be discussed:

- Site characteristics
- Waste characteristics
- Technology limitations

Site Characteristics

Site characteristics define the site and any constraints that may impact selecting and implementing remedial technologies. Characteristics to be considered include primarily the current and future use of the site or SWMU. Other characteristics include the contaminated media, areal distribution of contamination, and depth to/of contamination. Current migration pathways and the potential for intrinsic remediation will also be considered. Each site may have one or two technology lists which will be evaluated for residential and BRAC-specified future uses.

Waste Characteristics

Waste characteristics define the nature of contamination. The primary waste characteristics to be considered are those for SVOCs.

Technology Limitations

Technology limitations are used to assess the implementation feasibility of a particular technology. These limitations may include technical restrictions on application, including the presence of a shallow water table, depth to bedrock, etc. Additional limitations include minimum or maximum process volumes, such as technologies which are cost-effective only when contaminated soil volume exceeds 1,000 cubic yards. Other limitations to be assessed include effectiveness in meeting treatment goals and remedial time frame. Technologies meeting this screening criterion may differ from residential to BRAC-specified use scenarios due to the differences in cleanup goals for each scenario.

9.6 Identification of Corrective Measure Alternatives

Once specific remedial technologies are identified for the site, they will be assembled into specific alternatives that may meet the corrective action objectives for all media. Each alternative may consist of an individual technology or a combination of technologies used in

sequence (i.e., treatment train). Depending upon site-specific situations, different alternatives may be considered for separate areas of the facility.

AOC 507 is a less complex, relatively straightforward site and may only require evaluating one or two alternatives. Because the NAVBASE CMS will evaluate both residential and BRAC-specified future uses, two sets of alternatives may be developed for the site.

9.7 Evaluation of Corrective Measure Alternatives

Each alternative proposed (including single proposed alternatives) will be evaluated according to five standards reflecting the major technical components of remedies, including cleanup of releases, source control, and management of wastes that are generated by remedial activities. The specific standards are provided as follows.

- Protect human health and the environment.
- Attain media cleanup standards set by the implementing agency.
- Control the source of releases so as to reduce or eliminate, to the extent practical, further releases that may threaten human health and/or the environment.
- Comply with any applicable standards for managing wastes.
- Consider other factors.

These standards are detailed in the following sections.

9.7.1 Protect Human Health and the Environment

Corrective action remedies must be protective of human health and the environment. The degree of protection afforded by each alternative will be discussed in this section.

Remedies may also include those measures that are needed to be protective, but are not directly related to media cleanup, source control, or waste management. For example, access controls and deed restrictions may be implemented to prevent contact with contaminated media while intrinsic remediation or attenuation processes are monitored or augmented. This section will discuss any short-term remedies that may be implemented to meet this standard.

9.7.2 Attain Media Cleanup Standards Set by the Implementing Agency

Each alternative will be evaluated as to whether the potential remedy will achieve the remedial objective(s). This evaluation will estimate the time frame needed for each alternative to attain these standards. The selected remedy will be required to attain media cleanup standards set by the implementing agency, which may be derived from current state, federal, or other regulations or standards. The media cleanup standard will often play a large part in determining the extent of and technical approaches to the remedy. In some cases, the practical capabilities of remedial technologies (or other technical aspects of the remedy) may influence, to some degree, the cleanup standards that are established.

9.7.3 Control the Sources of Releases

As part of the CMS report, source control measures will be evaluated to determine if they are necessary to control or eliminate further releases that may threaten human health or the environment. If a source control measure is proposed, it will include a discussion on how well the method is expected to work, given site conditions and the known reliability of the selected technology.

Source control measures will be considered when it is necessary to stop further environmental degradation by controlling or eliminating future releases that may threaten human health or the environment. In some cases, without source control measures, efforts to clean up releases may be ineffective or (at best) will essentially involve a perpetual remedial effort. In these cases, an effective source control program may be essential to ensure the long-term effectiveness and protectiveness of the corrective action program. Source control measures may include all protective remedies to control the source. Such remedies may include partial waste removal, capping, in-situ treatment and/or stabilization, and consolidation.

9.7.4 Comply with Any Applicable Standards for Management of Wastes

Each alternative will discuss how the specific waste management activities will comply with all applicable state or federal regulations, such as closure requirements, land disposal restrictions, etc.

9.7.5 Other Factors

Five general factors will be considered in selecting/approving a remedy that meets the four standards listed above. These factors combine technical measures and management controls to address the environmental problems at the site. The five general decision factors include:

- Long-term reliability and effectiveness
- Reduction in the toxicity, mobility, or volume of wastes
- Short-term effectiveness
- Implementability
- Cost

Long-Term Reliability and Effectiveness

The CMS will evaluate whether the technology or a combination of technologies has been used effectively under similar site conditions, whether failure of any one technology in the alternative

would have an immediate impact on receptors, and whether the alternative would have the flexibility to deal with uncontrollable changes onsite.

This criterion will assess the proposed useful life of the overall alternative and of its component technologies. Useful life is defined as the length of time the level of effectiveness can be maintained. Typically, most corrective measure technologies deteriorate with time. Deterioration can often be slowed through proper system operation and maintenance, but the technology may eventually require replacement to maintain effectiveness. The CMS will consider these issues.

Reduction in the Toxicity, Mobility, or Volume of Wastes

This criterion will be used to assess the degree to which each alternative reduces the toxicity, mobility, or volume of wastes. In general, preferred remedies employ treatment and are capable of eliminating (or substantially reducing) the potential for contaminated media to cause future environmental releases or other risks to human health and the environment. Estimates of how much the corrective measure alternatives will reduce the waste toxicity, mobility, or volume may help in assessing this criterion.

In some situations, reducing toxicity, mobility, or volume may not be practical or even desirable. For example, large municipal-type landfills or unexploded munitions may be extremely dangerous to handle. In these situations, the short-term risks of treatment outweigh the potential long-term benefits.

Short-Term Effectiveness

The short-term effectiveness of each alternative will be assessed, including: the potential for fire, explosion, and exposure to hazardous substances, as well as threats associated with treatment, excavation, transportation, and redisposal or containment of waste material. This criterion is

important in densely populated areas and where waste characteristics are such that risks to workers or to the environment are high and special protective measures are needed.

Implementability

Each alternative will be evaluated to assess any potential impacts on the time required to implement a given remedy. Information to consider for implementability includes:

- The administrative activities needed to implement the corrective measure alternative (e.g., permits, rights-of-way, offsite approvals, etc.) and the length of time these activities will take.
- The constructability, time for implementation, and time for beneficial results.
- The availability of adequate offsite treatment, storage capacity, disposal services, needed technical services, and materials.
- The availability of prospective technologies for each corrective measure alternative.

Cost

The CMS will consider the relative cost for each remedy. This criterion is especially useful when several technologies offer the same degree of protection to human health and the environment but vary dramatically in cost. Cost estimates will include: engineering, site preparation, construction, materials, labor, sampling/analysis, waste management/disposal, permitting, health and safety measures, training, operations and maintenance, etc.

9.8 Ranking the Corrective Measures Alternatives

Once corrective measures have been discussed for each site using each applicable scenario (residential and/or BRAC-specified future use), alternatives under each will be ranked in order

of desirability. The ranking system will apply a weighting factor selected by the Navy to determine the importance of each corrective measure criterion. The weighting factors will be developed by the Navy during the CMS. Table 9.3 shows the format of the ranking system.

The example presented in Table 9.3 considers a hypothetical site which has soil contaminated with relatively high (10 to 1,000 ppm) PAH concentrations. Three alternatives were developed: excavation and disposal in a permitted landfill, excavation and thermal treatment, and capping in-situ. The purpose of this example is to show the format and the nature of comparisons that will be made in the CMS.

Once the weighting factors are selected, the rankings are set by multiplying the criteria values by the weighing factor. The weighted criteria values are then summed. Alternatives are ranked in order with the highest total being most preferable, and the lowest total being the least preferable.

Public participation and comment is an instrumental part of the RCRA Corrective Action Process. The ranked alternatives are presented to the public by way of the Restoration Advisory Board during the public meetings process. Public input is actively requested and can become an important factor during the selection of the corrective action alternative by the permitting authority.

Table 9.3
 Comparison and Ranking of Alternatives

Objective & Criteria	Weighing Factor	Alternative 1		Alternative 2		Alternative 3	
		Description	Meets Criteria	Description	Meets Criteria	Description	Meets Criteria
Protect human health and the environment		Protective of human health and community	3	Protective of human health and community	3	Protective of human health and community	3
Attain media cleanup standards		Excavates soil above cleanup goals	3	Excavates soil above cleanup goals	3	No	1
Control the sources of releases		Eliminates source material above cleanup goals	3	Eliminates source material above cleanup goals	3	Controls sources of releases through containment, reduction in leachate	3
Comply with any applicable standards for management of wastes		Must comply with LDRs, USDOT regulations	3	Must comply with LDRs, air emissions regulations	3	Must comply with RCRA cap requirements, monitoring	3
Other Factors							
Long-term reliability and effectiveness		Effective over the long term	3	Effective over the long term	3	Effective with regular maintenance.	3
Reduction in toxicity, mobility, and volume		Does not reduce toxicity, mobility, or volume	1	Reduces toxicity, mobility, and volume through treatment	4	Does not reduce toxicity, mobility, or volume	1
Short-term effectiveness		Minimal exposure to site workers during excavation	3	Minimal exposure to site workers during excavation and treatment	3	Minimal exposure to site workers during excavation	4

**Table 9.3
 Comparison and Ranking of Alternatives**

Objective & Criteria	Weighing Factor	Alternative 1			Alternative 2			Alternative 3		
		Description	Meets Criteria	Weighted Criteria Value	Description	Meets Criteria	Weighted Criteria Value	Description	Meets Criteria	Weighted Criteria Value
Other Factors										
Implementability		Easily implemented, common approach to contaminated soil	4		Requires mobile treatment unit mobilization; may be time inefficient	2		Easily implemented, common approach to contaminated soil	3	
Cost		Present worth cost = \$193,000	3		Present worth cost = \$354,000	1		Present worth cost = \$8,000	4	
Totals										

Notes:

Meets criteria ranking values are based on the following scale
 4 = Meets and far exceeds criteria/objectives
 3 = Slightly exceeds criteria/objectives
 2 = Meets only minimally the criteria/objectives
 1 = Does not meet criteria/objectives

Weighting Factors will be determined by NAVBASE.
 LDRs = Land Disposal Restrictions
 USDOT = U.S. Department of Transportation

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10.0 SITE-SPECIFIC EVALUATIONS

This section presents the site-specific evaluation for AOC 507 which includes a summary of analytical results from samples collected during the CSI, expected fate and transport of COPCs, human health and ecological risk assessments, and recommendations for corrective measures. A summary of all grid-based sampling is also included in this section.

Sampling was conducted in a phased approach presented in Section 2, Volume 1, of the *Final Comprehensive RFI Work Plan* (E/A&H, August 1994). The first round was performed per the *Final Zones A and B RFI Work Plan* (E/A&H, September 1995). Organic compound analytical results from the first round were compared to *USEPA Region III, Risk-Based Concentration Table, January - June 1995*, March 7, 1995. Inorganic analytical results were compared to RBCs and a background reference concentration determined as outlined in Section 5 of this report. Based on evaluation of the first round results, AOC 507 required further sampling to define the extent of BEQ contamination, and provide data collection for a possible corrective measures study (CMS).

Data Evaluation

The following screening tools and data evaluation methods were used to determine COPCs at each site:

- Surface soil analytical results were compared to residential soil ingestion screening values in the USEPA Region III, *Risk-Based Concentration Table, January - July 1996*, April 19, 1996. Noncarcinogenic chemicals were adjusted to equate with an HQ of 0.1.
- In accordance with USEPA *Interim Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment*, Bulletin No. 2, November 1995, TEFs were used to convert cPAHs to BEQs, which were subsequently summed for each sample and compared to the BaP RBC. Similarly, TEFs were used to convert dioxins to TEQs,

which were compared to the 2,3,7,8-TCDD RBC of 1.00 $\mu\text{g}/\text{kg}$ for soil and 4.00E-7 $\mu\text{g}/\text{L}$ for groundwater.

- Duplicate samples were incorporated with their respective primary samples. When either duplicate or primary analytical results had a detection, the detection value was used. When both the duplicate and primary analytical results had detections, an average of the two was used to compensate for matrix heterogeneity.

Deviations from *Final Zones A and B RFI Work Plan*

Deviations from the proposed sampling in the work plan were required in some cases and are specifically noted in the investigatory group subsections.

10.1 AOC 507, Oil Storehouse, Former Building 1010

AOC 507 is former Building 1010, an oil storehouse built on what is now part of the NAVBASE golf course. The building was demolished more than 80 years ago, so little information was available regarding its specifications. Due to the period of operation, it is unlikely that containment and spill cleanup procedures were in place. A review of historical maps and drawings indicated that the structure was at the end of a cul-de-sac, currently southwest of the fairway for hole No. 9. Another small structure of unknown construction date is currently in the vicinity. Appendix F includes a copy of this information, including the 1909 map. Because this information was discovered after the June 1995 RFA Report, the AOC 507 investigation area was relocated to the actual location of Building 1010. The relocation of the AOC investigation area was also included in the *Final Zones A and B RFI Work Plan* (E/A&H, September 1995).

Materials of concern, identified in the *Final Zones A and B RFI Work Plan* (E/A&H, September 1995), included petroleum, oils, and lubricants (POLs). Because AOC 507 is in the former residential and golf course portion of Zone B, potential receptors who might be exposed

to site contaminants include current and future land users, including NAVBASE personnel. Also, the Cooper River is approximately 300 feet from the site and the potential for exposure to biological receptors other than humans required evaluation.

To fulfill CSI objectives, soil was sampled in accordance with the *Final Zones A and B RFI Work Plan*, (E/A&H, September 1995) to confirm whether any contamination resulted from onsite activities at AOC 507.

10.1.1 Soil Sampling and Analysis

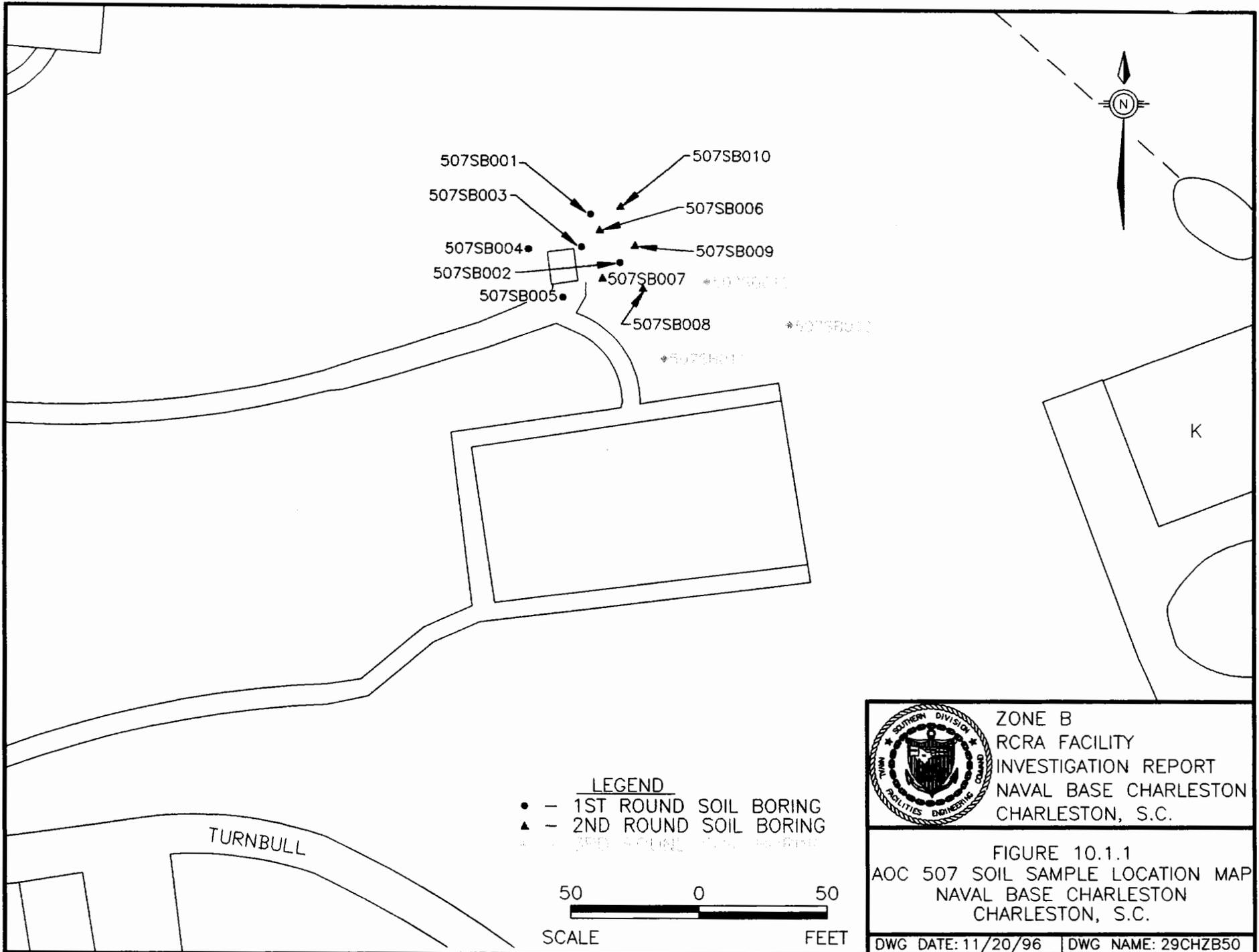
Soil was sampled in three rounds at AOC 507 from the locations shown on Figure 10.1.1. The *Final Zones A and B RFI Work Plan* (E/A&H, September 1995) proposed collecting five soil samples from the upper interval (0 to 1 foot) and five from the lower interval (3 to 5 feet). Thirteen samples were collected from the upper interval and five were collected from the lower interval. The first round occurred during the field investigation for Zone B. Data from that round indicated the presence of several organic compounds in soil samples collected at the site. As part of the Zones A and B second round RFI sampling effort, five additional surface soil samples were collected to delineate BEQs. In June 1996, three more (third round) surface soil samples were collected to better define the extent of contamination.

First round samples were submitted at DQO Level III for VOCs, SVOCs, and metals analyses. One sample was collected as a duplicate and submitted for Appendix IX analysis at DQO Level IV. Second and third round samples were submitted at DQO Level III for SVOCs, and one duplicate was collected at DQO Level IV.

Table 10.1.1 summarizes the samples collected at AOC 507.

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507SB001
 507SB003
 507SB004
 507SB002
 507SB005
 507SB010
 507SB006
 507SB009
 507SB007
 507SB008
 507SB011
 507SB011
 507SB011

LEGEND
 ● - 1ST ROUND SOIL BORING
 ▲ - 2ND ROUND SOIL BORING
 ◆ - 3RD ROUND SOIL BORING

50 0 50
 SCALE FEET

 ZONE B
 RCRA FACILITY
 INVESTIGATION REPORT
 NAVAL BASE CHARLESTON
 CHARLESTON, S.C.

FIGURE 10.1.1
 AOC 507 SOIL SAMPLE LOCATION MAP
 NAVAL BASE CHARLESTON
 CHARLESTON, S.C.

DWG DATE: 11/20/96 | DWG NAME: 29CHZB50

Table 10.1.1
AOC 507
Soil Sampling Summary

Interval	Samples Proposed	Samples Collected	Analyses Proposed	Analyses Performed	Deviations
Upper	5	13	VOCs, SVOCs, and Metals	VOCs, SVOCs, and Metals ^a SVOCs ^b	None
Lower	5	5	VOCs, SVOCs, and Metals	VOCs, SVOCs, and Metals	None

Notes:

^a = First round analytes

^b = Second round analytes

One duplicate sample for Appendix IX parameters and one duplicate for SVOCs only at DQO Level IV were collected and analyzed.

10.1.2 Nature and Extent of Contamination in Soil

Table 10.1.2 summarizes organic compound analytical results for soil. Inorganic analytical results are summarized in Table 10.1.3. Appendix D is the complete analytical data report for all samples collected during the Zone B RFI.

Table 10.1.2
AOC 507
Organic Compound Analytical Results for Soil

Compound	Sampling Interval	Frequency of Detection	Range of Detection (µg/kg)	Mean (µg/kg)	RBC ^a (µg/kg)	Number of Samples Exceeding RBC
Volatile Organic Compounds						
(10 Samples collected; 5 upper interval and 5 lower interval, 1 sample duplicated for Appendix IX analysis)						
Acetone	Upper	2/5	9.5 - 12.0	10.8	780,000	0
	Lower	0/5	NA	NA	NA	NA

Table 10.1.2
 AOC 507
 Organic Compound Analytical Results for Soil

Compound	Sampling Interval	Frequency of Detection	Range of Detection (µg/kg)	Mean (µg/kg)	RBC ^a (µg/kg)	Number of Samples Exceeding RBC
Volatile Organic Compounds						
(10 Samples collected; 5 upper interval and 5 lower interval, 1 sample duplicated for Appendix IX analysis)						
Benzene	Upper	0/5	NA	NA	22,000	0
	Lower	1/5	1.3	NA	NA	NA
2-Butanone (MEK)	Upper	1/5	4.9	NA	4,700,000	0
	Lower	0/5	NA	NA	NA	NA
Carbon disulfide	Upper	1/5	1.2	NA	780,000	0
	Lower	0/5	NA	NA	NA	NA
Toluene	Upper	2/5	1.9 - 2.4	2.2	1,600,000	0
	Lower	1/5	1.3	NA	NA	NA
Trichloroethene	Upper	2/5	1.8 - 2.9	2.4	58,000	0
	Lower	1/5	1.7	NA	NA	NA
Semivolatile Organic Compounds						
(18 Samples collected; 13 upper interval and 5 lower interval, 1 sample duplicated for Appendix IX analysis)						
Acenaphthylene	Upper	1/13	140	NA	470,000	0
	Lower	0/5	NA	NA	NA	NA
Anthracene	Upper	1/13	1/13	NA	2,300,000	0
	Lower	0/5	0/5	NA	NA	NA
BEQs ^b	Upper	8/13	196 - 1,544	577	88	8
Benzo(a)anthracene	Upper	8/13	160 - 1,500	500	880	2
	Lower	0/5	NA	NA	NA	NA
Benzo(a)pyrene	Upper	8/13	150 - 1,200	433	88	8
	Lower	0/5	NA	NA	NA	NA

Table 10.1.2
AOC 507
Organic Compound Analytical Results for Soil

Compound	Sampling Interval	Frequency of Detection	Range of Detection (µg/kg)	Mean (µg/kg)	RBC ^a (µg/kg)	Number of Samples Exceeding RBC
Semivolatile Organic Compounds (18 Samples collected; 13 upper interval and 5 lower interval, 1 sample duplicated for Appendix IX analysis)						
Benzo(b)fluoranthene	Upper	7/13	140 - 1,200	469	880	2
	Lower	0/5	NA	NA	NA	NA
Benzo(g,h,i)perylene	Upper	4/13	130 - 610	373	310,000 ^c	0
	Lower	0/5	NA	NA	NA	NA
Benzo(k)fluoranthene	Upper	5/13	200 - 950	510	8,800	0
	Lower	0/5	NA	NA	NA	NA
Benzoic acid	Upper	1/13	82	NA	31,000,000	0
	Lower	0/5	NA	NA	NA	NA
Chrysene	Upper	8/13	180 - 1,400	528	88,000	0
	Lower	0/5	NA	NA	NA	NA
Dibenz(a,h)anthracene	Upper	1/13	240	NA	88	1
	Lower	0/5	NA	NA	NA	NA
Fluoranthene	Upper	8/13	210 - 2,300	915	310,000	0
	Lower	0/5	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	Upper	5/13	120 - 630	316	880	0
	Lower	0/5	NA	NA	NA	NA
Phenanthrene	Upper	6/13	150 - 1,100	452	310,000 ^c	0
	Lower	0/5	NA	NA	NA	NA
Pyrene	Upper	8/13	150 - 2,500	836	230,000	0
	Lower	0/5	NA	NA	NA	NA

Table 10.1.2
 AOC 507
 Organic Compound Analytical Results for Soil

Compound	Sampling Interval	Frequency of Detection	Range of Detection ($\mu\text{g}/\text{kg}$)	Mean ($\mu\text{g}/\text{kg}$)	RBC ^a ($\mu\text{g}/\text{kg}$)	Number of Samples Exceeding RBC
Pesticides/PCBs/Herbicides (1 Sample collected)						
4,4'-DDD	Upper	1/1	1.7	NA	2,700	0
4,4'-DDE	Upper	1/1	21	NA	1,900	0
4,4'-DDT	Upper	1/1	13	NA	1,900	0
Dioxins (1 Sample collected)						
Dioxin (TCDD TEQ ^b)	Upper	1/1	0.000657	NA	1	0

Notes:

- ^a = Noncarcinogenic RBCs were adjusted to equate with an HQ of 0.1
- ^b = Calculated from method described in USEPA *Interim Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment*, Bulletin No. 2, November 1995
- ^c = RBC not available for this compound; fluoranthene RBC used as surrogate.
- NA = Not applicable

Table 10.1.3
AOC 507
Inorganic Analytical Results for Soil

Compound	Sampling Interval	Frequency of Detection	Range of Detection (mg/kg)	Mean (mg/kg)	Ref. Conc. (mg/kg)	Number of Samples Exceeding Ref. Conc.
Inorganic Analytical Results						
(10 Samples collected; 5 upper interval and 5 lower interval, 1 sample duplicated for Appendix IX analysis)						
Aluminum	Upper	5/5	5,890 - 8,100	7,250	15,500	0
	Lower	5/5	2,330 - 6,530	4,120	17,700	0
Arsenic	Upper	5/5	1.7 - 5.4	3.73	90.0	0
	Lower	3/5	1.1 - 1.4	1.23	48.9	0
Barium	Upper	5/5	21.6 - 52.8	41.2	98.7	0
	Lower	5/5	13.7 - 41.7	23.1	65.0	0
Beryllium	Upper	5/5	0.245 - 0.440	0.359	1.34	0
	Lower	2/5	0.300 - 0.300	0.300	1.61	0
Calcium	Upper	5/5	448 - 4,390	2,400	NA	NA
	Lower	5/5	286 - 1,280	677	NA	NA
Chromium	Upper	5/5	6.0 - 18.1	9.7	80.2	0
	Lower	5/5	2.9 - 7.4	4.5	75.7	0
Chromium (hexavalent)	Upper	1/1	0.300	NA	NA	NA
Cobalt	Upper	2/5	1.5 - 3.3	2.4	21.9	0
	Lower	1/5	2.7	NA	10.6	0
Copper	Upper	5/5	3.0 - 20.3	10.1	225	0
	Lower	5/5	0.92 - 4.90	2.58	47	0
Iron	Upper	5/5	2,930 - 8,020	4,660	NA	NA
	Lower	5/5	976 - 2,560	1,710	NA	NA
Lead	Upper	5/5	9.2 - 194	82.4	114	2
	Lower	5/5	3.3 - 12.2	5.9	145	0

Table 10.1.3
 AOC 507
 Inorganic Analytical Results for Soil

Compound	Sampling Interval	Frequency of Detection	Range of Detection (mg/kg)	Mean (mg/kg)	Ref. Conc. (mg/kg)	Number of Samples Exceeding Ref. Conc.
Inorganic Analytical Results						
(10 Samples collected; 5 upper interval and 5 lower interval, 1 sample duplicated for Appendix IX analysis)						
Magnesium	Upper	5/5	276 - 543	425	NA	NA
	Lower	5/5	159 - 383	248	NA	NA
Manganese	Upper	5/5	50.5 - 280	180	589	0
	Lower	5/5	9.9 - 48.4	22.1	288	0
Mercury	Upper	2/5	0.16 - 0.16	0.16	1.55	0
	Lower	0/5	NA	NA	NA	NA
Nickel	Upper	5/5	4.3 - 8.5	6.2	43.6	0
	Lower	3/5	3.6 - 4.5	4.0	29.9	0
Potassium	Upper	4/5	138 - 203	162	NA	NA
	Lower	1/5	275	NA	NA	NA
Selenium	Upper	1/5	0.770	NA	2.80	0
	Lower	0/5	NA	NA	NA	NA
Silver	Upper	3/5	0.81 - 1.60	1.20	1.70	0
	Lower	1/5	1.50	NA	1.80	0
Sodium	Upper	5/5	187 - 233	211	NA	NA
	Lower	5/5	172 - 205	189	NA	NA
Vanadium	Upper	5/5	5.4 - 10.5	7.8	156	0
	Lower	3/5	3.5 - 5.2	4.4	102	0
Zinc	Upper	5/5	12.5 - 182	77.6	293	0
	Lower	5/5	6.3 - 12.4	9.9	238	0

Volatile Organic Compounds in Soil

No VOCs were detected above their respective RBCs at AOC 507.

Semivolatile Organic Compounds in Soil

BEQs were not detected in five of the surface or any of the five subsurface soil samples. All eight surface soil detections exceeded the RBC (88 $\mu\text{g}/\text{kg}$). These locations (with BEQ concentration) were:

- 507SB00201 (272 $\mu\text{g}/\text{kg}$)
- 507SB00301 (1,544 $\mu\text{g}/\text{kg}$)
- 507SB00601 (214 $\mu\text{g}/\text{kg}$)
- 507SB00701 (196 $\mu\text{g}/\text{kg}$)
- 507SB00801 (1,225 $\mu\text{g}/\text{kg}$)
- 507SB01101 (426 $\mu\text{g}/\text{kg}$)
- 507SB01201 (335 $\mu\text{g}/\text{kg}$)
- 507SB01301 (402 $\mu\text{g}/\text{kg}$)

Pesticides and PCBs in Soil

No pesticides or PCBs were detected above their respective RBCs at AOC 507.

Other Organic Compounds in Soil

Dioxins were detected in the duplicate sample collected at AOC 507. The calculated TEQs were below the 2,3,7,8-TCDD RBC of 1 $\mu\text{g}/\text{kg}$.

Inorganics in Soil

Lead was detected above its reference concentration at AOC 507 in two samples, 507SB00201 and 507SB00301. However, the respective concentrations (194 and 130 mg/kg) were below the proposed USEPA action-level for lead in soil (400 mg/kg).

10.1.3 Groundwater Sampling and Analysis

No groundwater sampling was conducted in association with AOC 507 per the *Final Zones A and B RFI Work Plan* (E/A&H, September 1995).

10.1.4 Fate and Transport Assessment for AOC 507

AOC 507, formerly an oil storage facility, is in the east-central portion of Zone B adjacent to a golf course. Currently, the site is covered with maintained grass, which reduces the amount of rain water infiltration and consequently reduces the significance of the soil-to-groundwater transfer mechanism. Migration pathways investigated for AOC 507 include soil to groundwater, groundwater to surface water, and surface soil to air. Environmental media sampled as part of the AOC 507 CSI include surface and subsurface soil.

10.1.4.1 Soil-to-Groundwater Cross-Media Transport

Table 10.1.4 details constituents detected in soil, comparing maximum concentrations to groundwater protection SSLs or background reference concentrations. Benzo(a)anthracene was detected in surface soil at concentrations above groundwater protection SSLs in only one of thirteen surface soil samples and was not detected in subsurface soil. Although soil concentrations of benzo(a)anthracene suggest isolated leaching potential, no impact to the subsurface soil has been indicated. Therefore, AOC 507 soil concentrations of benzo(a)anthracene are not expected to impact the shallow aquifer.

10.1.4.2 Groundwater-to-Surface Water Cross-Media Transport

No constituents are expected to impact the shallow aquifer based on the evaluation of the soil-to-groundwater transfer mechanism described above. As a result, groundwater migration is not considered a significant pathway for AOC 507.

10.1.4.3 Soil-to-Air Cross-Media Transport

Table 10.1.4 details constituents detected in soil, comparing maximum VOC concentrations to soil-to-air SSLs. The maximum surface soil concentrations of VOCs detected did not exceed their respective soil-to-air volatilization screening levels. As a result, the soil-to-air migration pathway is not considered significant at AOC 507.

Table 10.1.4
 Chemicals Detected in Surface Soil and Subsurface Soil
 Comparison to Soil Screening Levels
 NAVBASE-Charleston, Zone B, AOC 507
 Charleston, South Carolina

Parameter	Maximum Concentration		Soil Screening Level *			Volatil- Leaching ization Potential Potential	
	Surface Soil	Subsurface Soil	Soil to Groundwater	Soil to Air	Soil Units	Potential	Potential
Inorganics							
Aluminum	8100	6530	Background	NA	mg/kg	NO	NO
Arsenic	5.4	1.4	2.9E+01	NA	mg/kg	NO	NO
Barium	52.8	41.7	1.6E+03	NA	mg/kg	NO	NO
Beryllium	0.44	0.3	6.3E+01	NA	mg/kg	NO	NO
Chromium (hexavalent)	0.3	ND	3.6E+06	NA	mg/kg	NO	NO
Chromium (total)	18.1	7.4	3.8E+01	NA	mg/kg	NO	NO
Cobalt	3.3	2.7	Background	NA	mg/kg	NO	NO
Copper	20.3	4.9	Background	NA	mg/kg	NO	NO
Lead	194	12.2	Background	NA	mg/kg	NO	NO
Manganese	280	48.4	Background	NA	mg/kg	NO	NO
Mercury	0.16	ND	2.1E+00	NA	mg/kg	NO	NO
Nickel	8.5	4.5	1.3E+02	NA	mg/kg	NO	NO
Selenium	0.77	ND	5.2E+00	NA	mg/kg	NO	NO
Silver	1.6	1.5	3.1E+01	NA	mg/kg	NO	NO
Vanadium	10.5	5.2	Background	NA	mg/kg	NO	NO
Zinc	182	12.4	1.4E+04	NA	mg/kg	NO	NO
Carcinogenic PAHs							
Benzo(a)pyrene Equivalents							
Benzo(a)anthracene	1500	ND	1.5E+03	NA	ug/kg	YES	NO
Benzo(a)pyrene	1200	ND	8.2E+04	NA	ug/kg	NO	NO
Benzo(b)fluoranthene	1200	ND	4.5E+03	NA	ug/kg	NO	NO
Benzo(k)fluoranthene	950	ND	4.5E+04	NA	ug/kg	NO	NO
Chrysene	1400	ND	1.5E+05	NA	ug/kg	NO	NO
Dibenz(a,h)anthracene	240	ND	1.4E+03	NA	ug/kg	NO	NO
Indeno(1,2,3-cd)pyrene	630	ND	1.3E+04	NA	ug/kg	NO	NO
Chlorinated Pesticides							
4,4'-DDD	1.7	ND	1.1E+04	NA	ug/kg	NO	NO
4,4'-DDE	21	ND	3.6E+04	NA	ug/kg	NO	NO
4,4'-DDT	13	ND	2.1E+04	NA	ug/kg	NO	NO
Semivolatile Organics							
Acenaphthylene	140	ND	2.9E+04	NA	ug/kg	NO	NO
Anthracene	200	ND	1.3E+06	NA	ug/kg	NO	NO
Benzo(ghi)perylene	610	ND	4.7E+07	NA	ug/kg	NO	NO
Benzoic acid	82	ND	6.0E+04	NA	ug/kg	NO	NO
Fluoranthene	2300	ND	6.4E+05	NA	ug/kg	NO	NO
Phenanthrene	1100	ND	1.4E+05	NA	ug/kg	NO	NO

Table 10.1.4
 Chemicals Detected in Surface Soil and Subsurface Soil
 Comparison to Soil Screening Levels
 NAVBASE-Charleston, Zone B, AOC 507
 Charleston, South Carolina

Parameter	Maximum Concentration		Soil Screening Level *			Volatil- Leaching ization Potential Potential	
	Surface Soil	Subsurface Soil	Soil to Groundwater	Soil to Air	Soil Units		
Pyrene	2500	ND	4.6E+05	NA	ug/kg	NO	NO
2,3,7,8-TCDD Equivalents	0.66	ND	4.0E+03	NA	ug/kg	NO	NO
Volatile Organics							
Acetone	12	ND	1.5E+03	620000	ug/kg	NO	NO
Benzene	ND	1.3	3.4E+01	500	ug/kg	NO	NO
2-Butanone	4.9	ND	7.9E+02	NA	ug/kg	NO	NO
Carbon disulfide	1.2	ND	8.0E+02	1100	ug/kg	NO	NO
Toluene	2.4	1.3	1.2E+04	52000	ug/kg	NO	NO
Trichloroethene	2.9	1.7	5.7E+01	3000	ug/kg	NO	NO

* - See Table 6.2

NA - Not available

ND - Not detected

mg/kg - Milligrams per kilogram

ug/kg - Micrograms per kilogram

Background - Constituent concentration compared to background in the absence of a Soil Screening Level

10.1.5 Human Health Risk Assessment for AOC 507

10.1.5.1 Site Background and Investigative Approach

AOC 507 formerly operated as an oil storehouse. Currently, the site is part of a former golf course and is adjacent to former senior officers' housing. AOC 507 is entirely covered with maintained grass as part of the golf course activities. The AOC 507 CSI was conducted to identify any petroleum-related impacts to surrounding soil from past site use.

A total of thirteen soil samples (five outlined in the work plan, five second round, and three third round) were collected from the upper interval. Table 10.1.5 lists the analytical methods employed for the corresponding samples. The number of soil samples may differ for various groups of compounds because specific groups were targeted at certain sample locations and/or sampling rounds. No groundwater was sampled in conjunction with AOC 507.

**Table 10.1.5
 Methods Run at AOC 507
 Surface Soil**

Site	Location	Metal	SVOA	VOA	CN	Hexa.	Dioxin	OPP	Herb.	Pest.
507	B001	S	S	S						
507	B002	S	S	S						
507	B003	S	S	S						
507	B004	S,D	S,D	S,D	Y	Y	Y	Y	S	S
507	B005	S	S	S						
507	B006		S							
507	B007		S							
507	B008		S							
507	B009		S							
507	B010		S							
507	B011		S							

Table 10.1.5
Methods Run at AOC 507
Surface Soil

Site	Location	Metal	SVOA	VOA	CN	Hexa.	Dioxin	OPP	Herb.	Pest.
507	B012		S							
507	B013		S,D							

Notes:

- Metal = TAL metals plus tin. Methods 6000/7000 Series.
- VOA = Volatile organics. Method 8240
- SVOA = Semivolatile organics. Method 8270
- CN = Cyanide. Soil Method 9010, Water Method 9012
- Hexa. = Hexavalent Chromium. Method 7195
- Dioxin = Method 8290
- OPP = Organophosphate pesticides. Method 8140
- Herb. = Chlorinated Herbicides. Method 8150
- Pest. = Chlorinated Pesticides. Method 8080

Key:

- Y = Analyzed for standard parameter list
- D = Duplicate Analysis
- S = Analyzed for SW-846 parameter list

10.1.5.2 COPC Identification

Soil

Based on the screening comparisons described in Section 7 of this RFI and presented in Table 10.1.6, BEQs were identified as a COPC because they exceeded the BaP RBC. The results of Wilcoxon rank-sum tests did not identify any additional organic or inorganic COPCs.

10.1.5.3 Exposure Assessment

Exposure Setting

AOC 507 is currently part of a former golf course covered with maintained grass. This AOC is in an area scheduled to remain a golf course or to be developed as a waterfront park according to current base reuse plans. Both options include maintaining the active recreational and/or housing uses of the area surrounding AOC 507.

Table 1
 Summary of Chemicals Present in Site Samples, AOC 507
 Surface Soil
 NAVBASE - Charleston, Zone B
 Charleston, South Carolina

Parameter	Units	Frequency of Detection	Range of Nondetected Upper Bounds	Range of Detected Concentrations	Average Detected Conc.	Screening Conc.	Num. Over Screen	Reference Conc.	Num. Over Ref.
Group: 507, S, 01									
Carcinogenic PAHs									
* B(a)P Equiv.	UG/KG	8/ 13	1,687.0 - 1,895.0	196.4200 - 1543.9000	576.9650	88.00	8		
* Benzo(a)anthracene	UG/KG	8/ 13	730.0 - 820.0	160.0000 - 1500.0000	500.0000	880.00 C	2		
* Benzo(b)fluoranthene	UG/KG	7/ 13	730.0 - 820.0	140.0000 - 1200.0000	468.5714	880.00 C	2		
Chrysene	UG/KG	8/ 13	730.0 - 820.0	180.0000 - 1400.0000	527.5000	88,000.00 C			
* Dibenz(a,h)anthracene	UG/KG	1/ 13	690.0 - 820.0	240.0000 - 240.0000	240.0000	88.00 C	1		
Indeno(1,2,3-cd)pyrene	UG/KG	5/ 13	690.0 - 820.0	120.0000 - 630.0000	316.0000	880.00 C			
Benzo(k)fluoranthene	UG/KG	5/ 13	710.0 - 820.0	200.0000 - 950.0000	510.0000	8,800.00 C			
* Benzo(a)pyrene	UG/KG	8/ 13	730.0 - 820.0	150.0000 - 1200.0000	432.5000	88.00 C	8		
Dioxins									
Dioxin Equiv.	NG/KG	1/ 1		0.6579 - 0.6579	0.6579	4.10			
1234678-HpCDD	NG/KG	1/ 1		11.1000 - 11.1000	11.1000				
1234678-HpCDF	NG/KG	1/ 1		17.3000 - 17.3000	17.3000				
123678-HxCDD	NG/KG	1/ 1		0.5200 - 0.5200	0.5200				
123789-HxCDD	NG/KG	1/ 1		0.4300 - 0.4300	0.4300				
123678-HxCDF	NG/KG	1/ 1		0.3100 - 0.3100	0.3100				
123478-HxCDF	NG/KG	1/ 1		0.2600 - 0.2600	0.2600				
OCDD	NG/KG	1/ 1		132.0000 - 132.0000	132.0000				
OCDF	NG/KG	1/ 1		21.9000 - 21.9000	21.9000				
2378-TCDF	NG/KG	1/ 1		0.6800 - 0.6800	0.6800				
Inorganics									
Aluminum (Al)	MG/KG	5/ 5		5890.0000 - 8100.0000	7254.0000	7,800.00 N	1	15,530.00	
Arsenic (As)	MG/KG	5/ 5		1.7000 - 5.4000	3.7300	0.43 C	5	90.00	
Barium (Ba)	MG/KG	5/ 5		21.6000 - 52.8000	41.1600	550.00 N		98.00	
Beryllium (Be)	MG/KG	5/ 5		0.2450 - 0.4400	0.3590	0.15 C	5	1.00	
Calcium (Ca)	MG/KG	5/ 5		448.0000 - 4390.0000	2398.4000				
Chromium (Cr)	MG/KG	5/ 5		6.0000 - 18.1000	9.7200	39.00 N		80.00	
Chromium (Hexavalent)	MG/KG	1/ 1		0.3000 - 0.3000	0.3000	39.00 N			
Cobalt (Co)	MG/KG	2/ 5	1.4 - 1.5	1.5000 - 3.3000	2.4000	470.00 N		21.00	
Copper (Cu)	MG/KG	5/ 5		3.0000 - 20.3000	10.1100	310.00 N		225.00	
Iron (Fe)	MG/KG	5/ 5		2925.0000 - 8020.0000	4657.0000				
Lead (Pb)	MG/KG	5/ 5		9.2000 - 194.0000	82.4000	400.00 j		113.00	2
Magnesium (Mg)	MG/KG	5/ 5		275.5000 - 543.0000	424.7000				
Manganese (Mn)	MG/KG	5/ 5		50.5000 - 280.0000	180.1000	180.00 N	3	588.00	
Mercury (Hg)	MG/KG	2/ 5	0.1 - 0.1	0.1600 - 0.1600	0.1600	2.30 N		1.00	

Table 10.1.6

Summary of Chemicals Present in Site Samples, AOC 507

Surface Soil

NAVBASE - Charleston, Zone B

Charleston, South Carolina

Parameter	Units	Frequency of Detection	Range of Nondetected Upper Bounds		Range of Detected Concentrations		Average Detected Conc.	Screening Conc.	Num. Over Screen	Reference Conc.	Num. Over Ref.
Inorganics											
Nickel (Ni)	MG/KG	5/ 5			4.3000 -	8.5000	6.2200	160.00 N			43.00
Potassium (K)	MG/KG	4/ 5	128.0 -	128.0	138.0000 -	203.0000	162.0000				
Selenium (Se)	MG/KG	1/ 5	0.6 -	0.7	0.7700 -	0.7700	0.7700	39.00 N			2.00
Silver (Ag)	MG/KG	3/ 5	0.6 -	0.6	0.8100 -	1.6000	1.2033	39.00 N			1.00
Sodium (Na)	MG/KG	5/ 5			187.0000 -	233.0000	211.4000				
Vanadium (V)	MG/KG	5/ 5			5.4000 -	10.5000	7.8200	55.00 N			156.00
Zinc (Zn)	MG/KG	5/ 5			12.5000 -	182.0000	77.5600	2,300.00 N			293.00
Pesticides											
4,4'-DDD	UG/KG	1/ 1			1.7000 -	1.7000	1.7000	2,700.00 C			
4,4'-DDE	UG/KG	1/ 1			21.0000 -	21.0000	21.0000	1,900.00 C			
4,4'-DDT	UG/KG	1/ 1			13.0000 -	13.0000	13.0000	1,900.00 C			
SVOAs											
Acenaphthylene	UG/KG	1/ 13	690.0 -	820.0	140.0000 -	140.0000	140.0000	310,000.00 e			
Anthracene	UG/KG	1/ 13	690.0 -	820.0	200.0000 -	200.0000	200.0000	2,300,000.00 N			
Benzo(g,h,i)perylene	UG/KG	4/ 13	690.0 -	820.0	130.0000 -	610.0000	372.5000	310,000.00 f			
Benzoic acid	UG/KG	1/ 13	3,500.0 -	4,100.0	82.0000 -	82.0000	82.0000	31,000,000.00 N			
Fluoranthene	UG/KG	8/ 13	730.0 -	820.0	210.0000 -	2300.0000	915.0000	310,000.00 N			
Phenanthrene	UG/KG	6/ 13	690.0 -	820.0	150.0000 -	1100.0000	451.6667	310,000.00 f			
Pyrene	UG/KG	8/ 13	730.0 -	820.0	150.0000 -	2500.0000	836.2500	230,000.00 N			
Total Dioxins											
Total Penta-Dioxins	NG/KG	1/ 1			1.2000 -	1.2000	1.2000				
Total Hepta-Dioxins	NG/KG	1/ 1			21.4000 -	21.4000	21.4000				
Total Hexa-Dioxins	NG/KG	1/ 1			4.9000 -	4.9000	4.9000				
Total Hexa-Furans	NG/KG	1/ 1			8.4000 -	8.4000	8.4000				
Total Penta-Furans	NG/KG	1/ 1			1.6000 -	1.6000	1.6000				
Total Tetra-Dioxins	NG/KG	1/ 1			2.0000 -	2.0000	2.0000				
Total Tetra-Furans	NG/KG	1/ 1			5.9000 -	5.9000	5.9000				
Total Hepta-Furans	NG/KG	1/ 1			33.4000 -	33.4000	33.4000				
VOAs											
Acetone	UG/KG	2/ 5	11.0 -	12.0	9.5000 -	12.0000	10.7500	780,000.00 N			
2-Butanone (MEK)	UG/KG	1/ 5	11.0 -	12.0	4.9000 -	4.9000	4.9000	4,700,000.00 N			
Carbon disulfide	UG/KG	1/ 5	5.6 -	6.2	1.2000 -	1.2000	1.2000	780,000.00 N			
Toluene	UG/KG	2/ 5	5.6 -	5.9	1.9000 -	2.4000	2.1500	1,600,000.00 N			
Trichloroethene	UG/KG	2/ 5	5.6 -	5.8	1.8000 -	2.9000	2.3500	58,000.00 C			

Table 10.1.6
 Summary of Chemicals Present in Site Samples, AOC 507
 Surface Soil
 NAVBASE - Charleston, Zone B
 Charleston, South Carolina

Name	Ref	Notes
Acenaphthylene	e	Acenaphthene used as surrogate
delta-BHC	l	gamma-BHC (Lindane) used as surrogate
Benzo (g, h, i) perylene	f	Fluoranthene used as surrogate
7,12-Dimethylbenz (a) anthracene	d	Dibenz (a,h)anthracene used as surrogate
Endrin aldehyde	h	Endrin used as surrogate
Endrin ketone	h	Endrin used as surrogate
Isodrin	p	Aldrin used as surrogate
1-Methylnaphthalene	e	Acenaphthene used as surrogate
2-Methylnaphthalene	e	Acenaphthene used as surrogate
2-Nitrophenol	b	2-Nitrophenol used as surrogate
Phenanthrene	f	Fluoranthene used as surrogate

Potentially Exposed Populations

Potentially exposed populations are current and future site workers. Additional potentially exposed populations are hypothetical future site residents or park users. Future site resident and worker exposure scenarios were addressed in this HHRA. The hypothetical future site worker scenario assumes continuous exposure to surface soil conditions. Current site workers' exposure would be less than that assumed for the hypothetical future site worker or residential scenario because of their limited soil contact (the area is currently vegetated) and the fact that groundwater is not currently used onsite. Similarly, exposure to soil conditions is expected to be greater for hypothetical future site residents than for hypothetical future park users. Therefore, the future worker assessment is considered to be protective of current site users and residential assessment is expected to be protective of future park users.

Exposure Pathways

Exposure pathways for the site workers are dermal contact and incidental ingestion of surface soil. The exposure pathways for future residential land use are the same as those for the future site worker. In addition, the hypothetical future site worker scenario assumes continuous exposure to surface soil conditions. Uniform exposure was assumed for all sample locations. Table 10.1.7 provides justification for exposure pathways assessed in this HHRA.

Exposure Point Concentrations

Table 10.1.8 presents the statistical analysis of surface soil COPC data for AOC 507. The 95% UCL on the arithmetic mean (0.78 mg/kg) for BEQs was used as the EPC to estimate risk due to soil exposure pathways.

Quantification of Exposure

Soil

CDIs for soil ingestion and dermal contact pathways are shown in Tables 10.1.9 and 10.1.10, respectively.

10.1.5.4 Toxicity Assessment

Toxicity assessment terms and methods are discussed in Section 7 of this report. Table 10.1.11 presents toxicological information specific to BEQ compounds as a group which were identified as a COPC for AOC 507 soil. This information was used to quantify risk/hazard associated with soil contaminants. A brief toxicological profile is provided in the following paragraphs.

Table 10.1.7
Exposure Pathways Summary — AOC 507
NAVBASE — Zone B
Charleston, South Carolina

Potentially Exposed Population	Medium and Exposure Pathway	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Current Land Uses			
Current Site Users/Maintenance	Air, Inhalation of gaseous contaminants emanating from soil	No	No significant VOC concentrations were reported in surface soil.
	Air, Inhalation of chemicals entrained in fugitive dust	No	The site is covered by maintained grass which limits fugitive dust generation.
	Shallow groundwater, Ingestion of contaminants during potable or general use	No	Shallow groundwater is not currently used as a source of potable or nonresidential water at AOC 507.
	Shallow groundwater, Inhalation of volatilized shallow groundwater contaminants	No	Shallow groundwater is not currently used as a source of potable or nonresidential water at AOC 507.
	Soil, Incidental ingestion	No (Qualified)	Future land use assessment is considered to be protective of current receptors.
	Soil, Dermal contact	No (Qualified)	Future land use assessment is considered to be protective of current receptors.

Table 10.1.7
Exposure Pathways Summary — AOC 507
NAVBASE — Zone B
Charleston, South Carolina

Potentially Exposed Population	Medium and Exposure Pathway	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Future Land Uses			
Future Site Residents (Child and Adult) and Future Site Worker	Air, Inhalation of gaseous contaminants emanating from soil	No	No significant VOC concentrations were reported in surface soil.
	Air, Inhalation of chemicals entrained in fugitive dust	No	The site is covered by maintained grass which limits fugitive dust generation.
	Shallow groundwater, Ingestion of contaminants during potable or general use	No	No groundwater sampling was performed in conjunction with the 507 investigation.
	Shallow groundwater, Inhalation of volatilized contaminants during domestic use	No	No groundwater sampling was performed in conjunction with the 507 investigation.
	Soil, Incidental ingestion	Yes	COPCs were identified subsequent to risk-based and background screening comparisons.
	Soil, Dermal contact	Yes	COPCs were identified subsequent to risk-based and background screening comparisons.
	Wild game or domestic animals, Ingestion of tissue impacted by media contamination	No	Hunting/taking of game and/or raising livestock is prohibited within the Charleston city limits.
	Fruits and vegetables, Ingestion of plant tissues grown in media	No	The potential for significant exposure via this pathway is low relative to that of other exposure pathways assessed.

Table 10.1.8
 Statistical Analysis of COPCs
 Surface Soils at AOC 507
 Naval Base Charleston Zone B
 Charleston, South Carolina

COPC	Natural Log Transformed				UCL	MAX	EPC
	n	mean	SD	H-stat	(mg/kg)	(mg/kg)	(mg/kg)
Benzo(a)pyrene equivalents	13	0.0060	0.673	2.341	0.78	1.7	0.78

NOTES:

- mean arithmetic mean of the logtransformed data
- n number of samples analyzed
- SD standard deviation for a sample of data
- H-stat "H" statistic; cuboidal interpolation was used to determine the value in accordance with USEPA Supplemental Guidance to RAGS, Calculating the Concentration Term
- EPC exposure point concentration
- UCL 95 percentile upper confidence level mean

Table 10.1.9
 Chronic Daily Intakes (CDI)
 Incidental Ingestion of Surface Soil (0-1')
 AOC 507 Zone B
 Naval Base Charleston
 Charleston, SC

Chemical	Fraction Ingested from Contaminated Source *	Exposure Point Concentration (mg/kg)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)
Benzo(a)pyrene equivalents	1	0.78	1.1E-06	1.0E-05	1.2E-06	3.8E-07	1.4E-07

NOTES:

- lwa Lifetime weighted average; used to calculate carcinogenic CDI, RAGS Parts A and B
- CDI Chronic Daily Intake in mg/kg-day
- H-CDI CDI for hazard quotient
- C-CDI CDI for excess cancer risk
- * Reflects the estimated fraction of the site impacted by the corresponding COPC.

Table 10.1.10
 Chronic Daily Intakes (CDI)
 Dermal Contact with Surface Soil (0-1')
 AOC 507 Zone B
 Naval Base Charleston
 Charleston, SC

Chemical	Exposure Point Concentration (mg/kg)	Fraction Contacted from Contaminated Source *	Dermal Absorption Factor (unitless)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)
Benzo(a)pyrene equivalents	0.78	1	0.01	4.4E-07	1.4E-06	2.7E-07	3.1E-07	1.1E-07

NOTES:

- CDI Chronic Daily Intake in mg/kg-day
- H-CDI CDI for hazard quotient
- C-CDI CDI for excess cancer risk
- The dermal absorption factor was applied to the exposure point concentration to reflect the different trans-dermal migration of inorganic versus organic chemicals
- * Reflects the estimated fraction of the site impacted by the corresponding COPC.

Table 10.1.11
 Toxicological Database Information
 for Chemicals of Potential Concern
 AOC 507 Zone B
 Naval Base Charleston
 Charleston, SC

Non-Carcinogenic Toxicity Data

Chemical	Oral Reference Dose (mg/kg/day)	Confidence Level	Critical Effect	Uncertainty Factor Oral	Inhalation Reference Dose (mg/kg/day)	Confidence Level	Critical Effect	Uncertainty Factor Inhalation
Benzo(a)pyrene Equivalents	ND			ND	ND			ND

Carcinogenic Toxicity Data

Chemical	Oral Slope Factor [(mg/kg/day)] ⁻¹	Inhalation Slope Factor [(mg/kg/day)] ⁻¹	Weight of Evidence	Tumor Type
Benzo(a)pyrene Equivalents	7.3 a	3.1	B2	mutagen

NOTES:

- a Integrated Risk Information System (IRIS)
- NA Not applicable or not available
- ND Not determined due to lack of information

Polyaromatic hydrocarbons or **benzo(a)pyrene equivalents** include the following list:

Benzo(a)anthracene	TEF	0.1
Benzo(b)fluoranthene	TEF	0.1
Dibenz(a,h)anthracene	TEF	1.0
Benzo(k)fluoranthene	TEF	0.01
Benzo(a)pyrene	TEF	1.0
Indeno(1,2,3-cd)pyrene	TEF	0.1
Chrysene	TEF	0.001

Some PAHs are toxic to the liver, kidneys, and blood. However, the toxic effects of the PAHs above have not been well established. There are no RfDs for the PAHs above due to a lack of data. All PAHs listed above are classified by USEPA as B2 carcinogens, and their carcinogenicity is addressed relative to that of BaP, having an oral SF of 7.3 mg/kg/day⁻¹. TEFs, also set by USEPA, are multipliers that are applied to the detected concentrations, with the results subsequently used to calculate excess cancer risk. These multipliers are discussed further in the exposure and toxicity assessment sections. Most cPAHs have been classified as such due to animal studies using large doses of purified PAHs. There is some doubt as to the validity of these listings, and the SFs listed in USEPA's RBC table are provisional. However, these PAHs are carcinogens when the exposure involves a mixture of other carcinogenic substances (e.g., coal tar, soot, cigarette smoke, etc.). As listed in IRIS (search date June 28, 1995), the basis for the BaP B2 classification is that human data specifically linking BaP to a carcinogenic effect are lacking. There are, however, multiple animal studies in many species demonstrating BaP to be carcinogenic by numerous routes.

BaP has produced positive results in numerous genotoxicity assays. At the June 1992 Carcinogen Risk Assessment Verification Endeavor (CRAVE) Work Group meeting, a revised risk estimate for BaP was verified. This section provides information on three aspects of the carcinogenic risk

assessment for the agent in question, two of which are the USEPA classification and quantitative estimate of exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in application of a low-dose extrapolation procedure and presented as the risk per mg/kg/day. The unit risk is the quantitative estimate in terms of either risk per microgram per liter ($\mu\text{g/L}$) of drinking water or risk per microgram per cubic meter ($\mu\text{g/m}^3$) of air breathed. The third form in which risk is presented is the drinking water or air concentration providing a cancer risk of 1 in 10,000 or 1 in 1,000,000. The Carcinogenicity Background Document provides details on the carcinogenicity values found in IRIS. Users are referred to the oral reference dose and reference concentration sections for information on long-term toxic effects other than carcinogenicity.

As listed in IRIS (search date of June 28, 1995), dibenz(a,h)anthracene and benzo(b)fluoranthene are classified B2 because there are no human data but sufficient data from animal bioassays. Benzo(b)fluoranthene produced tumors in mice after lung implantation, intraperitoneal or subcutaneous injection, and skin painting. As listed in IRIS (same date), benzo(a)anthracene is classified B2 because there are no human data but sufficient data from animal bioassays. Benzo(a)anthracene produced tumors in mice exposed by gavage; intraperitoneal, subcutaneous or intramuscular injection; and topical application. Benzo(a)anthracene produced mutations in bacteria and in mammalian cells, and transformed mammalian cells in culture. As listed in IRIS (same date), benzo(k)fluoranthene is classified B2 because there are no human data but sufficient data from animal bioassays. Benzo(k)fluoranthene produced tumors after lung implantation in mice and when administered with a promoting agent in skin-painting studies. Equivocal results have been found in lung adenoma assay in mice. Benzo(k)fluoranthene is mutagenic in bacteria.

Other PAHs — those not classified by USEPA as carcinogens — are toxic to the liver, kidney, and blood. This group of PAHs includes compounds such as pyrene, acenaphthene, acenaphthylene, benzo(g,h,i)perylene, and phenanthrene. USEPA determined RfDs for only two

of these compounds: pyrene's oral reference dose (RfD_o) of 0.03 mg/kg/day is also used as a surrogate RfD_o for phenanthrene, while the RfD_o for acenaphthene is 0.06 mg/kg/day.

10.1.5.5 Risk Characterization

Surface Soil Pathways

Exposure to surface soil onsite was evaluated under both residential and industrial (site worker) scenarios. For these scenarios, the incidental ingestion and dermal contact exposure pathways were evaluated. HQs were not computed for either scenario due to the lack of reference dose data. Tables 10.1.12 and 10.1.13 present the computed carcinogenic risk associated with the incidental ingestion of and dermal contact with site surface soil, respectively.

Hypothetical Site Residents

The surface soil ingestion ILCR (based on the adult and child lifetime weighted average) for AOC 507 future site residents is 9E-6. Based on dermal contact with surface soil, the ILCR for future site residents is 4E-6. ILCR values are based on exposure to BEQs.

Hypothetical Site Workers

Site worker ILCRs are 1E-6 and 2E-6 for the ingestion and dermal contact pathways, respectively. ILCR values are based on exposure to BEQs.

COCs Identified

BEQs were identified as COCs at AOC 507 based on cumulative (all pathway) risk projected for this site (Table 10.1.14). USEPA has established a generally acceptable risk range of 1E-4 to 1E-6 or HI of 1 (unity). In this HHRA, a COC was considered to be any chemical contributing to a cumulative risk level of 1E-6 or whose HQ exceeded 0.1. For carcinogens, this approach is relatively conservative, as a cumulative risk level of 1E-4 (and individual ILCR of 1E-6) is recommended by USEPA Region IV as the trigger for establishing COCs. The COC selection algorithm presented was used to provide a more comprehensive evaluation of chemicals contributing to carcinogenic risk or noncarcinogenic hazard during the RGO development process.

Table 10.1.12
 Hazard Quotients and Incremental Lifetime Cancer Risks
 Incidental Surface Soil Ingestion
 AOC 507 Zone B
 Naval Base Charleston

Charleston, SC

Chemical	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day) ⁻¹	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR
Benzo(a)pyrene equivalents	NA	7.3	ND	ND	8.9E-06	ND	1.0E-06

NOTES:

- NA Not available
- ND Not Determined due to lack of available information
- lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
- ILCR Incremental Lifetime excess Cancer Risk

Table 10.1.13
Hazard Quotients and Incremental Lifetime Cancer Risks
Dermal Contact With Surface Soil
AOC 507 Zone B
Naval Base Charleston
Charleston, SC

Chemical	Dermal Adjustment	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day) ⁻¹	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR
Benzo(a)pyrene equivalents	0.5	NA	14.6	ND	ND	4.0E-06	ND	1.6E-06

NOTES:

- NA Not available
- ND Not Determined due to lack of available information
- lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
- ILCR Incremental Lifetime excess Cancer Risk
 - Dermal to absorbed dose adjustment factor is applied to adjust for Oral SF and RfD (i.e., the oral RfD is based on oral absorption efficiency which should not be applied to dermal exposure and dermal CDI)

Table 10.1.14
 Summary of Risk and Hazard-based COCs
 AOC 507 Zone B
 NAVBASE - Charleston
 Charleston, South Carolina

Medium	Exposure Pathway		Future	Future	Future	Future Site Worker		Identification of COCs
			Resident Adult Hazard Quotient	Resident Child Hazard Quotient	Resident Iwa ILCR	Hazard Quotien	ILCR	
Surface Soil	Incidental Ingestion	Benzo(a)pyrene equivalent	ND	ND	8.9E-06	ND	1.0E-06	2
	Dermal Contact	Benzo(a)pyrene equivalent	ND	ND	4.0E-06	ND	1.6E-06	2 4
Surface Soil Pathway Sum			ND	ND	1E-05	ND	3E-06	

Notes:

ND indicates not determined due to the lack of available risk information.

ILCR indicates incremental excess lifetime cancer risk

HI indicates hazard index

1- Chemical is a COC by virtue of projected child residence non-carcinogenic hazard.

2- Chemical is a COC by virtue of projected future resident lifetime ILCR.

3- Chemical is a COC by virtue of projected site worker non-carcinogenic hazard.

4- Chemical is a COC by virtue of projected site worker ILCR.

Surface Soils

Hypothetical Site Residents (Future Land Use)

BEQs were identified as soil pathway COCs based on their contributions to cumulative ILCR projections.

Hypothetical Site Workers (Future Land Use)

BEQs were identified as soil pathway COCs based on cumulative ILCR projections in excess of 1E-6 for the future site worker scenario.

The extent of the COCs identified based on hypothetical residential exposure to surface soil is briefly discussed below. BEQs were detected in eight of thirteen upper interval soil samples collected, with a maximum concentration of 1.54 mg/kg in sample 507SB00301. All detections exceeded the residential RBC of 0.088 mg/kg for BEQs. Based on the AOC 507 sampling team's observations, the presence of BEQs in the surface soil is likely due to a layer of decaying asphalt just beneath the soil surface. This theory is supported by data which identified no BEQs in the subsurface soil. Figure 10.1.2 illustrates the spatial distribution of risk and the data used to generate the risk map is summarized on Table 10.1.15.

10.1.5.6 Risk Uncertainty

Characterization of Exposure Setting and Identification of Exposure Pathways

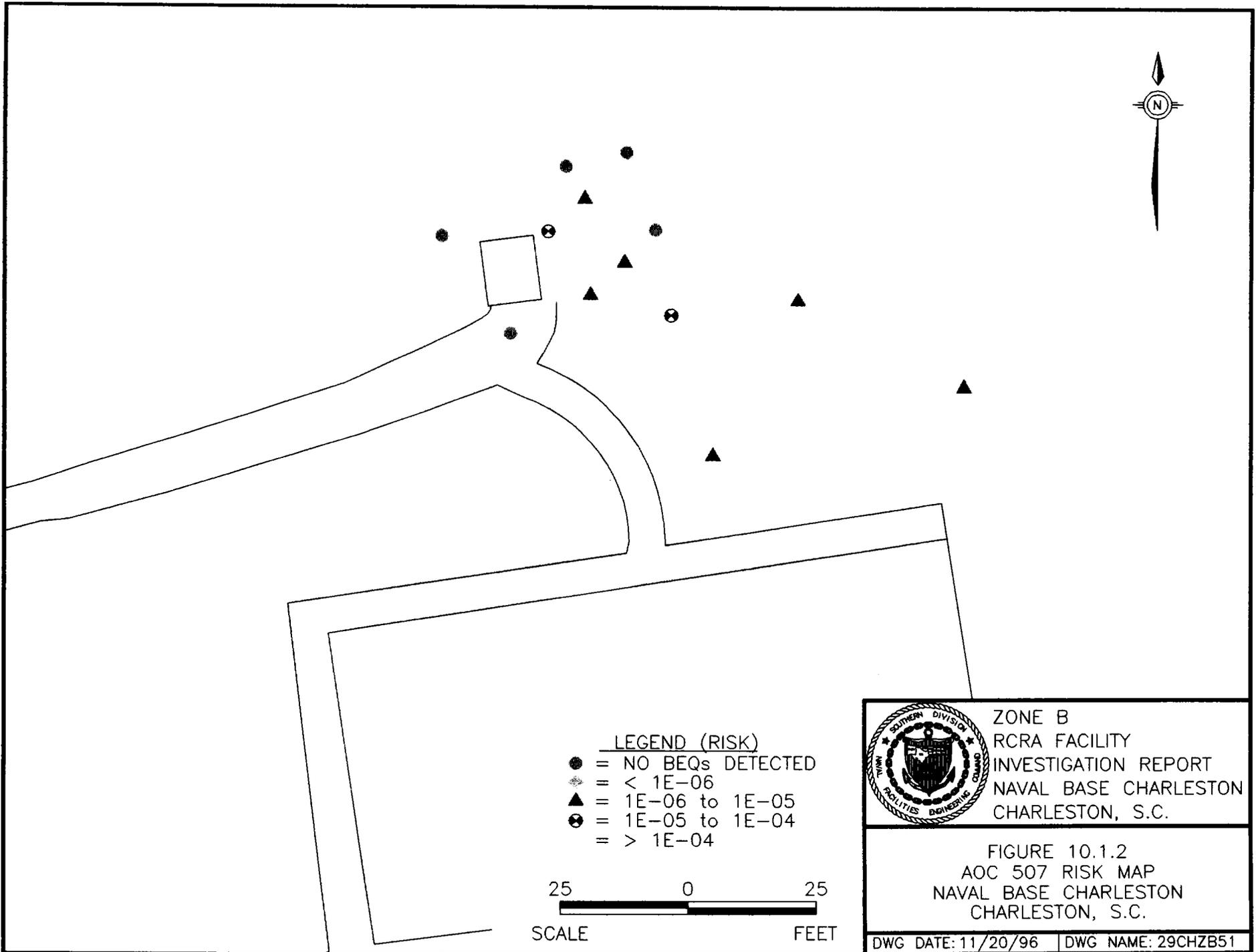
The potential for high bias is introduced through the exposure setting and pathway selection due to the highly conservative assumptions (i.e., future residential use) recommended by USEPA Region IV when assessing potential future and current exposure. The exposure assumptions made in the site worker scenario are highly protective and would tend to overestimate exposure. Most of AOC 507 is covered by vegetation, thus limiting current exposure to affected surface soil.

Table 10.1.15
Risk for COCs Identified in AOC 507 Surface Soil

Sample ID	BEQ (µg/kg)	Risk
507SB00101	ND	0
507SB00201	272	4.54 E-06
507SB00301	1,544	2.57 E-05
507SB00401	ND	0
507SB00501	ND	0
507SB00601	214	3.57 E-06
507SB00701	196	3.27 E-06
507SB00801	1,225	2.04 E-05
507SB00901	0	0
507SB01001	0	0
507SB01101	426	7.11 E-06
507SB01201	335	5.59 E-06
507SB01301	402	6.70 E-06

Current site workers could infrequently be exposed to surface soil during invasive activities such as excavation to repair utilities, etc. However, site workers would not be expected to work onsite in contact with the affected media for eight hours per day, 250 days per year as the exposure assessment assumes.

AOC 507 is in an area currently designated by NAVBASE reuse plans for residential and recreational areas. If this area were to be used as a residential site, the vegetative surface would be disturbed, and the surface soil conditions would likely change (i.e., the soil would then be covered with landscaping soil and/or a house). Consequently, exposure to current soil conditions would not be likely under a true residential scenario. These factors indicate that exposure



LEGEND (RISK)

- = NO BEQs DETECTED
- ⊛ = < 1E-06
- ▲ = 1E-06 to 1E-05
- ⊗ = 1E-05 to 1E-04
- ⊙ = > 1E-04

25 0 25
 ───────────────────
 SCALE FEET



ZONE B
 RCRA FACILITY
 INVESTIGATION REPORT
 NAVAL BASE CHARLESTON
 CHARLESTON, S.C.

FIGURE 10.1.2
 AOC 507 RISK MAP
 NAVAL BASE CHARLESTON
 CHARLESTON, S.C.

DWG DATE: 11/20/96 | DWG NAME: 29CHZB51

pathways assessed in this HHRA would generally overestimate the risk posed to current site workers and future site residents.

Quality of Data

Environmental samples were collected at AOC 507 from October 1995 to June 1996. All samples were analyzed by either Lockheed Analytical Services, Inc. or Southwest Labs of Oklahoma, Inc. which are SC-certified laboratories. Ninety percent of the samples were reported using USEPA DQO Level III, while 10% were analyzed for Appendix IX parameters using USEPA DQO Level IV. The analytical methods and DQO laboratory deliverables are summarized in Section 4, Data Validation. As noted in Section 7.3.2, all Zone B data were deemed usable for risk assessment in their qualified form.

Determination of Exposure Point Concentrations

Use of a 95% UCL on the arithmetic mean as an EPC, an upper bound estimate, is likely to overestimate rather than underestimate risk projections. The maximum concentrations of COPCs were used as the EPCs.

Quantification of Risk

As indicated by the discussions above, the uncertainty inherent in the risk assessment process is great. In addition, many site-specific factors that would upwardly bias the risk estimates have affected the uncertainty of this assessment. Exposure pathway-specific sources of uncertainty are discussed below.

Of the organic CPSSs screened and eliminated from formal assessment, none was reported at a concentration close to its corresponding RBC. This minimizes the likelihood of potentially significant cumulative risk/hazard based on the eliminated organic CPSSs. Aluminum, arsenic, beryllium, and manganese surface soil concentrations exceeded their RBCs and were eliminated from further evaluation in the HHRA based on comparison to background. Although the future

land use at this site is not definitively known, both the worker and residential exposure scenarios were assessed in this HHRA. As previously discussed, these scenarios would likely lead to overestimates of risk and/or hazard.

CT analysis was not formally performed for AOC 507 surface soil, but a simplified approach was taken to assess the potential influences of CT assumptions. The CT assumption for residential exposure duration is nine years compared to the 30-year assumption for RME. The CT exposure frequency assumption is 234 days/year compared to 350 days/year RME. In addition, the CT ingestion rate assumptions for adults and children are 0.5 the RME values. Considering the effects of CT estimates of Exposure Frequency (EF), Exposure Duration (ED), and Intake Rate (IR), risk/hazard projections would be approximately one order of magnitude below those based on the RME. As a result, under the CT assumption, cumulative soil pathway (ingestion and dermal contact) ILCR would be approximately equal to the 1E-6 point of departure.

10.1.5.7 Risk Summary

The risk posed by identified soil contaminants was assessed for the hypothetical site worker and the hypothetical future site resident under RME assumptions. The surface soil incidental ingestion and dermal contact pathways were assessed in the HHRA. Table 10.1.16 summarizes the risk for each pathway/receptor group evaluated for AOC 507.

10.1.5.8 Remedial Goal Options

Soil

Residential soil RGOs based on site residents and site workers are presented in Table 10.1.17 and Table 10.1.18, respectively.

Table 10.1.16
 Summary of Risk and Hazard
 AOC 507 Zone B
 Charleston, South Carolina
 Naval Base Charleston
 Charleston, SC

Medium	Exposure Pathway	HI (Adult)	HI (Child)	ILCR (LWA)	HI (Worker)	ILCR (Worker)
Surface Soil	Incidental Ingestion	ND	ND	9E-06	ND	1E-06
	Dermal Contact	ND	ND	4E-06	ND	2E-06
Sum of All Pathways		ND	ND	1E-05	ND	3E-06

Notes:
 ND indicates not determined due to the lack of available risk information.
 ILCR indicates incremental excess lifetime cancer risk
 HI indicates hazard index

Table 10.1.17
 Residential-Based Remedial Goal Options Surface Soil
 AOC 507 Zone B
 Naval Base Charleston
 Charleston, South Carolina

Chemical	Slope Factor (mg/kg-day) ⁻¹	Reference Dose (mg/kg-day)	FI/FC Factor	EPC mg/kg	Hazard-Based Remedial Goal Options			Risk-Based Remedial Goal Options			Background Concentration mg/kg
					3 mg/kg	1 mg/kg	0.1 mg/kg	1E-06 mg/kg	1E-05 mg/kg	1E-04 mg/kg	
Benzo(a)pyrene equivalents	7.3	NA	1	0.78	ND	ND	ND	0.060	0.60	6.0	NA

NOTES:

- EPC exposure point concentration
- NA Not applicable
- ND Not determined
- remedial goal options were based on the residential lifetime weighted average for carcinogens and the child resident for noncarcinogens

Table 10.1.18
 Worker-Based Remedial Goal Options Surface Soil
 AOC 507 Zone B
 Naval Base Charleston
 Charleston, South Carolina

Chemical	Slope Factor (mg/kg-day) ⁻¹	Reference Dose (mg/kg-day)	FI/FC Factor	Unadjusted EPC mg/kg	Hazard-Based Remedial Goal Options			Risk-Based Remedial Goal Options			Background Concentration mg/kg
					3 mg/kg	1 mg/kg	0.1 mg/kg	1E-06 mg/kg	1E-05 mg/kg	1E-04 mg/kg	
Benzo(a)pyrene equivalents	7.3	NA	1	0.78	ND	ND	ND	0.30	3.0	30	NA

NOTES:

- EPC exposure point concentration
- NA not applicable
- ND not determined

10.1.5.9 Corrective Measures

For AOC 507, soil was the only environmental medium investigated. Air, groundwater, and sediment were not addressed for this site, therefore, corrective measures are not considered for these media. BEQs were identified as the only surface soil COC. Potential corrective measures for this COC are indicated in Table 10.1.19.

Table 10.1.19
AOC 507 Potential Corrective Measures

Medium	Compounds	Potential Corrective Measures
Surface soil	Benzo(a)pyrene equivalents	a) No action, monitoring, intrinsic remediation b) Containment/capping c) Excavation, physical and biological treatment d) In-situ, biological treatment

10.1.6 Summary of Ecological Risk in Zone B

Although some contaminant concentrations (inorganics, pesticides) were above levels that might suggest risk to certain terrestrial groups (i.e. small mammals), the absence of natural habitat features in the vicinity of the AOC, the small area of contamination, and the limited migration pathways make exposure unlikely. Section 8 of this report includes the Phase II Preliminary Risk Characterization for ecological risk.

10.2 Grid-Based Sampling

To characterize background conditions across Zone B, as required by the *Final Zones A and B RFI Work Plan* (E/A&H, September 1995), systematic grid-based soil and groundwater sampling was performed.

10.2.1 Soil Sampling and Analysis

The *Final Zones A and B RFI Work Plan* (E/A&H, September 1995) proposed 15 upper interval soil samples and 15 lower interval samples. All 15 upper interval (0 to 1 foot) and 14 lower

interval (3 to 5 feet) samples were collected. Samples were collected from the locations in Figure 10.2.1. One lower interval sample (GDBSB00302) was not collected because a water table less than 5 feet bgs would have resulted in a saturated sample. Saturated samples are considered unacceptable for analysis. Samples were collected for the standard suite of parameters, which includes VOCs, SVOCs, metals, cyanide, pesticides, and PCBs. Table 10.2.1 summarizes soil sampling and analysis of the grid-based locations.

**Table 10.2.1
 Grid-Based Locations
 Soil Sampling Summary**

Interval	Samples Proposed	Samples Collected	Analyses Proposed	Analyses Performed	Deviation
Upper	15	15	Standard Suite ^a	Standard Suite ^a	None
Lower	15	14	Standard Suite ^a	Standard Suite ^a	One lower interval sample was not collected due to a water table less than 5 feet bgs.

Note:

^a = Standard suite includes VOCs, SVOCs, metals, cyanide, pesticides, and PCBs

10.2.2 Nature and Extent of Chemicals in Soil

Organic compound analytical results for soil are summarized in Table 10.2.2. Inorganic analytical results for soil are summarized in Table 10.2.3. Appendix D is a complete analytical data report for all Zone B samples.

Volatile Organic Compounds in Soil

Acetone, 2-butanone (MEK), carbon disulfide, toluene, and trichloroethene were detected in grid-based soil samples.

Semivolatile Organic Compounds in Soil

Nine SVOCs were detected in grid-based soil samples.

Table 10.2.2
Grid-Based Locations
Organic Compound Analytical Results for Soil

Compound	Sampling Interval	Frequency of Detection	Range of Detection ($\mu\text{g}/\text{kg}$)	Mean ($\mu\text{g}/\text{kg}$)
Volatile Organic Compounds				
(29 Samples collected; 15 upper interval and 14 lower interval, 2 samples duplicated)				
Acetone	Upper	6/15	10.0 - 19.0	14.5
	Lower	7/14	7.7 - 610	130
2-butanone (MEK)	Upper	1/15	3.3	NA
	Lower	3/14	4.3 - 120	47.4
Carbon disulfide	Upper	0/15	NA	NA
	Lower	3/14	7.6 - 56.0	26.2
Toluene	Upper	1/15	1.4	NA
	Lower	0/14	NA	NA
Trichloroethene	Upper	10/15	1.2 - 5.1	2.2
	Lower	0/14	NA	NA
Semivolatile Organic Compounds				
(29 Samples collected; 15 upper interval and 14 lower interval, 2 samples duplicated)				
BEQ ^b	Upper	2/15	179 - 272	226
	Lower	1/14	19.2	NA
Benzo(a)anthracene	Upper	2/15	160 - 260	210
	Lower	1/14	190	NA
Benzo(a)pyrene	Upper	2/15	150 - 210	180
	Lower	0/14	NA	NA
Benzo(b)fluoranthene	Upper	1/15	220	NA
	Lower	0/14	NA	NA
Benzo(g,h,i)perylene	Upper	1/15	170	NA
	Lower	0/14	NA	NA
Chysene	Upper	2/15	160 - 280	220
	Lower	1/14	230	NA

Table 10.2.2
Grid-Based Locations
Organic Compound Analytical Results for Soil

Compound	Sampling Interval	Frequency of Detection	Range of Detection (µg/kg)	Mean (µg/kg)
Semivolatile Organic Compounds (29 Samples collected; 15 upper interval and 14 lower interval, 2 samples duplicated)				
Fluoranthene	Upper	1/15	430	NA
	Lower	1/14	400	NA
Indeno(1,2,3-cd)pyrene	Upper	2/15	130 - 140	135
	Lower	0/14	NA	NA
Phenanthrene	Upper	1/15	180	NA
	Lower	1/14	210	NA
Pyrene	Upper	1/15	390	NA
	Lower	1/14	410	NA
Pesticides/PCBs (29 Samples collected; 15 upper interval and 14 lower interval, 2 samples duplicated)				
4,4'-DDD	Upper	5/15	2.3 - 24	10
	Lower	1/14	4.5	NA
4,4'-DDE	Upper	12/15	3.6 - 470	140
	Lower	5/14	1.3 - 6.5	3.6
4,4'-DDT	Upper	8/15	30 - 200	73
	Lower	0/14	NA	NA
alpha-Chlordane	Upper	1/15	12	NA
	Lower	0/14	NA	NA
gamma-Chlordane	Upper	4/15	1.1 - 42	12
	Lower	0/14	NA	NA
Dieldrin	Upper	1/15	1.3	NA
	Lower	0/14	NA	NA
Heptachlor	Upper	1/15	6.6	NA
	Lower	0/14	NA	NA

Table 10.2.2
Grid-Based Locations
Organic Compound Analytical Results for Soil

Compound	Sampling Interval	Frequency of Detection	Range of Detection (µg/kg)	Mean (µg/kg)
Pesticides/PCBs (29 Samples collected; 15 upper interval and 14 lower interval, 2 samples duplicated)				
Heptachlor epoxide	Upper	4/15	0.77 - 31	10
	Lower	0/14	NA	NA
Duplicate samples (2 samples collected for Appendix IX analysis)				
TCDD TEQ	Upper	2/2	0.000315 - 0.0083	0.0043

Notes:

- ^a = Noncarcinogens were adjusted to equate to an HQ of 0.1
- ^b = Calculated from method described in USEPA *Interim Supplemental Guidance to RAGS: Human Health Risk Assessment*, Bulletin 2, November 1995
- NA = Not applicable

Table 10.2.3
Grid-Based Locations
Inorganic Analytical Results for Soil

Element	Sample Interval	Frequency of Detections	Range of Detections (mg/kg)	Mean (mg/kg)
Inorganic Analyses (29 Samples collected; 15 upper interval and 14 lower interval, 2 samples duplicated)				
Aluminum	Upper	15/15	6,320 - 47,900	15,200
	Lower	14/14	1,970 - 55,600	12,700
Antimony	Upper	1/15	12.8	NA
	Lower	1/14	22.6	NA
Arsenic	Upper	14/15	1.7 - 28.7	9.1
	Lower	10/14	1.2 - 33.9	8.9
Barium	Upper	15/15	14.9 - 94.7	47.1
	Lower	14/14	11.5 - 65	28
Beryllium	Upper	13/15	0.28 - 1.45	0.62
	Lower	7/14	0.28 - 1.70	0.68

Table 10.2.3
Grid-Based Locations
Inorganic Analytical Results for Soil

Element	Sample Interval	Frequency of Detections	Range of Detections (mg/kg)	Mean (mg/kg)
Inorganic Analyses				
(29 Samples collected; 15 upper interval and 14 lower interval, 2 samples duplicated)				
Calcium	Upper	15/15	406 - 115,000	17,000
	Lower	14/14	279 - 182,000	17,400
Chromium	Upper	15/15	5.95 - 63.8	23.3
	Lower	14/14	2.5 - 75.7	19.5
Cobalt	Upper	12/15	1.4 - 9.4	3.9
	Lower	6/14	1.9 - 10.6	4.8
Copper	Upper	15/15	3.8 - 122	31
	Lower	14/14	0.8 - 47	9
Iron	Upper	15/15	2,630 - 45,700	12,500
	Lower	14/14	1,470 - 49,100	11,700
Lead	Upper	15/15	12.9 - 310	69
	Lower	14/14	1.4 - 145	21
Magnesium	Upper	15/15	226 - 6,240	1,720
	Lower	14/14	147 - 9,070	1,870
Manganese	Upper	15/15	27.2 - 500	219
	Lower	14/14	8.6 - 744	130
Mercury	Upper	8/15	0.12 - 1.50	0.59
	Lower	3/14	0.18 - 2.00	0.97
Nickel	Upper	15/15	3.4 - 26.5	11.4
	Lower	9/14	4.6 - 25	12
Potassium	Upper	13/15	145 - 3,040	868
	Lower	9/14	176 - 4,720	1,150
Selenium	Upper	5/15	0.78 - 2.8	1.8
	Lower	4/14	0.72 - 3.8	2.2
Silver	Upper	6/15	0.72 - 1.7	1.3
	Lower	7/14	1.2 - 1.8	1.5

Table 10.2.3
Grid-Based Locations
Inorganic Analytical Results for Soil

Element	Sample Interval	Frequency of Detections	Range of Detections (mg/kg)	Mean (mg/kg)
Inorganic Analyses				
(29 Samples collected; 15 upper interval and 14 lower interval, 2 samples duplicated)				
Sodium	Upper	15/15	173 - 6,080	720
	Lower	14/14	159 - 12,600	1,280
Tin	Upper	7/15	8.2 - 14.8	11.3
	Lower	2/14	8.2 - 20.4	14.3
Vanadium	Upper	15/15	6.5 - 90	26
	Lower	12/14	3.3 - 102	26
Zinc	Upper	15/15	18.2 - 266	106
	Lower	14/14	3.7 - 238	47

Pesticides and PCBs in Soil

Eight pesticides and no PCBs were detected in the grid-based soil samples.

Other Organic Compounds in Soil

Twelve dioxin compounds were detected among two upper interval samples. The values shown in Table 10.2.2 indicate the range of detection for the group of samples analyzed, and TEQs were calculated based on detection in an individual sample. The TEQs calculated ranged from 3.15E-04 to 8.30E-04 $\mu\text{g}/\text{kg}$, with a mean of 4.31E-04. All TEQs were below the TCDD RBC of 1.0 $\mu\text{g}/\text{kg}$.

Inorganics in Soil

Twenty-two metals were detected in grid-based soil samples.

10.2.3 Groundwater Sampling and Analysis

The *Final Zones A and B RFI Work Plan* (E/A&H, September 1995) proposed four shallow and four deep grid-based monitoring wells. All four shallow and two of the deep grid-based wells were installed (Figure 10.2.2). As previously detailed in Section 2, two deep grid-based wells (NBCB-GDB-02D and NBCB-GDB-03D) were not installed because the screened interval would have overlapped the adjacent shallow well. As proposed in the *Final Zones A and B RFI Work Plan* (E/A&H, September 1995), deep groundwater samples were collected for TDS, chlorides, sulfates, the standard suite of parameters, which includes VOCs, SVOCs, metals, cyanide, pesticides, and PCBs at DQO Level III. One sample was duplicated and submitted for Appendix IX parameters at DQO Level IV. Table 10.2.4 summarizes the grid-based groundwater sampling.

**Table 10.2.4
 Grid-Based Locations
 Groundwater Sampling Summary**

Interval	Samples Proposed	Samples Collected	Analyses Proposed	Analyses Performed	Deviation
Shallow	4	4	Standard Suite ^a	Standard Suite ^a	None
Deep	4	2	Standard Suite ^a , TDS, Sulfate, Chloride	Standard Suite ^a , TDS, Sulfate, Chloride	Two deep wells were not installed because the screened interval would have overlapped with the adjacent shallow well.

Note:

^a = Standard suite includes VOCs, SVOCs, metals, cyanide, pesticides, and PCBs.

10.2.4 Nature and Extent of Chemicals Detected in Groundwater

Table 10.2.5 summarizes the organic analytical results for groundwater. Table 10.2.6 summarizes inorganic analytical results.

Table 10.2.5
Grid-Based Locations
Organic Compound Analytical Results for Groundwater

Compound	Sampling Interval	Frequency of Detection	Range of Detection ($\mu\text{g/L}$)	Mean ($\mu\text{g/L}$)
Volatile Organic Compounds (4 Shallow samples collected and 2 Deep samples collected; 1 duplicate collected for Appendix IX analysis)				
Acetone	Shallow	0/4	NA	NA
	Deep	1/2	6.5	NA
Carbon disulfide	Shallow	1/4	5.6	NA
	Deep	0/2	NA	NA
4-Methyl-2-pentanone (MIBK)	Shallow	0/4	NA	NA
	Deep	1/2	1.2	NA
Semivolatile Organic Compounds (4 Shallow samples collected and 2 Deep samples collected; 1 duplicate collected for Appendix IX analysis)				
bis-(2-Ethylhexyl)phthalate	Shallow	1/4	9.6	NA
	Deep	0/2	NA	NA

Table 10.2.6
Grid-Based Locations
Inorganic Analytical Results for Groundwater

Parameter	Interval	Frequency of Detections	Range of Detections ($\mu\text{g/L}$)	Mean ($\mu\text{g/L}$)
Inorganic Analysis (4 Shallow samples and 2 Deep samples collected, 1 duplicate collected for Appendix IX analysis)				
Aluminum	Shallow	4/4	87.4 - 185	119
	Deep	1/2	50.9	NA
Arsenic	Shallow	3/4	7.6 - 15.5	10.4
	Deep	0/2	NA	NA
Barium	Shallow	4/4	21.1 - 89.7	43.0
	Deep	1/2	106	NA
Calcium	Shallow	4/4	13,700 - 467,000	183,000
	Deep	2/2	50,400 - 327,000	189,000

Table 10.2.6
Grid-Based Locations
Inorganic Analytical Results for Groundwater

Parameter	Interval	Frequency of Detections	Range of Detections ($\mu\text{g/L}$)	Mean ($\mu\text{g/L}$)
Inorganic Analysis (4 Shallow samples and 2 Deep samples collected, 1 duplicate collected for Appendix IX analysis)				
Chromium	Shallow	1/4	11	NA
	Deep	1/2	4	NA
Iron	Shallow	4/4	231 - 8,070	2,300
	Deep	1/2	156	NA
Lead	Shallow	0/4	NA	NA
	Deep	1/2	3.4	NA
Magnesium	Shallow	4/4	8,740 - 771,000	267,000
	Deep	2/2	5,760 - 405,000	205,000
Manganese	Shallow	4/4	60.2 - 2,060	919
	Deep	2/2	58.2 - 504	281
Nickel	Shallow	0/4	NA	NA
	Deep	1/2	14.4	NA
Potassium	Shallow	4/4	1,450 - 214,000	90,000
	Deep	2/2	3,470 - 124,000	63,700
Sodium	Shallow	4/4	29,600 - 6,200,000	2,310,000
	Deep	2/2	73,600 - 3,290,000	1,680,000
Vanadium	Shallow	1/4	12.9	NA
	Deep	0/2	NA	NA
Zinc	Shallow	3/4	5.9 - 16.9	10.3
	Deep	1/2	6.5	NA
TDS	Deep	2/2	415,000 - 11,000,000	5,700,000
Sulfates	Deep	2/2	22,500 - 360,000	191,000
Chlorides	Deep	2/2	92,000 - 6,400,000	3,246,000

Note:
 NA = Not applicable

Volatile Organic Compounds in Groundwater

Acetone, carbon disulfide, and 4-methyl-2-pentanone (MIBK) were detected in grid-based groundwater samples.

Semivolatile Organic Compounds in Groundwater

Bis(2-ethylhexyl)phthalate was detected in one shallow grid-based groundwater sample.

Pesticides and PCBs in Groundwater

No pesticides or PCBs were detected in grid-based groundwater samples.

Other Organic Compounds in Groundwater

No dioxins or furans were detected in grid-based groundwater samples.

Inorganics in Groundwater

Fourteen metals were detected in grid-based groundwater samples. Manganese was present at up to 2,040 $\mu\text{g/L}$ in shallow and 504 $\mu\text{g/L}$ in deep groundwater. Based on recent changes to the RfD, the risk-based concentration for manganese in water is 860 $\mu\text{g/L}$. The concentration in shallow groundwater exceeds this.

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11.0 CONCLUSIONS

The Zone B RFI was conducted to determine if AOC 507 poses unacceptable risk to human health or the environment (ecological concerns) and if it will require additional evaluation under the CMS. The following sections summarize the findings of the AOC 507 investigation and the ecological risk summary for Zone B.

11.1 AOC 507

AOC 507 is former Building 1010, an oil storehouse that operated more than 80 years ago. The area around the site is residential and recreational. Nonchlorinated semivolatile organic compounds detected in surface soil at the site resulted in an excess cancer risk for future site residents of 1E-05 when converted to benzo(a)pyrene equivalents (BEQs). Although USEPA has established a generally accepted risk range of 1E-4 to 1E-6, the project team has established the acceptable threshold for NAVBASE as 1E-06. Therefore, AOC 507 must be further evaluated in the CMS to determine whether further action will be required. The horizontal extent of contamination is shown in Figure 10.1.2. Adverse impacts are limited to the surface interval, as no COCs were identified in subsurface soil. Table 11.1 identifies the affected medium, the risk/hazard, and the chemicals driving the risk.

Table 11.1
AOC 507
Conclusion Summary

Affected Medium	Unacceptable Risk/Hazard in the Future Residential Scenario	Chemicals Driving Risk
Surface Soil	Yes — ILCR	Nonchlorinated SVOCs (BEQs)

11.2 Ecological Risk Summary

Based upon the limited habitat within Zone B, the small area of contamination, and the limited migration pathways to ecological habitats of concern, ecological risks related to Zone B are considered to be minimal. Therefore, no further ecological risk evaluation is recommended for Zone B.

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13.0 SIGNATORY REQUIREMENT

Condition I.E. of the Hazardous and Solid Waste Amendments (HSWA) portion of RCRA Part B Permit (EPA SCO 170 022 560) states: *All applications, reports, or information submitted to the Regional Administrator shall be signed and certified in accordance with 40 CFR §270.11. The certification reads as follows:*

I certify under penalty of law that this document and all attachments were prepared under by direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



Caretaker Site Officer

11/22/96
Date

Final Zone B RFI Report — NAVBASE Charleston
Section 13 — Signatory Requirement
Revision: 0
November 21, 1996

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Appendix A

Lithologic Boring Logs and Well Construction Diagrams

EnSafe/Allen & Hoshall

Monitoring Well NBCBGDB001

Project: ZONE B - Naval Base Charleston

Coordinates: 2315793.584 E, 379198.013 N

Location: Charleston, SC

Surface Elevation: 3.68 feet msl

Started at 1000 on 10-10-95

TOC Elevation: 6.31 feet msl

Completed at 1135 on 10-10-95

Depth to Groundwater: 3.60 feet TOC Measured: 1-22-96

Drilling Method: 4.25" ID (7.5" OD) HSA with split spoon

Groundwater Elevation: 2.71 feet msl

Drilling Company: GES/Miller Drilling

Total Well Depth: 12.3 feet bgs

Geologist: P. Bayley

Well Screen: 2.3 to 11.8 feet bgs

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
								Surface conditions: grass on golf course.		<p>WELL DIAGRAM</p> <p>2" ID Sch. 40 PVC, 0.01 slot screen</p> <p>PVC Riser</p> <p>end cap</p> <p>#1 sand filter</p> <p>bentonite seal</p> <p>grout</p>
5			1	60	0	OL OH	Clay: dark gray-brown and black, some silty, soft, plastic, wet, H ₂ S odor-- Marsh clay.	3 15		
10			2	55	0	OL OH	Clay: Marsh clay as above with some vegetative matter.	4.3 5.4		
15			3	60	0	OL OH	Clay: Marsh clay as above; at 14.1-14.7' becomes brown with vegetative matter.	9.8 11		

EnSafe/Allen & Hoshall

Monitoring Well NBCBGDB002

Project: ZONE B - Naval Base Charleston

Coordinates: 2316802.447 E, 379015.733 N

Location: Charleston, SC

Surface Elevation: 6.80 feet msl

Started at 0900 on 10-09-95

TOC Elevation: 9.60 feet msl

Completed at 1325 on 10-09-95

Depth to Groundwater: 5.87 feet TOC Measured: 1-22-96

Drilling Method: 4.25" ID (7.5" OD) HSA with split spoon

Groundwater Elevation: 3.73 feet msl

Drilling Company: GES/Miller Drilling

Total Well Depth: 13.1 feet bgs

Geologist: P. Bayley

Well Screen: 3.1 to 12.6 feet bgs

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
								Surface conditions: grass on golf course		
5			1	100		OL OH	Clay: dark gray to black, silty, soft, plastic, wet with H ₂ S odor, with alternating dark gray, very fine to fine sandy bands from 4-4.2' and 4.4-4.8'; from 5-6', silty thin laminae.	2.8		
10			2	60		OL OH	Clay: olive-brown, some silt, plastic, soft, H ₂ S odor, wet.	8		
			3	100			Shelby Tube: (10.0-12.5') Top: clay as above; bottom: gray, very fine to medium sand with shell hash.	12		
15			4	60		OL SP SM	Clay: dark gray to black, silty, some sand and shell hash, soft, plastic, wet. Sand: light brown, very fine to fine, silty, soft, wet, with very silty lense from 14.6-14.7'.	24		
20									72	
25									8.400001	
30										
35										
40										

EnSafe/Allen & Hoshall

Monitoring Well NBCBGDB003

Project: ZONE B - Naval Base Charleston

Coordinates: 2317344.829 E, 378572.945 N

Location: Charleston, SC

Surface Elevation: 4.66 feet msl

Started at 1210 on 10-09-95

TOC Elevation: 8.93 feet msl

Completed at 1325 on 10-09-95

Depth to Groundwater: 6.01 feet TOC Measured: 1-22-96

Drilling Method: 4.25" ID (7.5" OD) HSA with split spoon

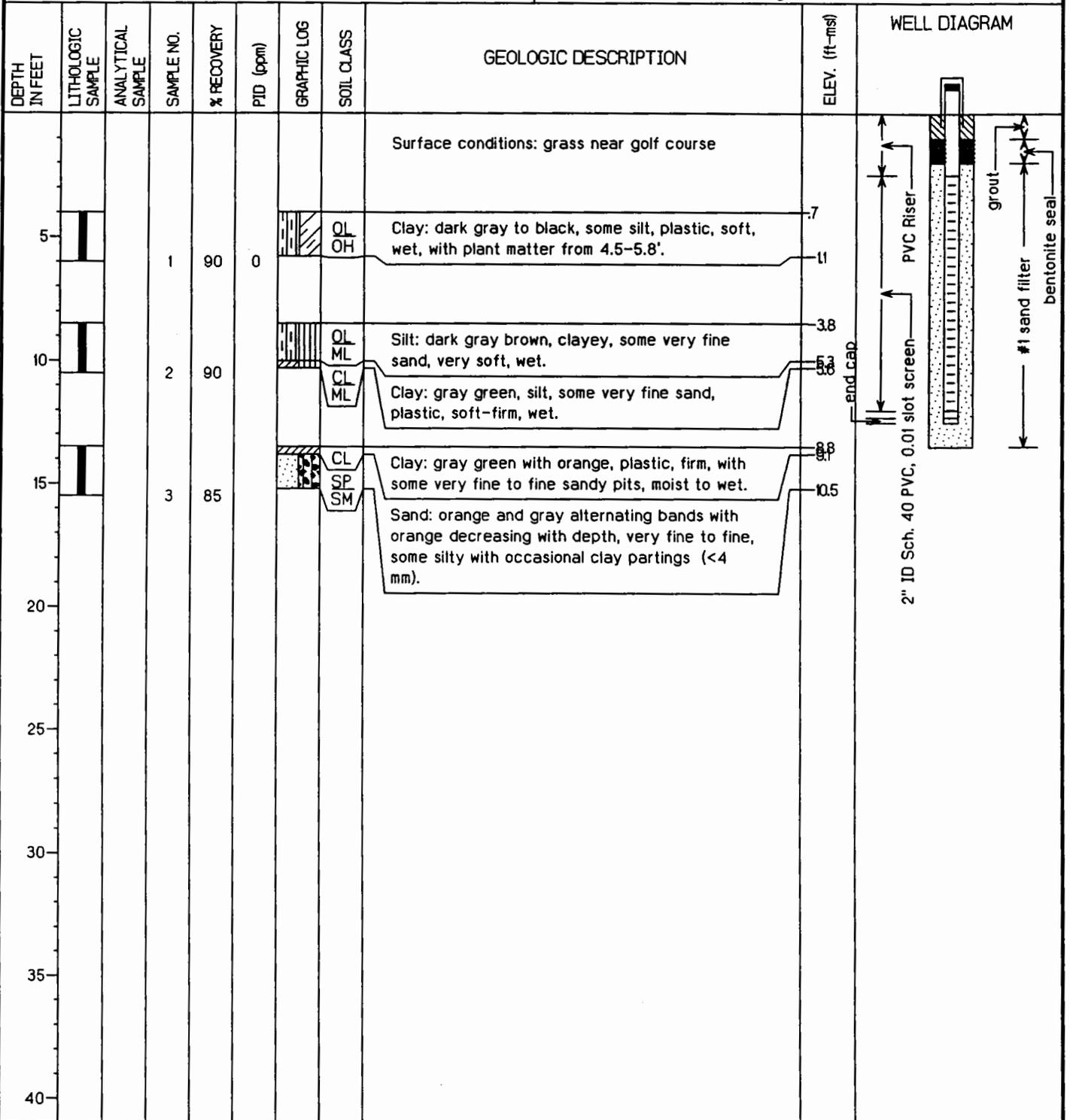
Groundwater Elevation: 2.92 feet msl

Drilling Company: GES/Miller Drilling

Total Well Depth: 12.5 feet bgs

Geologist: P. Bayley

Well Screen: 2.5 to 12.0 feet bgs



EnSafe/Allen & Hoshall

Monitoring Well NBCBGDB004

Project: ZONE B - Naval Base Charleston

Coordinates: 2316606.156 E, 377803.183 N

Location: Charleston, SC

Surface Elevation: 24.47 feet msl

Started at 1545 on 10-09-95

TOC Elevation: 26.86 feet msl

Completed at 1850 on 10-09-95

Depth to Groundwater: 23.98 feet TOC Measured: 1-22-96

Drilling Method: 4.25" ID (7.5" OD) HSA with split spoon

Groundwater Elevation: 2.88 feet msl

Drilling Company: GES/Miller Drilling

Total Well Depth: 27.0 feet bgs

Geologist: P. Bayley

Well Screen: 17.0 to 26.5 feet bgs

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
								Surface conditions: grass lawn		
5			1	75	0	SP	Sand: orange-brown, very fine to fine, subhedral-subrounded, equigranular quartz, clear-translucent, soft, loose, damp to moist.	20.5 19		
10			2	80	0	SP	Sand: light brown, very fine to fine, as above; root at 9.3'.	16.5 14.9		
15			3	80	0	SP	Sand: dark brown, very fine to fine, as above with some root and leaf fragments; becomes light brown with brown mottling at 14.1'.	11 9.400001		
20			4	80		CL SC SP SW	Sand: orange-red, very fine to fine, silty, clayey, soft, moist to wet.	8.7 4.4		
25			5	100			Sand: orange-brown, very fine to fine/medium, some silt, trace clay, soft, moist to wet; silty clay lenses at 19-19.1' and 19.5-19.7'.			
25-23'	Shelby Tube 20.5-23'-- top: orange-brown, very fine to fine/medium, silty, clayey sand; bottom: brown, very fine to fine/medium, silty, firm sand.									

EnSafe/Allen & Hoshall

Monitoring Well NBCBGDB01D

Project: ZONE E - Naval Base Charleston

Coordinates: 2315813.161 E, 379191498 N

Location: Charleston, SC

Surface Elevation: 3.79 feet msl

Started at 1550 on 11-16-95

TOC Elevation: 6.47 feet msl

Completed at 0915 on 11-17-95

Depth to Groundwater: 4.23 feet TOC Measured: 1-22-96

Drilling Method: Rotasonic (6.5" OD casing, 3.8" ID coring bit)

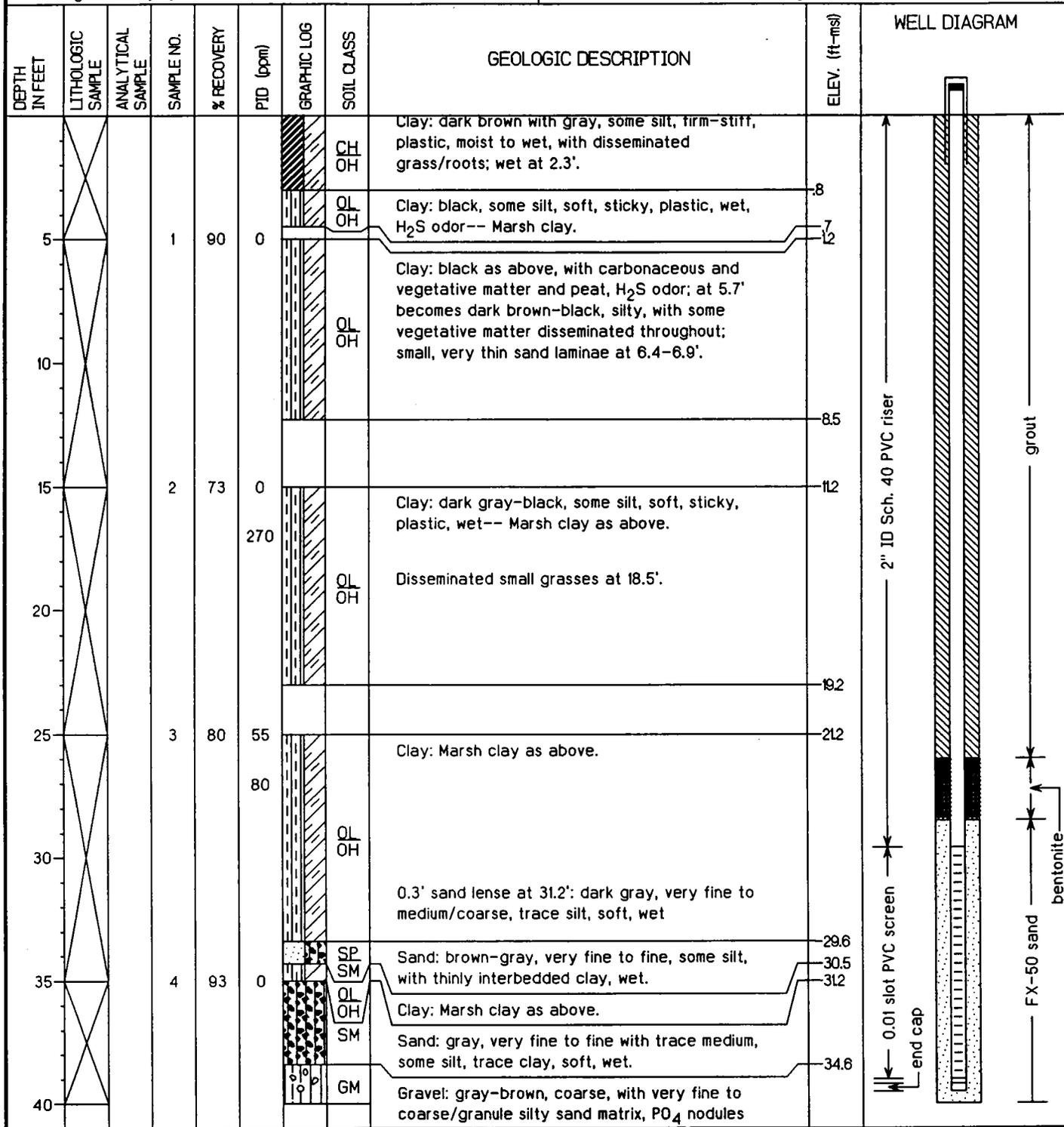
Groundwater Elevation: 224 feet msl

Drilling Company: Alliance Environmental

Total Well Depth: 39.5 feet bgs

Geologist: P. Bayley

Well Screen: 29.6 to 39.0 feet bgs



EnSafe/Allen & Hoshall

Monitoring Well NBCBGDB01D

Project: ZONE E - Naval Base Charleston

Coordinates: 2315813.161 E, 379191.498 N

Location: Charleston, SC

Surface Elevation: 3.79 feet msl

Started at 1550 on 11-16-95

TOC Elevation: 6.47 feet msl

Completed at 0915 on 11-17-95

Depth to Groundwater: 4.23 feet TOC Measured: 1-22-96

Drilling Method: Rotasonic (6.5" OD casing, 3.8" ID coring bit)

Groundwater Elevation: 2.24 feet msl

Drilling Company: Alliance Environmental

Total Well Depth: 39.5 feet bgs

Geologist: P. Bayley

Well Screen: 29.6 to 39.0 feet bgs

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM	
45	X		5	90	0	GM CF	Clay: yellow-olive, silty, stiff, plastic, wet-- Ashley Formation.	38.4	▼	▼	
45								412	▼	▼	
50											
55											
60											
65											
70											
75											
80											

EnSafe/Allen & Hoshall

Monitoring Well NBCBGDB04D

Project: ZONE E - Naval Base Charleston

Coordinates: 2316634.587 E, 377809.480 N

Location: Charleston, SC

Surface Elevation: 23.21 feet msl

Started at 1515 on 11-18-95

TOC Elevation: 25.66 feet msl

Completed at 1415 on 11-19-95

Depth to Groundwater: 22.98 feet TOC Measured: 1-22-96

Drilling Method: Rotasonic (6.5" OD casing, 3.8" ID coring bit)

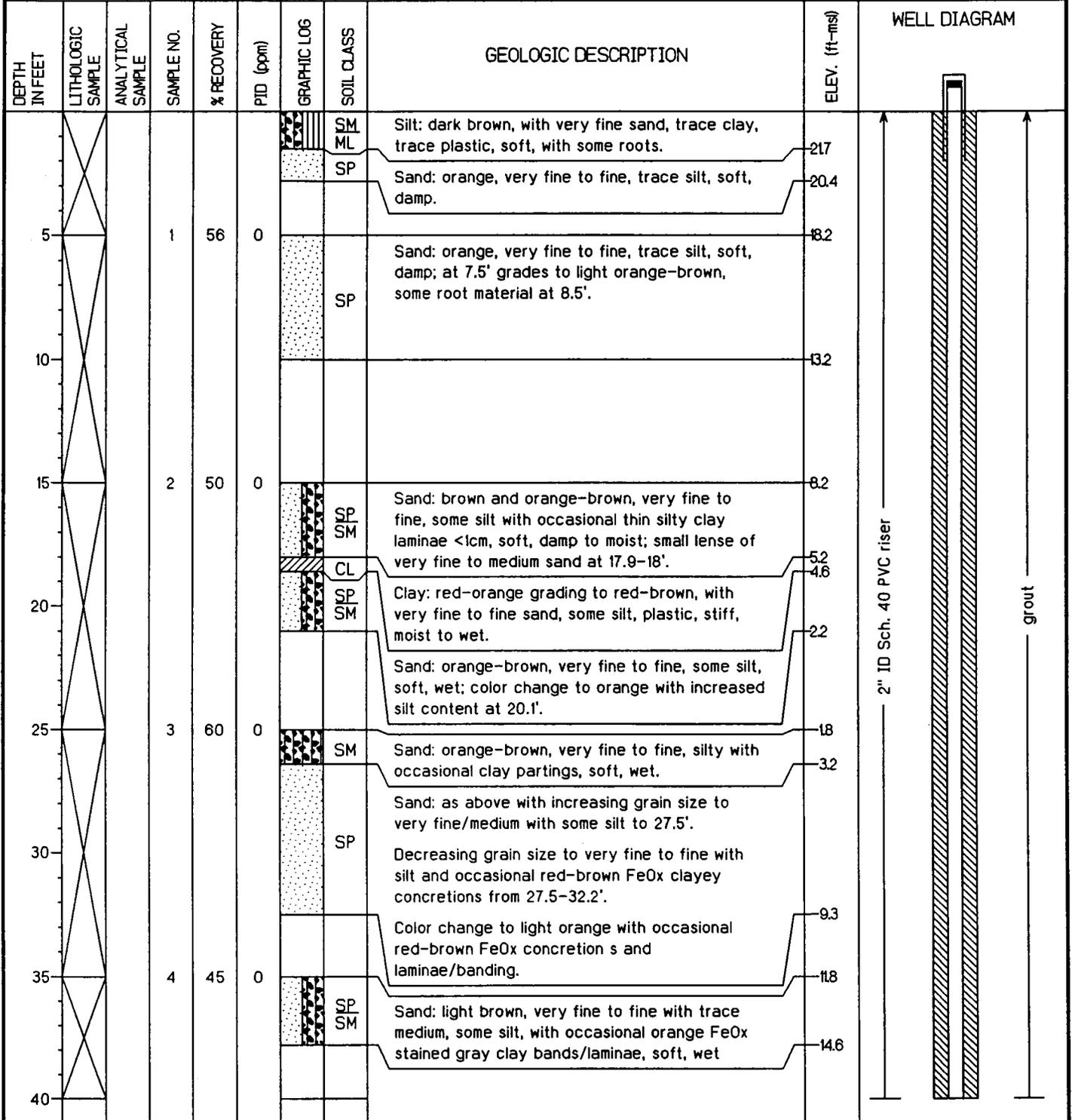
Groundwater Elevation: 2.68 feet msl

Drilling Company: Alliance Environmental

Total Well Depth: 76.3 feet bgs

Geologist: P. Bayley

Well Screen: 65.9 to 75.3 feet bgs



EnSafe/Allen & Hoshall

Monitoring Well NBCBGDB04D

Project: ZONE E - Naval Base Charleston

Coordinates: 2316634.587 E, 377809.480 N

Location: Charleston, SC

Surface Elevation: 23.21 feet msl

Started at 1515 on 11-18-95

TOC Elevation: 25.66 feet msl

Completed at 1415 on 11-19-95

Depth to Groundwater: 22.98 feet TOC Measured: 1-22-96

Drilling Method: Rotasonic (6.5" OD casing, 3.8" ID coring bit)

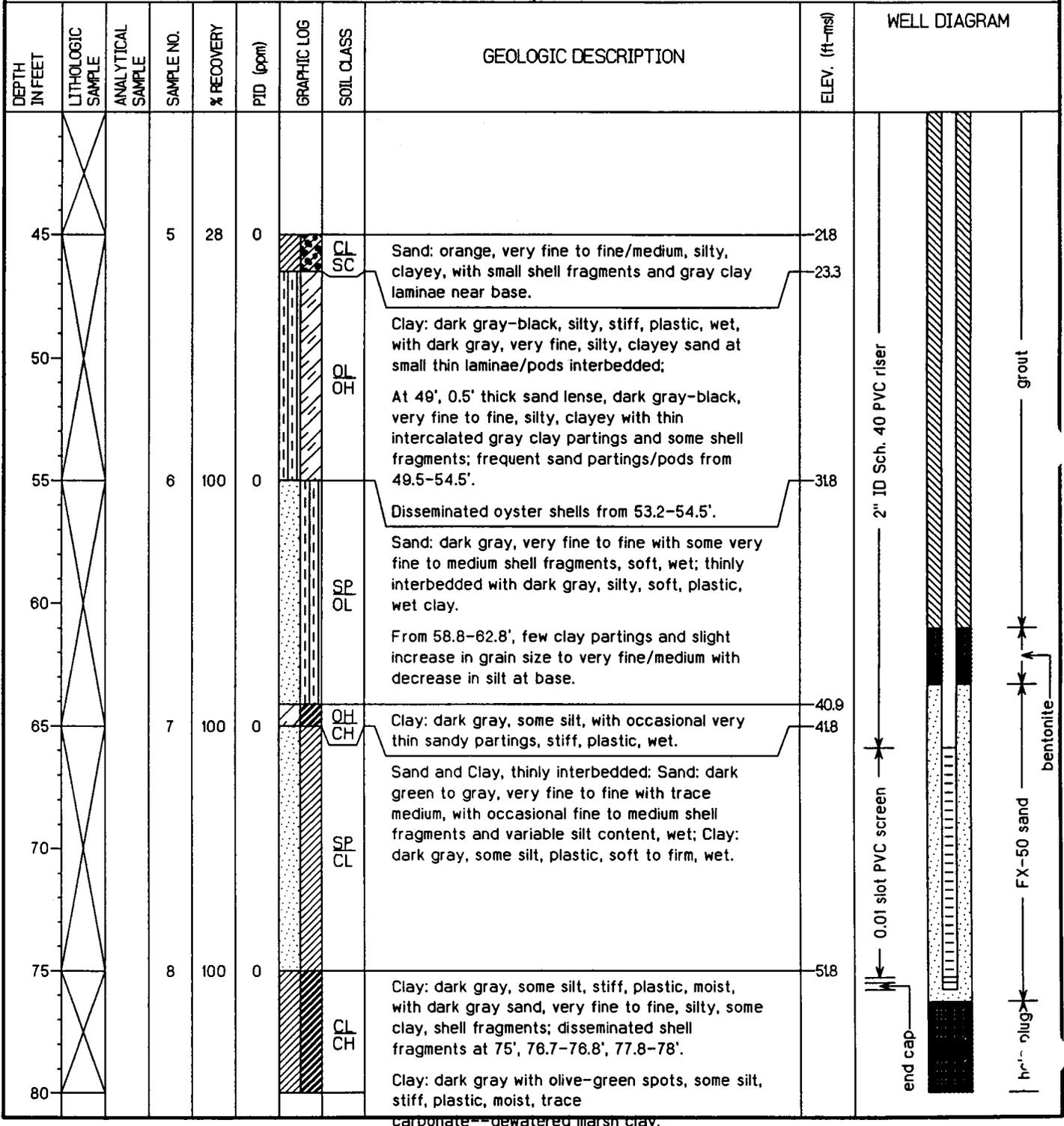
Groundwater Elevation: 2.68 feet msl

Drilling Company: Alliance Environmental

Total Well Depth: 76.3 feet bgs

Geologist: P. Bayley

Well Screen: 65.9 to 75.3 feet bgs



EnSafe/Allen & Hoshall

Monitoring Well NBCBGDB04D

Project: ZONE E - Naval Base Charleston

Coordinates: 2316634.587 E, 377809.480 N

Location: Charleston, SC

Surface Elevation: 23.21 feet msl

Started at 1515 on 11-18-95

TOC Elevation: 25.66 feet msl

Completed at 1415 on 11-19-95

Depth to Groundwater: 22.98 feet TOC Measured: 1-22-96

Drilling Method: Rotasonic (6.5" OD casing, 3.8" ID coring bit)

Groundwater Elevation: 2.68 feet msl

Drilling Company: Alliance Environmental

Total Well Depth: 76.3 feet bgs

Geologist: P. Bayley

Well Screen: 65.9 to 75.3 feet bgs

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
85			9	100	0		CL CH	Clay: olive-green, some silt, very stiff, plastic, moist with trace shell fragments, trace carbonate. At 88', dark gray-blue sand parting, very fine to fine.		
90										
95			10	100	0			Clay: as above.		
100										
105			11	100	0				81.8	
110										
115										
120										

EnSafe/Allen & Hoshall

Boring NBCBGDB02D

Project: ZONE E - Naval Base Charleston

Coordinates: 2316809.82 E, 379003.83 N

Location: Charleston, SC

Geologist: P. Bayley

Started at 0800 on 11-18-95

Surface Elevation: 7.75 feet msl

Completed at 1115 on 11-18-95

Depth to Groundwater: feet TOC Measured:

Drilling Method: Rotasonic (6.5" OD casing, 3.8" ID coring bit)

Groundwater Elevation: feet msl

Drilling Company: Alliance Environmental

Total Depth: feet bgs

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PTD (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
0							ML	Silt: brown, clayey, with some very fine sand, plastic, soft, moist.	6.1
0							CL	Clay: brown, some silt, plastic, firm to stiff, moist.	5.2
5			1	50	0		SC	Sand: brown to red-brown, very fine to fine with trace medium, silty, clayey, soft, wet.	2.7
5							SM		15
10							OL	Clay: dark gray to black, silty, soft, plastic, wet, some grass; with fine to medium gray sand lenses from 10-10.4', 11-11.5'.	
10							OH		
15			2	100	10		SP	Sand: orange to yellow, very fine to fine, trace to some silt, soft, wet; with 1 cm brown clay laminae.	3.7
15							SW		
20							CL	Sand: orange-brown, very fine to fine, clayey and silty, firm, plastic, wet.	8.6
20							SC		9.5
20							CH	Clay: orange, gray, and brown, silty, stiff, plastic, wet, with orange brown clay and shell hash mixture from 17.4-18'.	10.7
20							ML	Silt: gray-green, clayey, trace to some sand, plastic, soft, with shell hash, wet.	11.9
25			3	100	0		CL	Clay: olive-green, very silty, some very fine sand, stiff, plastic, with trace calcareous minerals, wet.	
25							ML		
25								No well installed due to shallow depth of Ashley Formation.	17.2
30									
35									
40									

EnSafe/Allen & Hoshall

Boring NBCBGDB03D

Project: ZONE E - Naval Base Charleston

Coordinates: 2317329.02 E, 378574.65 N

Location: Charleston, SC

Geologist: P. Bayley

Started at 1300 on 11-18-95

Surface Elevation: 4.36 feet msl

Completed at 1350 on 11-18-95

Depth to Groundwater: feet TOC Measured:

Drilling Method: Rotasonic (6.5" OD casing, 3.8" ID coring bit)

Groundwater Elevation: feet msl

Drilling Company: Alliance Environmental

Total Depth: feet bgs

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
0							ML	Silt: brown, some very fine sand, trace to some clay, soft, low plasticity, wet.	3
0							CL CH	Clay: brown with some orange-brown and black, some silt with occasional sandy pits, medium plasticity, firm to stiff.	1.9
5			1	50	0		OL OH	Clay: dark gray to black, some silt, soft, plastic, wet, H ₂ S odor with grass; pod of grass from 7-7.3'; color change to dark gray brown with more organic matter 7-8.6'; sand pod from 8.6-8.9'.	6
10							CL CH	Clay: dark gray with yellow-orange, some silt, plastic, stiff, with occasional sandy pits/pods and FeOx nodules < 1 cm, wet.	5.6 7.6
15			2	70	0		SC SM	Sand: light gray to yellow brown, very fine to fine, silty, clayey, with granule to small pebbles and shell fragments, trace plastic, soft, wet.	10.6 11.4
20			3	100	0		ML	Silt: olive-brown, some clay, some very fine sand, with shell hash throughout, and occasional PO ₄ nodules and shells, slightly plastic, wet; at 19.5-20', increased shell hash.	5.9
20							SM SC	Sand: olive-brown to gray, very fine to fine, silty, clayey, with shell fragments and PO ₄ granules and nodules, wet.	16.1
25			4	100	0		ML CL	Silt: olive-brown, clayey, some very fine sand, firm, stiff, plastic, trace carbonate minerals, wet, with occasional 2-3 cm sandy pods at 1' intervals.	20.6
25								No well installed due to shallow depth of Ashley Formation.	

Appendix B

Geotechnical/Physical Parameter Data Reports

Table II - Summary Data for Zone B

Sample Number	CETCO Sample #	Permeability (k)	Specific Gravity (Gs)	Unit Weight (lbs/cu. ft)	Percent Moisture	Void Ratio (e)	Porosity (n)
NBCB GDB002	5	0.00227	2.67	140	66.4	0.98	0.4948
NBCB GDB004	6	0.000158	2.63	127.5	24.1	0.6	0.3747

Sample NBCB GDB002

Sample Date 10/09/95

Page 1 of 3

Sample Depth 10'-12.5'

Sample Test Data

Permeability Test Data

k = coefficient of permeability (cm/s)

a = cross sectional area of burette (sq cm)

L = length of specimen (cm)

A = cross sectional area of specimen

h1 = head at beginning of test (cm)

h2 = head at end of test (cm)

t = time from h1 to h2 (s)

a = 1.67 sq cm
L = 10.32 cm
A = 39.16 sq cm
h1 = 97.5 cm
h2 = 52.5 cm
t = 120 sec

k = 2.27E-03 cm/s

Specific Gravity Test Data

Wp = 167.6 g
Wpw = 663.5 g
Ti = 23 Degrees C
Wpws = 687.9 g
Tx = 24 Degrees C
Ws = 39.2 g

K = 0.9991
Wtr @Tx = 0.9973286
Wtr @Ti = 0.9975702

Wpw(@Tx) = 663.3799

Gs = 2.6679149

Test Data For Sample NBCB GDB002 Cont...

Unit Weight (Bulk Density) Test Data

A = 39.16 sq cm
L = 10.32 cm
Volume = 404.1312 cu cm

Wt Soil & Tube = 1175.4 g
Wt Tube = 268.8 g
Wt Soil = 906.6 g

Unit Weight = 139.98385 lbs/cu ft

Percent Moisture (Moisture Content) Test Data

W_{sw} = 500 g
W_s = 300.4 g
W_w = 199.6 g

%M = 66.44474

Sieve Analysis Test Data

Sieve	Wt Ret (grams)	Wt Pass (grams)	% Pass
3"	0	90.00	100.0000
1 1/2"	0	90.00	100.0000
3/4"	0	90.00	100.0000
3/8"	0	90.00	100.0000
#4	0	90.00	100.0000
#8	0	90.00	100.0000
#16	1.3	88.70	98.5556
#30	3.8	84.90	94.3333
#40	3	81.90	91.0000
#50	7.4	74.50	82.7778
#100	47.8	26.70	29.6667
#200	16	10.70	11.8889
Pan	10.7	0	0

total 90 g

Hydrometer Test Data

W(grams)= 90

Time (minutes)	Actual Reading	Correct Factor	Corrected Reading	Temp Cecius	L	K	D	P
0		0	0	21		0.1348	ERR	-1777.279
2	1.013	0	1.013	21	12.9	0.1348	0.43473	23.104625
5	1.012	0	1.012	21	13.1	0.1348	0.176588	21.327346
15	1.011	0	1.011	21	13.4	0.1348	0.0602107	19.550068
30	1.0105	0	1.0105	22	13.5	0.1332	0.02997	18.661428
60	1.01	0	1.01	22	13.7	0.1332	0.015207	17.772789

L - Effective Depth Of Hydrometer (cm)

K - Value taken From Table

D - Diameter of Soil Particle (mm)

P - Soil in Suspension (%)

(i.e., % of Soil Finer)

Void Ratio Test Data

Wet Unit Weight = 139.98385 lbs/cu ft

Percent Moisture = 66.44474 %

Dry Unit Weight = 84.102295 lbs/cu ft

Gs = 2.6679149

Volume Solids = 0.505186

Volume Voids = 0.494814

Void Ratio = 0.979469

Porosity Test Data

Porosity= 0.494814

Test Data For Sample NBCB GDB004

Sample Date 10/09/95

Page 1 of 3

Sample Depth 20.5'-23'

Sample Test Data

Permeability Test Data

k = coefficient of permeability (cm/s)

a = cross sectional area of burette (sq cm)

L = length of specimen (cm)

A = cross sectional area of specimen

h1 = head at beginning of test (cm)

h2 = head at end of test (cm)

t = time from h1 to h2 (s)

a = 1.67 sq cm
L = 10.32 cm
A = 39.16 sq cm
h1 = 97.5 cm
h2 = 49 cm
t = 1920 s

k = 1.58E-04 cm/s

Specific Gravity Test Data

Wp = 158.1 g
Wpw = 656 g
Ti = 23 Degrees C
Wpws = 679.4 g
Tx = 23 Degrees C
Ws = 37.7 g

K = 0.9993
Wtr @Tx = 0.9975702
Wtr @Ti = 0.9975702

Wpw(@Tx = 656

Gs= 2.6345182

Test Data For Sample NBCB GDB004 Cont..

Unit Weight (Bulk Density) Test Data

A = 39.16 sq cm
L = 10.32 cm
Volume = 404.1312 cu cm

Wt Soil & Tube = 1050 g
Wt Tube = 224 g
Wt Soil = 826 g

Unit Weight = 127.53878 lbs/cu ft

Percent Moisture (Moisture Content) Test Data

Wsw = 500 g
Ws = 403 g
Ww = 97 g

%M = 24.069479

Sieve Analysis Test Data

Sieve	Wt Ret (grams)	Wt Pass (grams)	% Pass
3"	0.00	90.00	100.0000
1 1/2"	0.00	90.00	100.0000
3/4"	0.00	90.00	100.0000
3/8"	0.00	90.00	100.0000
#4	0.00	90.00	100.0000
#8	0.00	90.00	100.0000
#16	1.90	88.10	97.8889
#30	10.10	78.00	86.6667
#40	5.50	72.50	80.5556
#50	8.00	64.50	71.6667
#100	46.10	18.40	20.4444
#200	10.60	7.80	8.6667
Pan	7.80	0.00	0.0000

total 90 g

Hydrometer Test Data

W(grams)= 90

Time (minutes)	Actual Reading	Correct Factor	Corrected Reading	Temp Celcius	L	K	D	P
0		0	0	19		0.1382	ERR	-1790.89
2	1.006	0	1.006	19	14.7	0.1382	0.507885	10.745341
5	1.0055	0	1.0055	20	14.8	0.1365	0.20202	9.8498955
15	1.0052	0	1.0052	20	14.95	0.1365	0.0680225	9.3126285
30	1.005	0	1.005	21	15	0.1348	0.0337	8.9544505
60	1.005	0	1.005	21	15	0.1348	0.01685	8.9544505

L - Effective Depth Of Hydrometer (cm)

K - Value taken From Table

D - Diameter of Soil Particle (mm)

P - Soil in Suspension (%)

(i.e., % of Soil Finer)

Void Ratio Test Data

Wet Unit Weight = 127.53878 lbs/cu ft

Percent Moisture = 24.069479 %

Dry Unit Weight = 102.79626 lbs/cu ft

Gs = 2.6345182 g/cc

Volume Solids = 0.6253044 cu cm

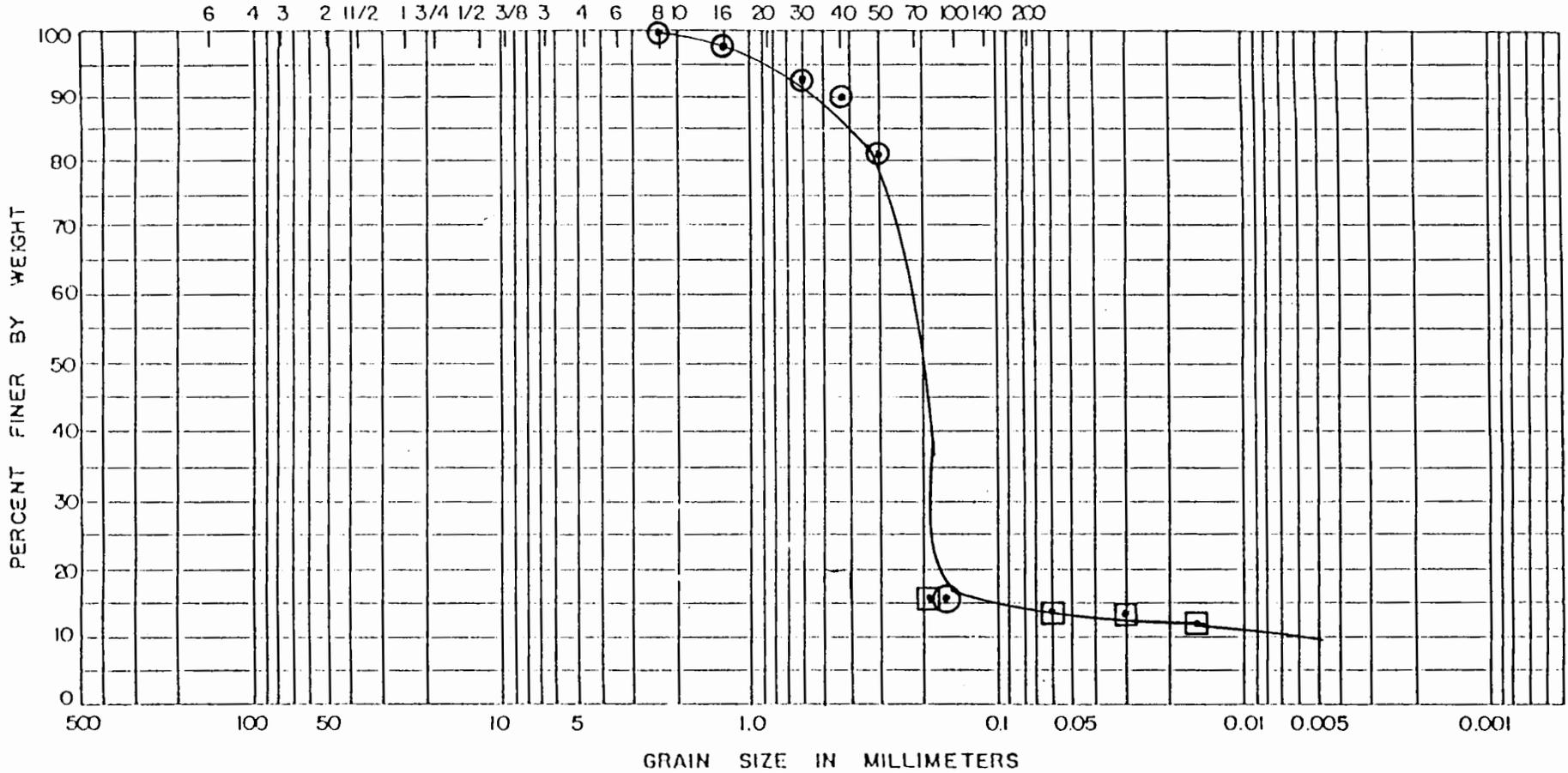
Volume Voids = 0.3746956 cu cm

Void Ratio = 0.599221

Porosity Test Data

Porosity= 0.3746956

U.S. STANDARD SIEVE SIZES

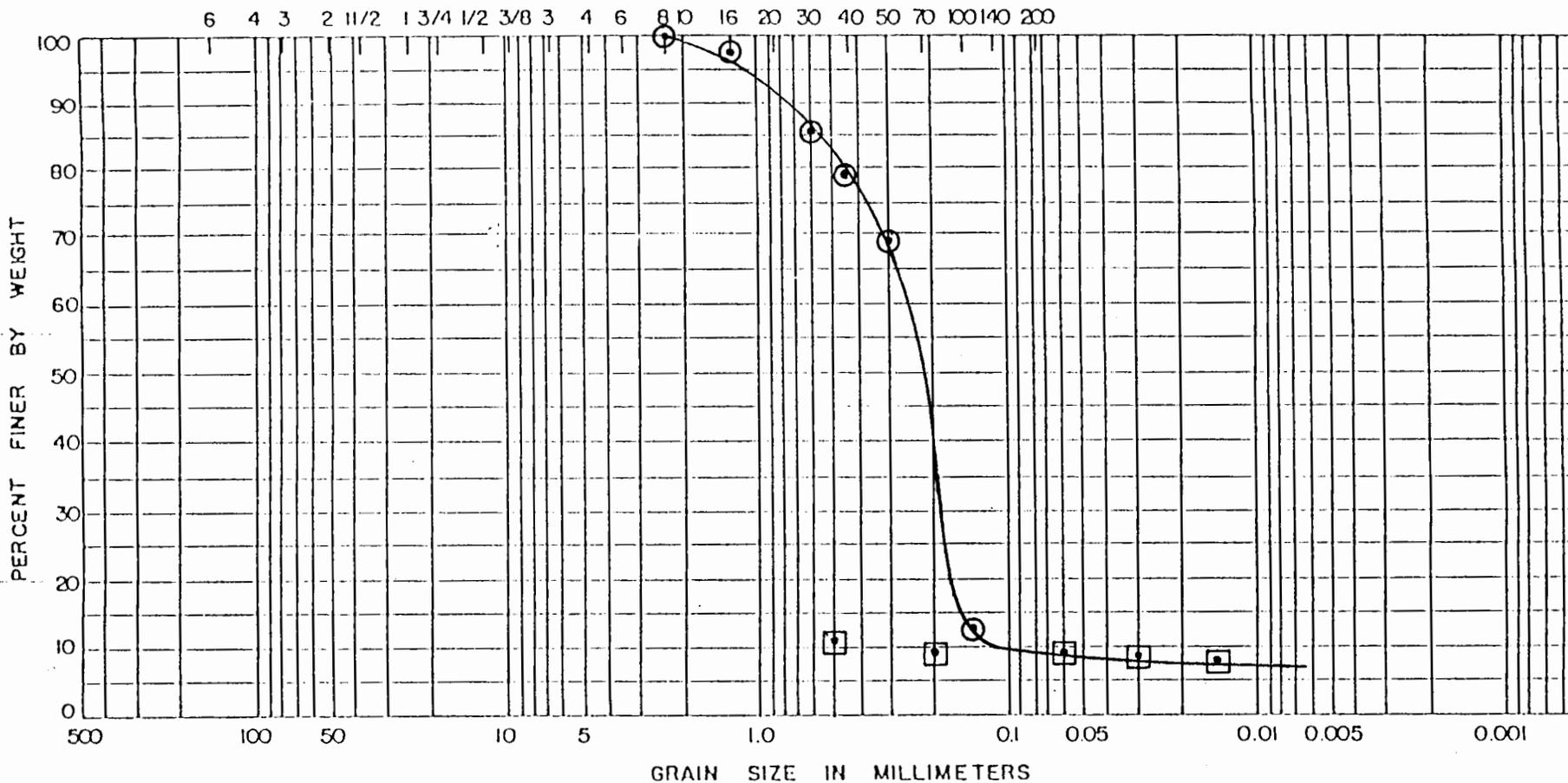


BOULDERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES

FORING NO. NBCB	ELEV. OR DEPTH 90002 10'-12.5'	NAT WC	LL	PL	PI	CLASSIFICATION	GRAIN SIZE DISTRIBUTION
							JOB NO. 95-03-123
							CHARLESTON NAVY BASE



U.S. STANDARD SIEVE SIZES



BOUL. DERS	COBBLES	GRAVEL		SAND			FINES	
		COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZES	CLAY SIZES

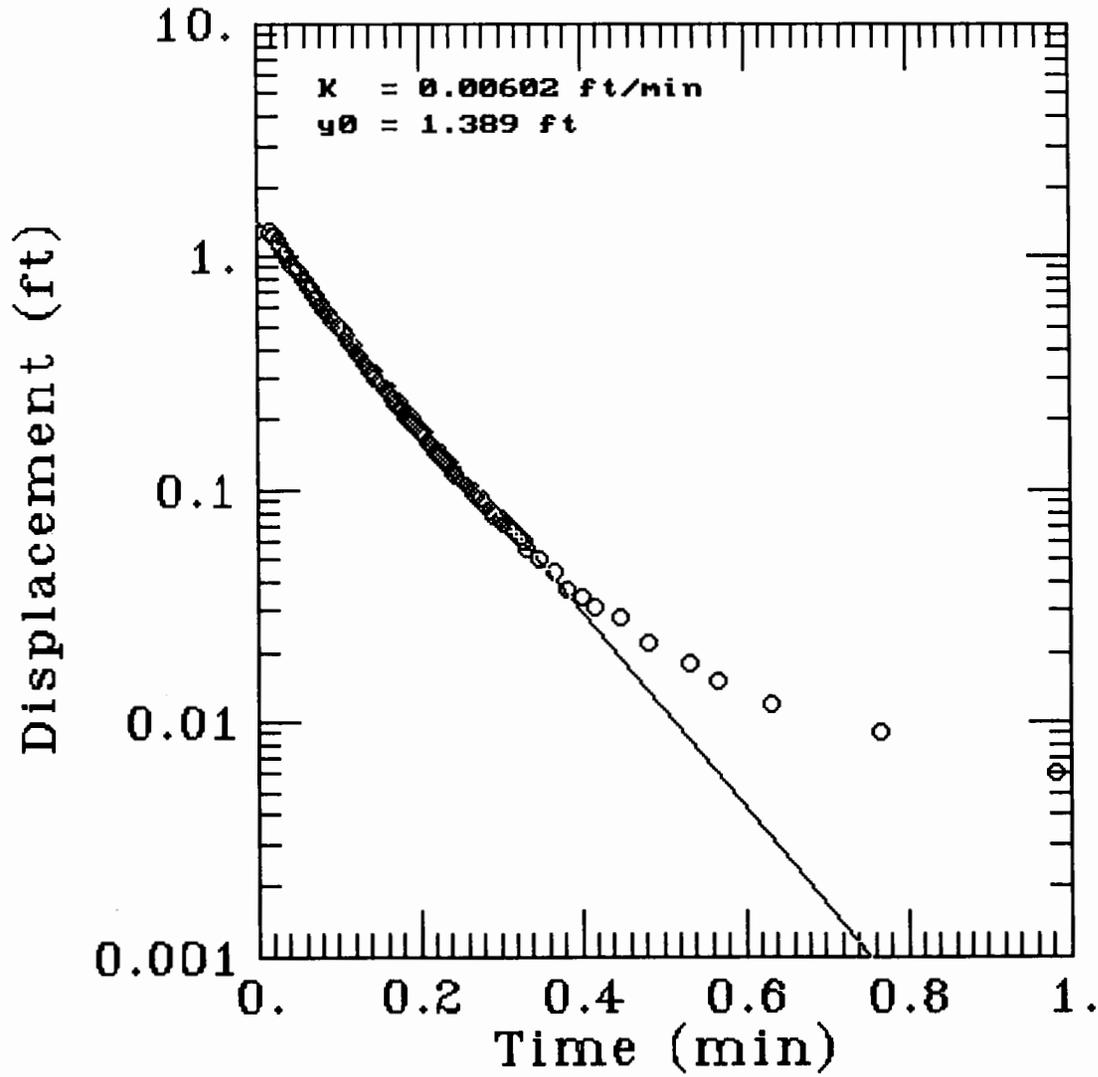
BORING NO.	ELEV. OR DEPTH	NAT WC	LL	PL	PI	CLASSIFICATION	GRAIN SIZE DISTRIBUTION
NBCB GDB004	10'-12.5'						JOB NO. <u>95-03-123</u> CHARLESTON NAVY BASE



Appendix C

Aquifer Characteristic Data

GDB004-1



AQTESOLV



GERAGHTY
& MILLER, INC.

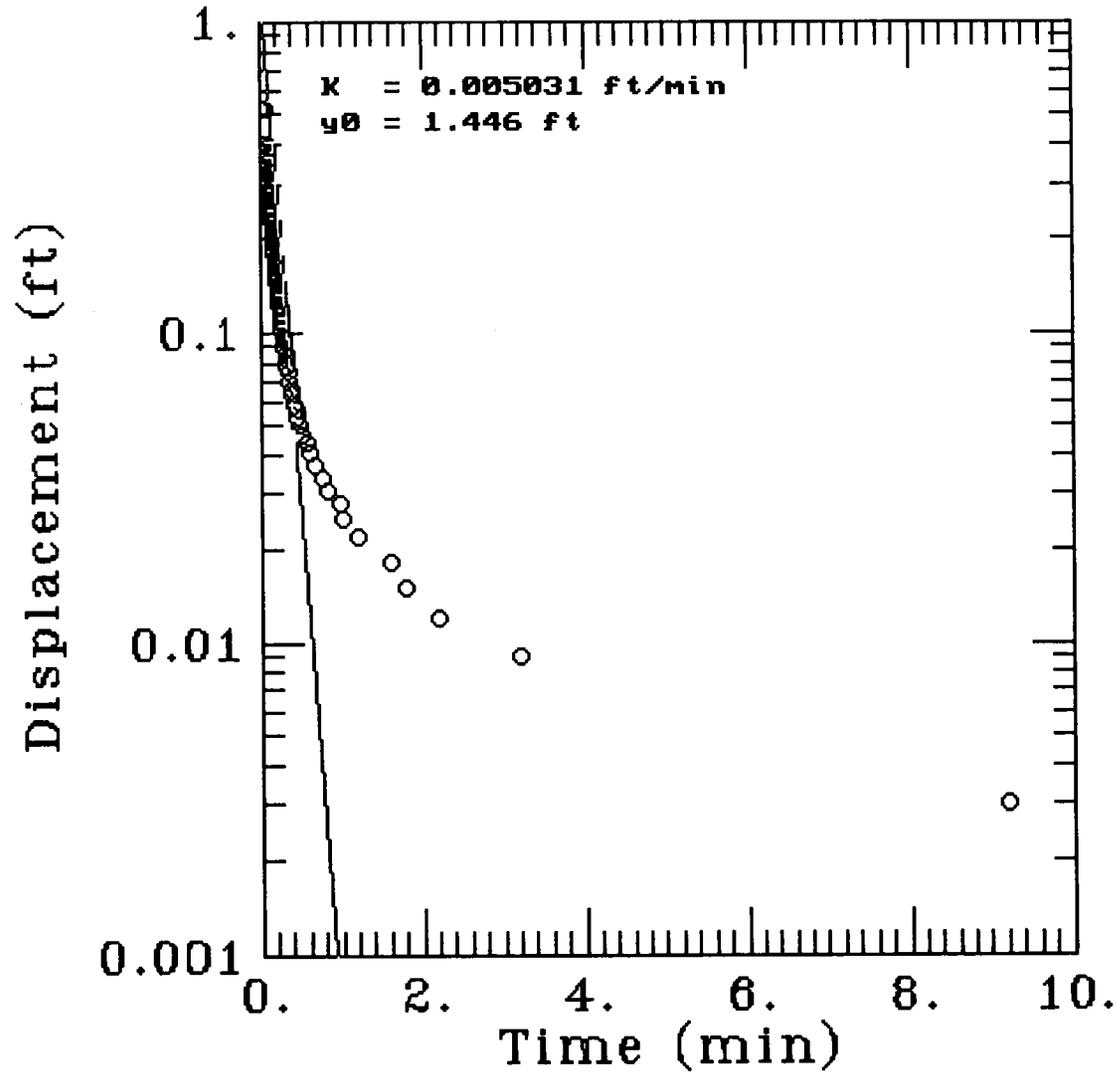


Modeling Group

0.0966	0.517	1
0.1	0.498	1
0.1033	0.479	1
0.1066	0.467	1
1	0.451	1
0.1133	0.429	1
0.1166	0.416	1
0.12	0.401	1
0.1233	0.388	1
0.1266	0.375	1
0.13	0.363	1
0.1333	0.347	1
0.1366	0.337	1
0.14	0.325	1
0.1433	0.315	1
0.1466	0.303	1
0.15	0.293	1
0.1533	0.284	1
0.1566	0.274	1
0.16	0.262	1
0.1633	0.255	1
0.1666	0.246	1
0.17	0.236	1
0.1733	0.23	1
0.1766	0.224	1
0.18	0.214	1
0.1833	0.208	1
0.1866	0.202	1
0.19	0.195	1
0.1933	0.192	1
0.1966	0.186	1
0.2	0.176	1
0.2033	0.173	1
0.2066	0.167	1
0.21	0.161	1
0.2133	0.157	1
0.2166	0.154	1
0.22	0.145	1
0.2233	0.142	1
0.2266	0.138	1
0.23	0.135	1
0.2333	0.132	1
0.2366	0.126	1
0.24	0.123	1
0.2433	0.119	1
0.2466	0.116	1
0.25	0.113	1
0.2533	0.11	1
0.26	0.104	1
0.2633	0.101	1
0.2666	0.097	1
0.27	0.094	1
0.2766	0.091	1
0.28	0.088	1
0.2833	0.085	1
0.289	0.082	1
0.2933	0.078	1
0.3	0.075	1
0.3033	0.072	1
0.31	0.069	1

0.3166	0.066	1
0.3233	0.063	1
0.33	0.06	1
0.3333	0.056	1
0.35	0.05	1
0.3666	0.044	1
0.3833	0.037	1
0.4	0.034	1
0.4166	0.031	1
0.45	0.028	1
0.4833	0.022	1
0.5333	0.018	1
0.5666	0.015	1
0.6333	0.012	1
0.7666	0.009	1
0.9833	0.006	1

GDB004-0



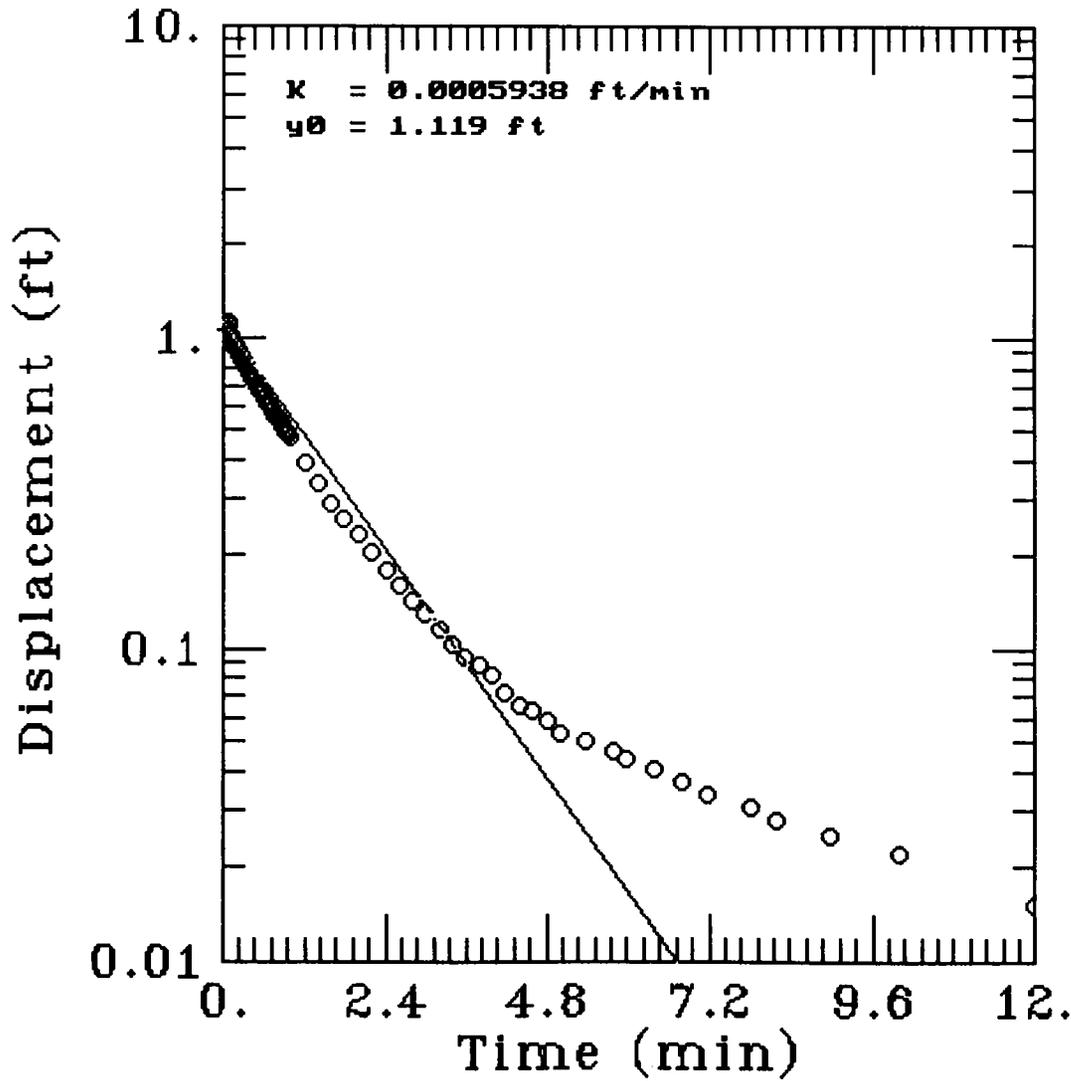
AQTESOLV



Modeling Group

0.17	0.202	1
0.1733	0.195	1
0.1766	0.192	1
0.18	0.186	1
0.1833	0.183	1
0.1866	0.18	1
0.19	0.173	1
0.1933	0.17	1
0.1966	0.167	1
0.2	0.164	1
0.2033	0.157	1
0.2066	0.154	1
0.21	0.151	1
0.2133	0.148	1
0.2166	0.145	1
0.22	0.142	1
0.2233	0.138	1
0.2266	0.135	1
0.2333	0.132	1
0.2366	0.129	1
0.24	0.126	1
0.2433	0.123	1
0.25	0.119	1
0.2533	0.116	1
0.26	0.113	1
0.2633	0.11	1
0.27	0.107	1
0.2733	0.104	1
0.28	0.101	1
0.2833	0.097	1
0.2966	0.094	1
0.3033	0.091	1
0.31	0.088	1
0.3166	0.085	1
0.33	0.082	1
0.3333	0.078	1
0.35	0.075	1
0.3666	0.069	1
0.3833	0.066	1
0.4	0.063	1
0.4166	0.059	1
0.45	0.056	1
0.4666	0.053	1
0.4833	0.05	1
0.5166	0.047	1
0.5666	0.044	1
0.6166	0.041	1
0.6666	0.037	1
0.75	0.034	1
0.8333	0.031	1
0.9833	0.028	1
1	0.025	1
1.2	0.022	1
1.6	0.018	1
1.8	0.015	1
	0.012	1
3.2	0.009	1
9.2	0.003	1

gdb002-0



AQTESOLV



Modeling Group

```

A Q T E S O L V
Version 1.10
Geraghty & Miller Modeling Group
Data Set Title
gdb002-0
Initial drawdown in well... 1.101
Radius of well casing..... 0.083
Radius of well..... 0.3125
Saturated thickness..... 7.73
Screen length..... 10
Height of water in well.... 7.73
Number of data points..... 131
Last time on file..... 12
Last drawdown on file..... 0.015
Press any key to continue

```

DATA ENTRY

AQTESOLV F1=HELP Fri Feb 2, 1996 8:46 AM

```

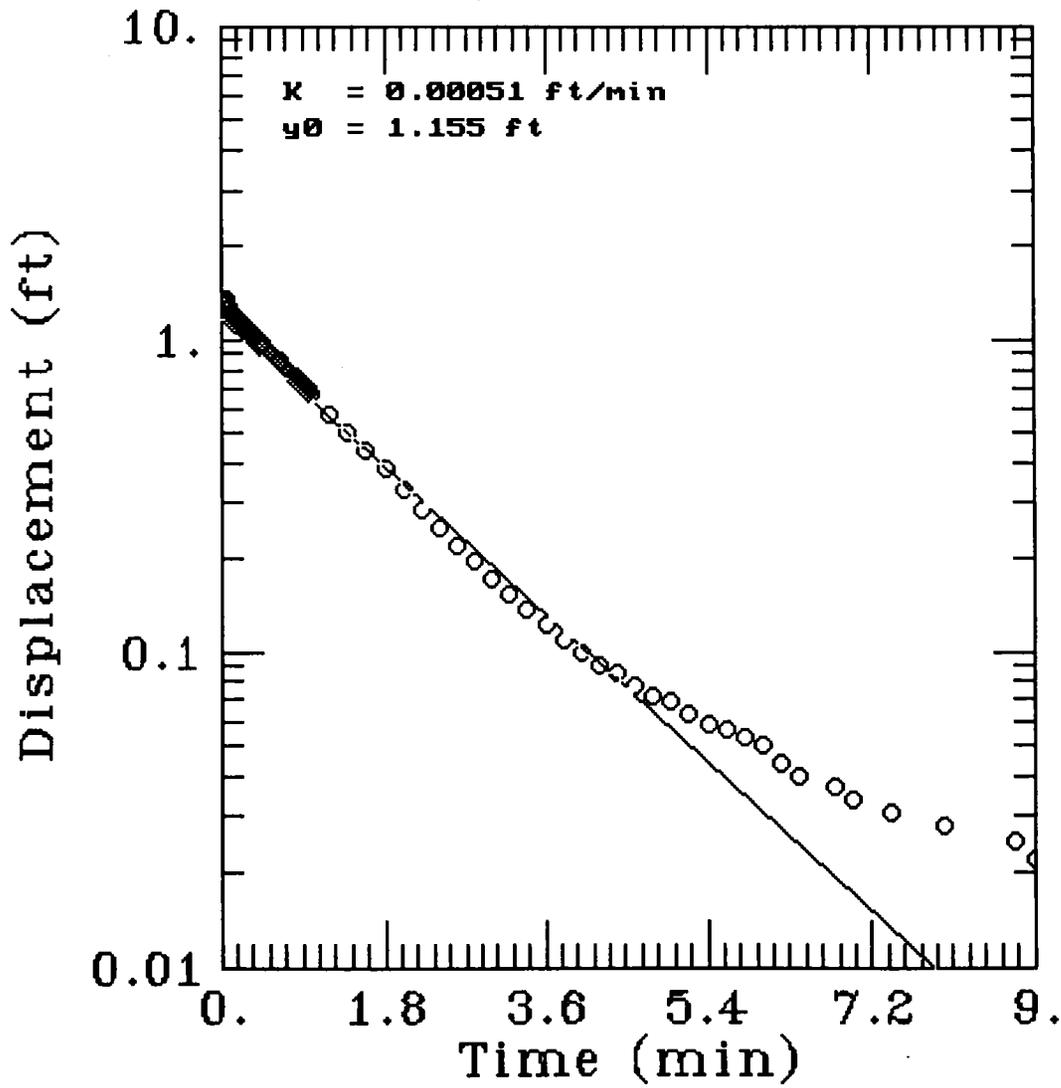
gdb002-0
slugt1
1.101
.083
125
slugt2
7.73
10
7.73
tsdata
0.08 1.116 1
0.0833 1.094 1
0.1 1.047 1
0.1033 1.043 1
0.1066 1.025 1
0.12 1.009 1
0.1233 1.006 1
0.1266 1.002 1
0.13 0.993 1
0.1333 0.99 1
0.1366 0.987 1
0.14 0.984 1
0.1433 0.98 1
0.1466 0.977 1
0.15 0.971 1
0.1533 0.968 1
0.1566 0.965 1
0.16 0.961 1
0.1633 0.961 1
.566 0.955 1
.7 0.952 1
0.1733 0.949 1
0.1766 0.946 1
0.18 0.943 1

```

0.1833	0.939	1
0.1866	0.936	1
0.19	0.933	1
0.1966	0.93	1
0.2	0.927	1
0.2033	0.92	1
0.21	0.917	1
0.2133	0.914	1
0.2166	0.911	1
0.22	0.908	1
0.2233	0.905	1
0.2266	0.902	1
0.23	0.898	1
0.2333	0.895	1
0.2366	0.892	1
0.24	0.889	1
0.2466	0.886	1
0.25	0.883	1
0.2533	0.879	1
0.2566	0.876	1
0.26	0.873	1
0.2666	0.87	1
0.27	0.867	1
0.2733	0.864	1
0.2766	0.861	1
0.2833	0.857	1
0.2866	0.854	1
0.29	0.851	1
0.2933	0.848	1
0.2966	0.845	1
0.3066	0.842	1
0.31	0.838	1
0.3166	0.832	1
0.32	0.829	1
0.33	0.823	1
0.3333	0.82	1
0.35	0.804	1
0.3666	0.791	1
0.3833	0.779	1
0.4	0.769	1
0.4166	0.756	1
0.4333	0.747	1
0.45	0.738	1
0.4666	0.725	1
0.4833	0.715	1
0.5	0.706	1
0.5166	0.696	1
0.5333	0.684	1
0.55	0.674	1
0.5666	0.665	1
0.5833	0.655	1
0.6	0.649	1
0.6166	0.64	1
0.6333	0.63	1
0.65	0.624	1
0.6666	0.614	1
0.6833	0.605	1
0.7	0.599	1
0.7166	0.589	1
0.7333	0.583	1

0.75	0.574	1
0.7666	0.567	1
0.7833	0.558	1
0.8	0.551	1
0.8166	0.545	1
0.8333	0.539	1
0.85	0.529	1
0.8666	0.523	1
0.8833	0.517	1
0.9	0.51	1
0.9166	0.504	1
0.9333	0.498	1
0.95	0.491	1
0.9666	0.485	1
0.9833	0.479	1
1	0.473	1
1.2	0.397	1
1.4	0.34	1
1.6	0.293	1
1.8	0.258	1
2	0.23	1
2.2	0.205	1
2.4	0.179	1
2.6	0.16	1
2.8	0.141	1
3	0.129	1
3.2	0.116	1
3.4	0.104	1
3.6	0.094	1
3.8	0.088	1
4	0.082	1
4.2	0.072	1
4.4	0.066	1
4.6	0.063	1
4.8	0.059	1
5	0.053	1
5.4	0.05	1
5.8	0.047	1
6	0.044	1
6.4	0.041	1
6.8	0.037	1
7.2	0.034	1
7.8	0.031	1
8.2	0.028	1
9	0.025	1
10	0.022	1
12	0.015	1

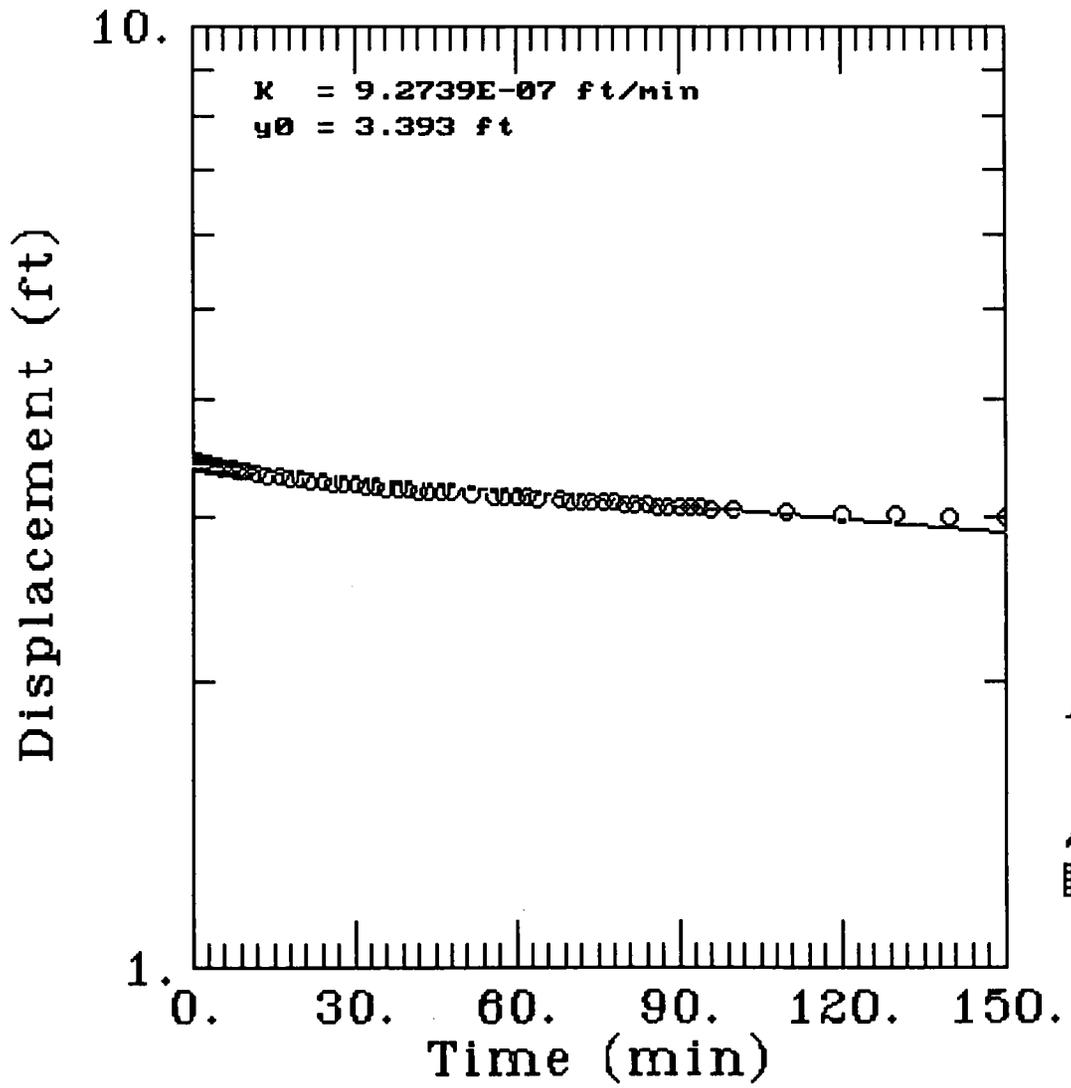
gdb002-1



0.1733	1.172	1
0.1766	1.166	1
0.18	1.169	1
0.1833	1.163	1
0.1866	1.16	1
0.1933	1.157	1
0.2	1.15	1
0.2033	1.147	1
0.2066	1.144	1
0.21	1.141	1
0.2133	1.138	1
0.2166	1.134	1
0.22	1.131	1
0.2266	1.128	1
0.23	1.125	1
0.2333	1.122	1
0.2366	1.119	1
0.2433	1.116	1
0.2466	1.112	1
0.25	1.109	1
0.2533	1.106	1
0.26	1.103	1
0.2633	1.1	1
0.2666	1.097	1
0.27	1.093	1
0.2733	1.09	1
0.28	1.087	1
0.2833	1.084	1
0.2866	1.081	1
0.2933	1.078	1
0.2966	1.075	1
0.3	1.071	1
0.3066	1.068	1
0.31	1.065	1
0.3133	1.062	1
0.32	1.059	1
0.3233	1.056	1
0.3266	1.053	1
0.3333	1.049	1
0.35	1.037	1
0.3666	1.024	1
0.3833	1.015	1
0.4	1.002	1
0.4166	0.993	1
0.4333	0.98	1
0.45	0.971	1
0.4666	0.958	1
0.4833	0.948	1
0.5	0.936	1
0.5166	0.926	1
0.5333	0.917	1
0.55	0.904	1
0.5666	0.895	1
0.5833	0.885	1
0.6	0.876	1
0.6166	0.867	1
0.6333	0.857	1
0.65	0.848	1
0.6666	0.838	1
0.6833	0.829	1

0.7	0.819	1
0.7166	0.81	1
0.7333	0.8	1
0.75	0.794	1
0.666	0.785	1
0.6833	0.775	1
0.8	0.769	1
0.8166	0.759	1
0.8333	0.75	1
0.85	0.744	1
0.8666	0.734	1
0.8833	0.728	1
0.9	0.718	1
0.9166	0.712	1
0.9333	0.703	1
0.95	0.696	1
0.9666	0.69	1
0.9833	0.681	1
1	0.674	1
1.2	0.576	1
1.4	0.504	1
1.6	0.441	1
1.8	0.384	1
2	0.334	1
2.2	0.286	1
2.4	0.249	1
2.6	0.22	1
2.8	0.195	1
3	0.173	1
3.2	0.154	1
	0.138	1
3.6	0.122	1
3.8	0.11	1
4	0.1	1
4.2	0.091	1
4.4	0.085	1
4.6	0.078	1
4.8	0.072	1
5	0.069	1
5.2	0.063	1
5.4	0.059	1
5.6	0.056	1
5.8	0.053	1
6	0.05	1
6.2	0.044	1
6.4	0.04	1
6.8	0.037	1
7	0.034	1
7.4	0.031	1
8	0.028	1
8.8	0.025	1
9	0.022	1

GDB001-0



AQTESOLV



Modeling Group

```

    Program Control
    Data Set Manager      A Q T E S O L V
    Confined solutions   Version 1.10
    Unconfined solutions Geraghty & Miller Modeling Group
    Leaky solutions
    Slug Data Set Manager
    Fracture Read       cgd001-0.txt
    Misc. Create       Data Set Title
    Quit Modify       GDB001-0
    Save c Initial drawdown in well... 0.459
    Open n Radius of well casing..... 0.083
    Radius of well..... 0.3125
    Saturated thickness..... 8.7
    Screen length..... 10
    Height of water in well.... 8.7
    Number of data points..... 76
    Last time on file..... 150
    Last drawdown on file..... 2.991
    Press any key to continue
    AQTESOLV F1=HELP Mon Feb 12, 1996 9:27 AM
  
```

GDB001-0

slugt1

0.459

0.083

0 125

slugt2

8.7

10

8.7

tsdata

0.8166 3.45 1

0.95 3.447 1

1 3.444 1

1.2 3.441 1

1.4 3.434 1

1.8 3.431 1

2 3.428 1

2.2 3.425 1

2.4 3.422 1

2.6 3.418 1

3 3.415 1

3.2 3.412 1

3.4 3.409 1

3.8 3.406 1

4 3.403 1

4.2 3.4 1

4.8 3.396 1

5 3.393 1

5.2 3.39 1

5 3.387 1

6 3.384 1

6.4 3.381 1

6.6 3.377 1

7 3.374 1

7.6 3.371 1

8.4 3.368 1

9 3.361 1

9.2 3.358 1

9.8 3.355 1

10 3.352 1

12 3.336 1

14 3.324 1

16 3.314 1

18 3.305 1

20 3.292 1

22 3.279 1

24 3.273 1

26 3.263 1

28 3.257 1

30 3.251 1

32 3.244 1

34 3.235 1

36 3.225 1

38 3.216 1

40 3.21 1

4 3.203 1

44 3.2 1

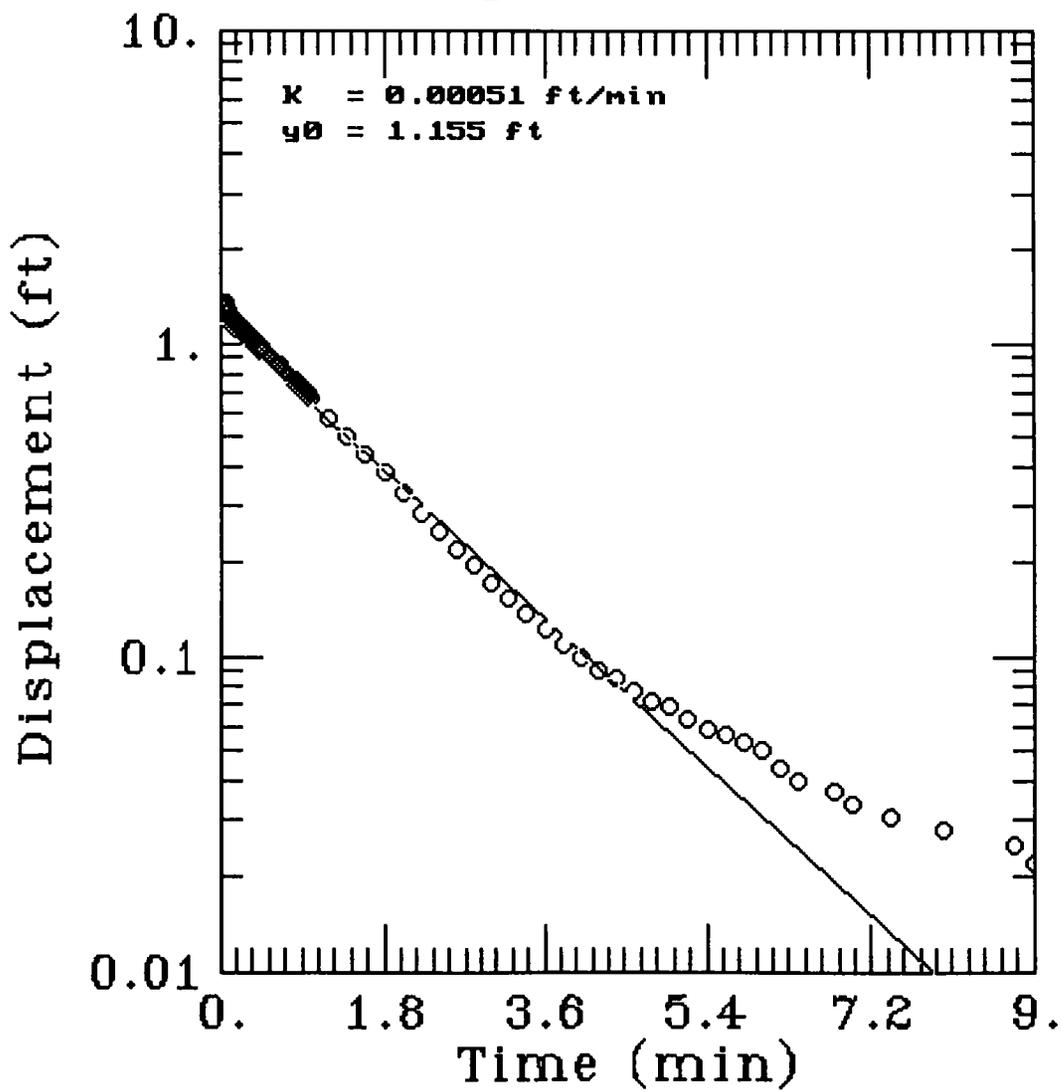
46 3.194 1

48 3.187 1

52 3.178 1

56	3.165	1
58	3.156	1
60	3.149	1
62	3.146	1
	3.14	1
68	3.134	1
70	3.124	1
72	3.121	1
74	3.115	1
76	3.111	1
78	3.108	1
80	3.102	1
82	3.099	1
84	3.092	1
86	3.086	1
88	3.083	1
90	3.08	1
92	3.077	1
94	3.07	1
96	3.067	1
100	3.061	1
110	3.042	1
120	3.026	1
130	3.02	1
140	3.001	1
150	2.991	1

gdb002-1



```

Program Control
Data Set Manager      A Q T E S O L V
Confined solutions   Version 1.10
Unconfined solutions Geraghty & Miller Modeling Group
Leaky solutions
Slug Data Set Manager
Fracture Read       gdb002-1.txt
Misc. Create       Data Set Title
Quit Modify       gdb002-1
Save Initial drawdown in well... 1.311
Open Radius of well casing..... 0.083
  Radius of well..... 0.3125
  Saturated thickness..... 7.73
  Screen length..... 10
  Height of water in well.... 7.73
  Number of data points..... 136
  Last time on file..... 9
  Last drawdown on file..... 0.022
  Press any key to continue
  DATA ENTRY

```

AQTESOLV F1=HELP Fri Feb 2, 1996 8:52 AM

```

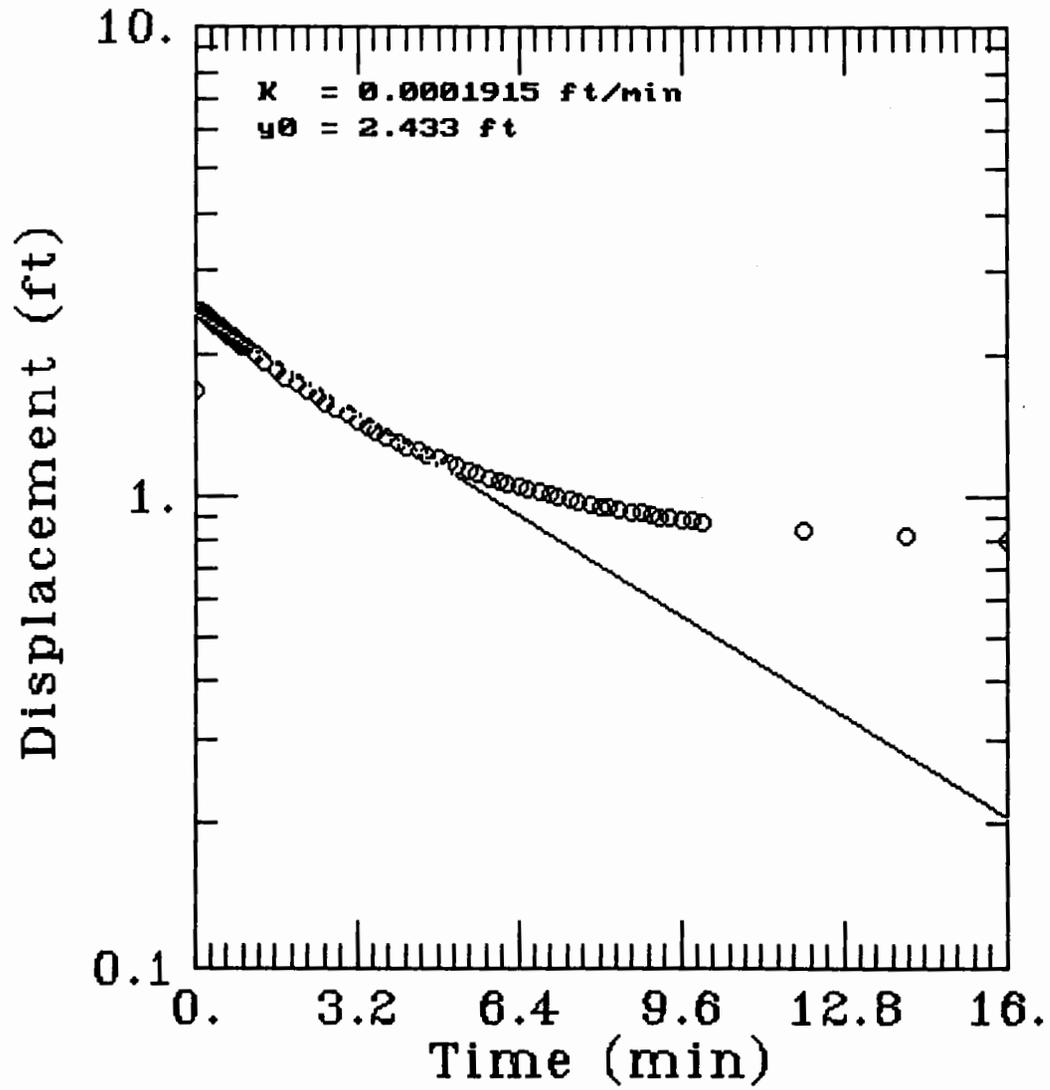
gdb002-1
slugt1
1.311
  .83
  .125
slugt2
7.73
10
7.73
tsdata
0.0566 1.333 1
0.0666 1.308 1
0.07 1.298 1
0.0766 1.289 1
0.08 1.286 1
0.0866 1.276 1
0.09 1.267 1
0.0966 1.261 1
0.1033 1.251 1
0.1066 1.242 1
0.11 1.238 1
0.1166 1.232 1
0.12 1.226 1
0.1233 1.223 1
0.13 1.216 1
0.1333 1.21 1
0.14 1.207 1
0.1433 1.201 1
^ 15 1.198 1
  533 1.191 1
0.16 1.188 1
0.1633 1.182 1
0.1666 1.175 1
0.17 1.179 1

```

0.1733	1.172	1
0.1766	1.166	1
0.18	1.169	1
0.1833	1.163	1
0.1866	1.16	1
0.1933	1.157	1
0.2	1.15	1
0.2033	1.147	1
0.2066	1.144	1
0.21	1.141	1
0.2133	1.138	1
0.2166	1.134	1
0.22	1.131	1
0.2266	1.128	1
0.23	1.125	1
0.2333	1.122	1
0.2366	1.119	1
0.2433	1.116	1
0.2466	1.112	1
0.25	1.109	1
0.2533	1.106	1
0.26	1.103	1
0.2633	1.1	1
0.2666	1.097	1
0.27	1.093	1
0.2733	1.09	1
0.28	1.087	1
0.2833	1.084	1
0.2866	1.081	1
0.2933	1.078	1
0.2966	1.075	1
0.3	1.071	1
0.3066	1.068	1
0.31	1.065	1
0.3133	1.062	1
0.32	1.059	1
0.3233	1.056	1
0.3266	1.053	1
0.3333	1.049	1
0.35	1.037	1
0.3666	1.024	1
0.3833	1.015	1
0.4	1.002	1
0.4166	0.993	1
0.4333	0.98	1
0.45	0.971	1
0.4666	0.958	1
0.4833	0.948	1
0.5	0.936	1
0.5166	0.926	1
0.5333	0.917	1
0.55	0.904	1
0.5666	0.895	1
0.5833	0.885	1
0.6	0.876	1
0.6166	0.867	1
0.6333	0.857	1
0.65	0.848	1
0.6666	0.838	1
0.6833	0.829	1

0.7	0.819	1
0.7166	0.81	1
0.7333	0.8	1
0.75	0.794	1
0.666	0.785	1
0.7833	0.775	1
0.8	0.769	1
0.8166	0.759	1
0.8333	0.75	1
0.85	0.744	1
0.8666	0.734	1
0.8833	0.728	1
0.9	0.718	1
0.9166	0.712	1
0.9333	0.703	1
0.95	0.696	1
0.9666	0.69	1
0.9833	0.681	1
1	0.674	1
1.2	0.576	1
1.4	0.504	1
1.6	0.441	1
1.8	0.384	1
2	0.334	1
2.2	0.286	1
2.4	0.249	1
2.6	0.22	1
2.8	0.195	1
3	0.173	1
3.2	0.154	1
3.4	0.138	1
3.6	0.122	1
3.8	0.11	1
4	0.1	1
4.2	0.091	1
4.4	0.085	1
4.6	0.078	1
4.8	0.072	1
5	0.069	1
5.2	0.063	1
5.4	0.059	1
5.6	0.056	1
5.8	0.053	1
6	0.05	1
6.2	0.044	1
6.4	0.04	1
6.8	0.037	1
7	0.034	1
7.4	0.031	1
8	0.028	1
8.8	0.025	1
9	0.022	1

GDB04D-0



0.26	2.393	1
0.2666	2.39	1
0.27	2.386	1
0.28	2.383	1
C 333	2.38	1
0.29	2.377	1
0.2966	2.374	1
0.3033	2.371	1
0.31	2.367	1
0.3166	2.364	1
0.3233	2.361	1
0.33	2.358	1
0.3333	2.355	1
0.35	2.345	1
0.3666	2.339	1
0.3833	2.329	1
0.4	2.323	1
0.4166	2.314	1
0.4333	2.307	1
0.45	2.298	1
0.4666	2.288	1
0.4833	2.282	1
0.5	2.276	1
0.5166	2.266	1
0.5333	2.26	1
0.55	2.25	1
0.5666	2.244	1
0.5833	2.238	1
0.6	2.231	1
0.6166	2.222	1
0.6333	2.216	1
0.65	2.206	1
0.6666	2.2	1
0.6833	2.193	1
0.7	2.184	1
0.7166	2.178	1
0.7333	2.171	1
0.75	2.165	1
0.7666	2.155	1
0.7833	2.149	1
0.8	2.143	1
0.8166	2.136	1
0.8333	2.127	1
0.85	2.121	1
0.8666	2.114	1
0.8833	2.108	1
0.9	2.102	1
0.9166	2.095	1
0.9333	2.086	1
0.95	2.079	1
0.9666	2.073	1
0.9833	2.067	1
1	2.06	1
1.2	1.984	1
1.4	1.912	1
1.6	1.845	1
1.8	1.785	1
2	1.725	1
2.2	1.668	1
2.4	1.617	1

2.6	1.57	1
2.8	1.525	1
3	1.484	1
3.2	1.443	1
	1.405	1
3.6	1.367	1
3.8	1.335	1
4	1.304	1
4.2	1.272	1
4.4	1.247	1
4.6	1.221	1
4.8	1.196	1
5	1.174	1
5.2	1.152	1
5.4	1.13	1
5.6	1.111	1
5.8	1.092	1
6	1.076	1
6.2	1.06	1
6.4	1.044	1
6.6	1.028	1
6.8	1.016	1
7	1.006	1
7.2	0.994	1
7.4	0.981	1
7.6	0.971	1
7.8	0.962	1
8	0.949	1
8.2	0.943	1
	0.933	1
	0.927	1
8.8	0.918	1
9	0.911	1
9.2	0.905	1
9.4	0.899	1
9.6	0.892	1
9.8	0.886	1
10	0.88	1
12	0.842	1
14	0.819	1
16	0.804	1

Appendix D
Analytical Data

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

APX9 SVOA		SAMPLE ID -----> 507-C-B004-01		507-C-B013-01		GDB-C-B001-01		GDB-C-B008-01			
	ORIGINAL ID ----->	507C800401		507C801301		GDBC800101		GDBC800801			
	LAB SAMPLE ID ---->	L5530-5		L7280-1		L5530-6		L5530-4			
	ID FROM REPORT -->	507C800401		507C801301		GDBC800101		GDBC800801			
	SAMPLE DATE ----->	10/04/95		06/19/96		10/04/95		10/04/95			
	DATE EXTRACTED -->	10/17/95		06/26/96		10/17/95		10/17/95			
	DATE ANALYZED ---->	10/30/95		07/11/96		10/30/95		10/30/95			
	MATRIX ----->	Soil		Soil		Soil		Soil			
	UNITS ----->	UG/KG	A	UG/KG	A	UG/KG	A	UG/KG	A		
CAS #	Parameter	L5530	VAL	L7280	VAL	L5530	VAL	L5530	VAL		
108-95-2	Phenol	730.	U	700.	U	970.	U	690.	U		
111-44-4	bis(2-Chloroethyl)ether	730.	U	700.	U	970.	U	690.	U		
95-57-8	2-Chlorophenol	730.	U	700.	U	970.	U	690.	U		
100-51-6	Benzyl alcohol	1400.	U	1400.	U	1900.	U	1400.	U		
95-48-7	2-Methylphenol (o-Cresol)	730.	U	700.	U	970.	U	690.	U		
108-60-1	2,2'-oxybis(1-Chloropropane)	730.	U	700.	U	970.	U	690.	U		
621-64-7	N-Nitroso-di-n-propylamine	730.	U	700.	U	970.	U	690.	U		
67-72-1	Hexachloroethane	730.	U	700.	U	970.	U	690.	U		
98-95-3	Nitrobenzene	730.	U	700.	U	970.	U	690.	U		
78-59-1	Isophorone	730.	U	700.	U	970.	U	690.	U		
88-75-5	2-Nitrophenol	730.	U	700.	U	970.	U	690.	U		
105-67-9	2,4-Dimethylphenol	730.	U	700.	U	970.	U	690.	U		
111-91-1	bis(2-Chloroethoxy)methane	730.	U	700.	U	970.	U	690.	U		
120-83-2	2,4-Dichlorophenol	730.	U	700.	U	970.	U	690.	U		
91-20-3	Naphthalene	730.	U	700.	U	970.	U	690.	U		
106-47-8	4-Chloroaniline	1400.	U	1400.	U	1900.	U	1400.	U		
87-68-3	Hexachlorobutadiene	730.	U	700.	U	970.	U	690.	U		
59-50-7	4-Chloro-3-methylphenol	1400.	U	1400.	U	1900.	U	1400.	U		
91-57-6	2-Methylnaphthalene	730.	U	700.	U	970.	U	690.	U		
77-47-4	Hexachlorocyclopentadiene	730.	U	700.	U	970.	U	690.	U		
88-06-2	2,4,6-Trichlorophenol	730.	U	700.	U	970.	U	690.	U		
95-95-4	2,4,5-Trichlorophenol	730.	U	700.	U	970.	U	690.	U		
91-58-7	2-Chloronaphthalene	730.	U	700.	U	970.	U	690.	U		
88-74-4	2-Nitroaniline	3700.	U	3500.	U	4900.	U	3400.	U		
131-11-3	Dimethyl phthalate	730.	U	700.	U	970.	U	690.	U		
208-96-8	Acenaphthylene	730.	U	700.	U	970.	U	690.	U		
606-20-2	2,6-Dinitrotoluene	730.	U	700.	U	970.	U	690.	U		
99-09-2	3-Nitroaniline	3700.	U	3500.	U	4900.	U	3400.	U		
83-32-9	Acenaphthene	730.	U	700.	U	970.	U	690.	U		
51-28-5	2,4-Dinitrophenol	3700.	U	3500.	U	4900.	U	3400.	U		
100-02-7	4-Nitrophenol	3700.	U	3500.	U	4900.	U	3400.	U		
132-64-9	Dibenzofuran	730.	U	700.	U	970.	U	690.	U		
121-14-2	2,4-Dinitrotoluene	730.	U	700.	U	970.	U	690.	U		
84-66-2	Diethylphthalate	730.	U	700.	U	970.	U	690.	U		
7005-72-3	4-Chlorophenylphenylether	730.	U	700.	U	970.	U	690.	U		
86-73-7	Fluorene	730.	U	700.	U	970.	U	690.	U		

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

APX9 SVOA		SAMPLE ID -----> 507-C-B004-01		507-C-B013-01		GDB-C-B001-01		GDB-C-B008-01	
	ORIGINAL ID ----->	507CB00401		507CB01301		GDBC00101		GDBC00801	
	LAB SAMPLE ID ---->	L5530-5		L7280-1		L5530-6		L5530-4	
	ID FROM REPORT -->	507CB00401		507CB01301		GDBC00101		GDBC00801	
	SAMPLE DATE ----->	10/04/95		06/19/96		10/04/95		10/04/95	
	DATE EXTRACTED -->	10/17/95		06/26/96		10/17/95		10/17/95	
	DATE ANALYZED ---->	10/30/95		07/11/96		10/30/95		10/30/95	
	MATRIX ----->	Soil		Soil		Soil		Soil	
	UNITS ----->	UG/KG	A	UG/KG	A	UG/KG	A	UG/KG	A
CAS #	Parameter	L5530	VAL	L7280	VAL	L5530	VAL	L5530	VAL
100-01-6	4-Nitroaniline	3700.	U	3500.	U	4900.	U	3400.	U
534-52-1	2-Methyl-4,6-Dinitrophenol	3700.	U	3500.	U	4900.	U	3400.	U
86-30-6	N-Nitrosodiphenylamine	3700.	U	3500.	U	4900.	U	3400.	U
101-55-3	4-Bromophenyl-phenylether	730.	U	700.	U	970.	U	690.	U
118-74-1	Hexachlorobenzene	730.	U	700.	U	970.	U	690.	U
87-86-5	Pentachlorophenol	3700.	U	3500.	U	4900.	U	3400.	U
85-01-8	Phenanthrene	730.	U	700.	U	970.	U	690.	U
120-12-7	Anthracene	730.	U	700.	U	970.	U	690.	U
84-74-2	Di-n-butylphthalate	730.	U	700.	U	970.	U	690.	U
206-44-0	Fluoranthene	730.	U	700.	U	970.	U	690.	U
129-00-0	Pyrene	730.	U	700.	U	970.	U	690.	U
85-68-7	Butylbenzylphthalate	730.	U	700.	U	970.	U	690.	U
91-94-1	3,3'-Dichlorobenzidine	1400.	U	1400.	U	1900.	U	1400.	U
56-55-3	Benzo(a)anthracene	730.	U	700.	U	970.	U	690.	U
218-01-9	Chrysene	730.	U	700.	U	970.	U	690.	U
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	730.	U	700.	U	970.	U	690.	U
117-84-0	Di-n-octyl phthalate	730.	U	700.	U	970.	U	690.	U
205-99-2	Benzo(b)fluoranthene	730.	U	700.	U	970.	U	690.	U
207-08-9	Benzo(k)fluoranthene	730.	U	270.	J	970.	U	690.	U
50-32-8	Benzo(a)pyrene	730.	U	700.	U	970.	U	690.	U
193-39-5	Indeno(1,2,3-cd)pyrene	730.	U	700.	U	970.	U	690.	U
53-70-3	Dibenz(a,h)anthracene	730.	U	700.	U	970.	U	690.	U
191-24-2	Benzo(g,h,i)perylene	730.	U	700.	U	970.	U	690.	U
95-53-4	o-Toluidine	1400.	U	1400.	U	1900.	U	1400.	U
1888-71-7	Hexachloropropene	730.	U	700.	U	970.	U	690.	U
95-94-3	1,2,4,5-Tetrachlorobenzene	730.	U	700.	U	970.	U	690.	U
608-93-5	Pentachlorobenzene	730.	U	700.	U	970.	U	690.	U
91-59-8	2-Naphthylamine	3700.	U	3500.	U	4900.	U	3400.	U
134-32-7	1-Naphthylamine	3700.	U	3500.	U	4900.	U	3400.	U
297-97-2	Thionazin	3700.	U	3500.	U	4900.	U	3400.	U
99-55-8	5-Nitro-o-toluidine	3700.	U	3500.	U	4900.	U	3400.	U
2303-16-4	Diallate	1400.	U	1400.	U	1900.	U	1400.	U
298-02-2	Phorate	1400.	U	1400.	U	1900.	U	1400.	U
62-44-2	Phenacetin	1400.	U	1400.	U	1900.	U	1400.	U
60-51-5	Dimethoate	1400.	U	1400.	U	1900.	U	1400.	U
92-67-1	4-Aminobiphenyl	3700.	U	3500.	U	4900.	U	3400.	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

APX9 SVQA		SAMPLE ID ----->	507-C-B004-01	507-C-B013-01	GDB-C-B001-01	GDB-C-B008-01			
		ORIGINAL ID ----->	507CB00401	507CB01301	GDBC00101	GDBC00801			
		LAB SAMPLE ID ---->	L5530-5	L7280-1	L5530-6	L5530-4			
		ID FROM REPORT -->	507CB00401	507CB01301	GDBC00101	GDBC00801			
		SAMPLE DATE ----->	10/04/95	06/19/96	10/04/95	10/04/95			
		DATE EXTRACTED -->	10/17/95	06/26/96	10/17/95	10/17/95			
		DATE ANALYZED ---->	10/30/95	07/11/96	10/30/95	10/30/95			
		MATRIX ----->	Soil	Soil	Soil	Soil			
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG			
			A	A	A	A			
CAS #	Parameter	L5530	VAL	L7280	VAL	L5530	VAL	L5530	VAL
23950-58-5	Pronamide	1400.	U	1400.	U	1900.	U	1400.	U
298-04-4	Disulfoton	1400.	U	1400.	U	1900.	U	1400.	U
298-00-0	Methyl parathion	3700.	UR	3500.	U	4900.	U	3400.	UR
56-38-2	Parathion	1400.	UR	1400.	U	1900.	U	1400.	UR
140-57-8	Aramite	1400.	U	1400.	U	1900.	U	1400.	U
510-15-6	Chlorobenzilate	1400.	U	1400.	U	1900.	U	1400.	U
119-93-7	3,3-Dimethylbenzidine	22000.	U	21000.	U	29000.	U	21000.	U
52-85-7	Famphur	730.	U	700.	UJ	970.	U	690.	U
53-96-3	Acetamidofluorene	1400.	U	1400.	U	1900.	U	1400.	U
70-30-4	Hexachlorophene	12000.	U	1400.	U	16000.	U	11000.	U
56-49-5	3-Methyl cholanthrene	1400.	U	1400.	U	1900.	U	1400.	U
110-86-1	Pyridine	1400.	U	1400.	U	1900.	U	1400.	U
76-01-7	Pentachloroethane	730.	U	700.	U	970.	U	690.	U
62-75-9	N-Nitrosodimethylamine	1400.	U	1400.	U	1900.	U	1400.	U
109-06-8	2-Picoline	2600.	U	2400.	U	3400.	U	2400.	U
10595-95-6	N-Nitrosomethylethylamine	1400.	U	1400.	UJ	1900.	U	1400.	U
66-27-3	Methyl methanesulfonate	730.	U	700.	U	970.	U	690.	U
55-18-5	N-Nitrosodiethylamine	1400.	U	1400.	U	1900.	U	1400.	U
62-50-0	Ethyl methanesulfonate	730.	U	700.	U	970.	U	690.	U
62-53-3	Aniline	1400.	U	1400.	U	1900.	U	1400.	U
930-55-2	N-Nitrosopyrrolidine	1400.	U	1400.	U	1900.	U	1400.	U
59-89-2	N-Nitrosomorpholine	1400.	U	1400.	U	1900.	U	1400.	U
9999900-32-2	3-Methylphenol/4-Methylphenol	1400.	U	1400.	U	1900.	U	1400.	U
98-86-2	Acetophenone	730.	U	700.	U	970.	U	690.	U
87-65-0	2,6-Dichlorophenol	1400.	U	1400.	U	1900.	U	1400.	U
100-75-4	N-Nitrosopiperidine	1400.	U	1400.	U	1900.	U	1400.	U
924-16-3	N-Nitroso-di-n-butylamine	1400.	U	1400.	U	1900.	U	1400.	U
120-58-1	Isosafrole	730.	U	700.	U	970.	U	690.	U
94-59-7	Safrole	730.	U	700.	U	970.	U	690.	U
130-15-4	1,4-Naphthoquinone	1400.	U	1400.	U	1900.	U	1400.	U
99-65-0	1,3-Dinitrobenzene	1400.	U	1400.	U	1900.	U	1400.	U
58-90-2	2,3,4,6-Tetrachlorophenol	3700.	U	3500.	U	4900.	U	3400.	U
99-35-4	1,3,5-Trinitrobenzene	1400.	UJ	1400.	U	1900.	U	1400.	UJ
82-68-8	Pentachloronitrobenzene	730.	U	700.	U	970.	U	690.	U
88-85-7	Dinoseb	2200.	U	2100.	U	2900.	U	2100.	U
3689-24-5	Sulfotep	1400.	U	1400.	U	1900.	U	1400.	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

APX9 SVQA		SAMPLE ID ----->	507-C-8004-01	507-C-8013-01	GDB-C-8001-01	GDB-C-8008-01			
		ORIGINAL ID ----->	507C800401	507C801301	GDBC800101	GDBC800801			
		LAB SAMPLE ID ---->	L5530-5	L7280-1	L5530-6	L5530-4			
		ID FROM REPORT -->	507C800401	507C801301	GDBC800101	GDBC800801			
		SAMPLE DATE ----->	10/04/95	06/19/96	10/04/95	10/04/95			
		DATE EXTRACTED -->	10/17/95	06/26/96	10/17/95	10/17/95			
		DATE ANALYZED ---->	10/30/95	07/11/96	10/30/95	10/30/95			
		MATRIX ----->	Soil	Soil	Soil	Soil			
		UNITS ----->	UG/KG A	UG/KG A	UG/KG A	UG/KG A			
CAS #	Parameter	L5530	VAL	L7280	VAL	L5530	VAL	L5530	VAL
126-68-1	0,0,0-Triethylphosphorothioate	1400.	U	1400.	U	1900.	U	1400.	U
60-11-7	p-(Dimethylamino)azobenzene	1400.	U	1400.	U	1900.	U	1400.	U
57-97-6	7,12-Dimethylbenz(a)anthracene	730.	U	700.	U	970.	U	690.	U
56-57-5	4-Nitroquinoline 1-oxide	1400.	U	1400.	U	1900.	U	1400.	U
91-80-5	Methapyrilene	1400.	U	1400.	U	1900.	U	1400.	U
108-39-4	3-Methylphenol (m-Cresol)	???????????		1400.	U	???????????		???????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

APX9 VOA		SAMPLE ID ----->	507-C-B004-01	GDB-C-B001-01	GDB-C-B008-01			
		ORIGINAL ID ----->	507C800401	GDBC800101	GDBC800801			
		LAB SAMPLE ID ---->	L5530-8	L5530-9	L5530-7			
		ID FROM REPORT -->	507C800401	GDBC800101	GDBC800801			
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95			
		DATE ANALYZED ---->	10/14/95	10/13/95	10/13/95			
		MATRIX ----->	Soil	Soil	Soil			
		UNITS ----->	UG/KG	UG/KG	UG/KG			
CAS #	Parameter	L5530	VAL	L5530	VAL	L5530	VAL	
74-87-3	Chloromethane	11.	U	14.	UJ	10.	UJ	
75-01-4	Vinyl chloride	11.	U	14.	UJ	10.	UJ	
74-83-9	Bromomethane	11.	U	14.	UJ	10.	UJ	
75-00-3	Chloroethane	11.	U	14.	UJ	10.	UJ	
75-69-4	Trichlorofluoromethane	5.6	U	7.1	UJ	5.2	UJ	
67-64-1	Acetone	110.	U	15.	J	9.2	UJ	
75-35-4	1,1-Dichloroethene	5.6	U	7.1	UJ	5.2	UJ	
75-15-0	Carbon disulfide	5.6	U	7.1	UJ	5.2	UJ	
75-09-2	Methylene chloride	5.6	U	7.1	UJ	5.2	UJ	
156-60-5	trans-1,2-Dichloroethene	5.6	U	7.1	UJ	5.2	UJ	
108-05-4	Vinyl acetate	5.6	U	7.1	UJ	5.2	UJ	
75-34-3	1,1-Dichloroethane	5.6	U	7.1	UJ	5.2	UJ	
78-93-3	2-Butanone (MEK)	56.	U	71.	UJ	52.	UJ	
67-66-3	Chloroform	5.6	U	7.1	UJ	5.2	UJ	
71-55-6	1,1,1-Trichloroethane	5.6	U	7.1	UJ	5.2	UJ	
56-23-5	Carbon tetrachloride	5.6	U	7.1	UJ	5.2	UJ	
107-06-2	1,2-Dichloroethane	5.6	U	7.1	UJ	5.2	UJ	
71-43-2	Benzene	5.6	U	7.1	UJ	5.2	UJ	
79-01-6	Trichloroethene	5.6	U	7.1	UJ	5.2	UJ	
78-87-5	1,2-Dichloropropane	5.6	U	7.1	UJ	5.2	UJ	
75-27-4	Bromodichloromethane	5.6	U	7.1	UJ	5.2	UJ	
108-10-1	4-Methyl-2-Pentanone (MIBK)	56.	U	71.	UJ	52.	UJ	
10061-01-5	cis-1,3-Dichloropropene	5.6	U	7.1	UJ	5.2	UJ	
108-88-3	Toluene	2.4	J	7.1	UJ	5.2	UJ	
10061-02-6	trans-1,3-Dichloropropene	5.6	U	7.1	UJ	5.2	UJ	
591-78-6	2-Hexanone	56.	U	71.	UJ	52.	UJ	
79-00-5	1,1,2-Trichloroethane	5.6	U	7.1	UJ	5.2	UJ	
127-18-4	Tetrachloroethene	5.6	U	7.1	UJ	5.2	UJ	
124-48-1	Dibromochloromethane	5.6	U	7.1	UJ	5.2	UJ	
108-90-7	Chlorobenzene	5.6	U	7.1	UJ	5.2	UJ	
100-41-4	Ethylbenzene	5.6	U	7.1	UJ	5.2	UJ	
1330-20-7	Xylene (Total)	5.6	U	7.1	UJ	5.2	UJ	
95-47-6	o-Xylene	5.6	U	7.1	UJ	5.2	UJ	
100-42-5	Styrene	5.6	U	7.1	UJ	5.2	UJ	
75-25-2	Bromoform	5.6	U	7.1	UJ	5.2	UJ	
79-34-5	1,1,2,2-Tetrachloroethane	5.6	U	7.1	UJ	5.2	UJ	
541-73-1	1,3-Dichlorobenzene	5.6	U	7.1	UJ	5.2	UJ	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

APX9 VOA	SAMPLE ID ----->	507-C-8004-01	GDB-C-8001-01	GDB-C-8008-01			
	ORIGINAL ID ----->	507CB00401	GDBC800101	GDBC800801			
	LAB SAMPLE ID ---->	L5530-8	L5530-9	L5530-7			
	ID FROM REPORT -->	507CB00401	GDBC800101	GDBC800801			
	SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95			
	DATE ANALYZED ---->	10/14/95	10/13/95	10/13/95			
	MATRIX ----->	Soil	Soil	Soil			
	UNITS ----->	UG/KG	UG/KG	UG/KG			

CAS #	Parameter	L5530	VAL	L5530	VAL	L5530	VAL
106-46-7	1,4-Dichlorobenzene	5.6	U	7.1	UJ	5.2	UJ
95-50-1	1,2-Dichlorobenzene	5.6	U	7.1	UJ	5.2	UJ
75-05-8	Acetonitrile	56.	UJ	71.	UJ	52.	UJ
107-02-8	Acrolein	56.	U	71.	UJ	52.	UJ
107-13-1	Acrylonitrile	56.	U	71.	UJ	52.	UJ
107-05-1	3-Chloropropene	22.	U	28.	UJ	21.	UJ
106-93-4	1, 2-Dibromoethane	5.6	U	7.1	UJ	5.2	UJ
74-95-3	Methylene bromide	5.6	U	7.1	UJ	5.2	UJ
96-12-8	1,2-Dibromo-3-Chloropropane	110.	U	140.	UJ	100.	UJ
110-57-6	trans-1,4-Dichloro-2-butene	110.	U	140.	UJ	100.	UJ
75-71-8	Dichlorodifluoromethane	5.6	U	7.1	UJ	5.2	UJ
123-91-1	1,4-Dioxane	110.	U	140.	UJ	100.	UJ
107-12-0	Propionitrile	11.	U	14.	UJ	10.	UJ
97-63-2	Ethyl methacrylate	5.6	U	7.1	UJ	5.2	UJ
74-88-4	Methyl iodide	5.6	U	7.1	UJ	5.2	UJ
78-83-1	Isobutyl alcohol	110.	U	140.	UJ	100.	UJ
126-98-7	Methacrylonitrile	5.6	U	7.1	UJ	5.2	UJ
80-62-6	Methyl methacrylate	5.6	U	7.1	UJ	5.2	UJ
630-20-6	1,1,1,2-Tetrachloroethane	5.6	U	7.1	UJ	5.2	UJ
120-82-1	1,2,4-Trichlorobenzene	5.6	U	7.1	UJ	5.2	UJ
96-18-4	1,2,3-Trichloropropane	5.6	U	7.1	UJ	5.2	UJ

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

CHLORIDE	SAMPLE ID ----->	GDB-G-W01D-01	GDB-G-W04D-01	GDB-H-W04D-01			
	ORIGINAL ID ----->	GDBGW01D01	GDBGW04D01	GDBHW04D01			
	LAB SAMPLE ID ---->	L6024-96	L6024-97	L6022-14			
	ID FROM REPORT -->	GDBGW01D01	GDBGW04D01	GDBHW04D01			
	SAMPLE DATE ----->	12/09/95	12/11/95	12/11/95			
	DATE EXTRACTED -->	12/20/95	12/19/95	12/19/95			
	DATE ANALYZED ---->	12/20/95	12/19/95	12/19/95			
	MATRIX ----->	Water	Water	Water			
UNITS ----->	MG/L	A	MG/L	A	MG/L	A	

CAS #	Parameter	L6024	VAL	L6024	VAL	L6022	VAL
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16887-00-6	Chloride	6400.		92.		92.	
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NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

CYANIDE	SAMPLE ID ----->	507-C-B004-01	GDB-S-B001-01	GDB-C-B001-01	GDB-S-B001-02	GDB-S-B002-01	GDB-S-B002-02
	ORIGINAL ID ----->	507CB00401	GDBSB00101	GDBC00101	GDBSB00102	GDBSB00201	GDBSB00202
	LAB SAMPLE ID ---->	L5530-2	L5540-124	L5530-3	L5540-125	L5540-122	L5540-123
	ID FROM REPORT -->	507CB00401	GDBSB00101	GDBC00101	GDBSB00102	GDBSB00201	GDBSB00202
	SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95
	DATE EXTRACTED -->	10/11/95	10/11/95	10/11/95	10/11/95	10/11/95	10/11/95
	DATE ANALYZED ---->	10/11/95	10/11/95	10/11/95	10/11/95	10/11/95	10/11/95
	MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil
UNITS ----->	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	

CAS #	Parameter	L5530I	VAL	L5540I	VAL	L5530I	VAL	L5540I	VAL	L5540I	VAL	L5540I	VAL
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57-12-5	Cyanide (CN)	1.1	U	1.6	U	1.5	U	2.5	U	1.3	U	1.8	U
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NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

CYANIDE		SAMPLE ID ----->	GDB-S-8003-01	GDB-S-8004-01	GDB-S-8004-02	GDB-S-8005-01	GDB-S-8005-02	GDB-S-8006-01					
		ORIGINAL ID ----->	GDBS800301	GDBS800401	GDBS800402	GDBS800501	GDBS800502	GDBS800601					
		LAB SAMPLE ID ---->	L5540-88	L5540-119	L5540-121	L5540-128	L5540-129	L5540-126					
		ID FROM REPORT -->	GDBS800301	GDBS800401	GDBS800402	GDBS800501	GDBS800502	GDBS800601					
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95					
		DATE EXTRACTED -->	10/11/95	10/11/95	10/11/95	10/11/95	10/11/95	10/11/95					
		DATE ANALYZED ---->	10/11/95	10/11/95	10/11/95	10/11/95	10/11/95	10/11/95					
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil					
		UNITS ----->	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG					
CAS #	Parameter	L5540I	VAL	L5540I	VAL	L5540I	VAL	L5540I	VAL	L5540I	VAL		
57-12-5	Cyanide (CN)	1.3	U	1.	U	1.1	U	1.1	U	1.2	U	1.1	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

CYANIDE

SAMPLE ID ----->	GDB-S-B006-02	GDB-S-B007-01	GDB-S-B007-02	GDB-S-B008-01	GDB-C-B008-01	GDB-S-B008-02
ORIGINAL ID ----->	GDBSB00602	GDBSB00701	GDBSB00702	GDBSB00801	GDBC800801	GDBSB00802
LAB SAMPLE ID ---->	L5540-127	L5540-103	L5540-104	L5540-101	L5530-1	L5540-102
ID FROM REPORT -->	GDBSB00602	GDBSB00701	GDBSB00702	GDBSB00801	GDBC800801	GDBSB00802
SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95
DATE EXTRACTED -->	10/11/95	10/11/95	10/11/95	10/11/95	10/11/95	10/11/95
DATE ANALYZED ---->	10/11/95	10/11/95	10/11/95	10/11/95	10/11/95	10/11/95
MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil
UNITS ----->	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG

CAS #	Parameter	L55401	VAL	L55401	VAL	L55401	VAL	L55401	VAL	L55301	VAL	L55401	VAL
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57-12-5	Cyanide (CN)	1.2	U	1.2	U	1.2	U	1.1	U	1.1	U	1.1	U
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NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

CYANIDE		SAMPLE ID ----->	GDB-S-B009-01	GDB-S-B009-02	GDB-S-B010-01	GDB-S-B010-02	GDB-S-B011-01	GDB-S-B011-02					
ORIGINAL ID ----->		GDBSB00901	GDBSB00902	GDBSB01001	GDBSB01002	GDBSB01101	GDBSB01102	GDBSB01102					
LAB SAMPLE ID ---->		L5540-105	L5540-106	L5540-130	L5540-131	L5540-99	L5540-100	L5540-100					
ID FROM REPORT -->		GDBSB00901	GDBSB00902	GDBSB01001	GDBSB01002	GDBSB01101	GDBSB01102	GDBSB01102					
SAMPLE DATE ----->		10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95					
DATE EXTRACTED -->		10/11/95	10/11/95	10/11/95	10/11/95	10/11/95	10/11/95	10/11/95					
DATE ANALYZED ---->		10/11/95	10/11/95	10/11/95	10/11/95	10/11/95	10/11/95	10/11/95					
MATRIX ----->		Soil	Soil	Soil	Soil	Soil	Soil	Soil					
UNITS ----->		MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG					
CAS #	Parameter	L55401	VAL	L55401	VAL	L55401	VAL	L55401	VAL	L55401	VAL		
57-12-5	Cyanide (CN)	1.1	U	1.1	U	1.2	U	1.5	U	1.5	U	1.4	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

CYANIDE		SAMPLE ID -----> ORIGINAL ID -----> LAB SAMPLE ID ----> ID FROM REPORT --> SAMPLE DATE -----> DATE EXTRACTED --> DATE ANALYZED ----> MATRIX -----> UNITS ----->	GDB-S-B012-01 GDBSB01201 L5540-97 GDBSB01201 10/04/95 10/11/95 10/11/95 Soil MG/KG	A	GDB-S-B012-02 GDBSB01202 L5540-98 GDBSB01202 10/04/95 10/11/95 10/11/95 Soil MG/KG	A	GDB-S-B013-01 GDBSB01301 L5540-95 GDBSB01301 10/04/95 10/11/95 10/11/95 Soil MG/KG	A	GDB-S-B013-02 GDBSB01302 L5540-96 GDBSB01302 10/04/95 10/11/95 10/11/95 Soil MG/KG	A	GDB-S-B014-01 GDBSB01401 L5540-91 GDBSB01401 10/04/95 10/11/95 10/11/95 Soil MG/KG	A	GDB-S-B014-02 GDBSB01402 L5540-94 GDBSB01402 10/04/95 10/11/95 10/11/95 Soil MG/KG	A
CAS #	Parameter	L5540I	VAL	L5540I	VAL	L5540I	VAL	L5540I	VAL	L5540I	VAL	L5540I	VAL	
57-12-5	Cyanide (CN)	1.1	U	1.1	U	1.2	U	1.4	U	1.1	U	1.2	U	

*** Validation Complete ***

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

CYANIDE		SAMPLE ID ----->	GDB-S-B015-01	GDB-S-B015-02	GDB-G-W001-01	GDB-G-W002-01	GDB-G-W003-01	GDB-G-W004-01					
ORIGINAL ID ----->		GDBSB01501	GDBSB01502	GDBGW00101	GDBGW00201	GDBGW00301	GDBGW00401						
LAB SAMPLE ID ---->		L5540-117	L5540-118	L6024-87	L6024-88	L6024-89	L6024-90						
ID FROM REPORT -->		GDBSB01501	GDBSB01502	GDBGW00101	GDBGW00201	GDBGW00301	GDBGW00401						
SAMPLE DATE ----->		10/04/95	10/04/95	12/09/95	12/09/95	12/10/95	12/10/95						
DATE EXTRACTED -->		10/11/95	10/11/95	12/12/95	12/12/95	12/12/95	12/12/95						
DATE ANALYZED ---->		10/11/95	10/11/95	12/12/95	12/12/95	12/12/95	12/12/95						
MATRIX ----->		Soil	Soil	Water	Water	Water	Water						
UNITS ----->		MG/KG	MG/KG	MG/L	MG/L	MG/L	MG/L						
CAS #	Parameter	L55401	VAL	L55401	VAL	L6024	VAL	L6024	VAL	L6024	VAL	L6024	VAL
57-12-5	Cyanide (CN)	1.1	U	1.2	U	0.01	U	0.01	U	0.01	U	0.01	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

CYANIDE		SAMPLE ID -----> ORIGINAL ID -----> LAB SAMPLE ID ----> ID FROM REPORT --> SAMPLE DATE -----> DATE EXTRACTED --> DATE ANALYZED ----> MATRIX -----> UNITS ----->	GDB-G-W01D-01 GDBGW01D01 L6024-86 GDBGW01D01 12/09/95 12/12/95 12/12/95 Water MG/L	A	GDB-G-W04D-01 GDBGW04D01 L6024-93 GDBGW04D01 12/11/95 12/12/95 12/12/95 Water MG/L	A	GDB-H-W04D-01 GDBHW04D01 L6022-13 GDBHW04D01 12/11/95 12/12/95 12/12/95 Water MG/L	A			
CAS #	Parameter	L6024	VAL	L6024	VAL	L6022	VAL				
57-12-5	Cyanide (CN)	0.01	U	0.01	U	0.01	U				

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

HEXACHROME		SAMPLE ID ----->	507-C-8004-01	GDB-C-8001-01	GDB-C-8008-01	GDB-H-W04D-01			
		ORIGINAL ID ----->	507CB00401	GDBC800101	GDBC800801	GDBHW04001			
		LAB SAMPLE ID ---->	L5530-2	L5530-3	L5530-1	L6022-11			
		ID FROM REPORT -->	507CB00401	GDBC800101	GDBC800801	GDBHW04001			
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	12/11/95			
		DATE EXTRACTED -->	10/05/95	10/05/95	10/05/95	12/12/95			
		DATE ANALYZED ---->	10/05/95	10/05/95	10/05/95	12/12/95			
		MATRIX ----->	Soil	Soil	Soil	Water			
		UNITS ----->	MG/KG	MG/KG	MG/KG	MG/L			
CAS #	Parameter	L5530I	VAL	L5530I	VAL	L5530I	VAL	L6022	VAL
9999900-00-5	Hexavalent Chromium	???????????		???????????		???????????		???????????	
18540-29-9	Chromium (Hexavalent)	0.3		0.15 U		0.13 U		0.002 U	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SULFATE		SAMPLE ID -----> ORIGINAL ID -----> LAB SAMPLE ID ----> ID FROM REPORT --> SAMPLE DATE -----> DATE EXTRACTED --> DATE ANALYZED ----> MATRIX -----> UNITS ----->	GDB-G-W01D-01 GDBGW01D01 L6024-96 GDBGW01D01 12/09/95 12/19/95 12/19/95 Water MG/L	A	GDB-G-W04D-01 GDBGW04D01 L6024-97 GDBGW04D01 12/11/95 12/19/95 12/19/95 Water MG/L	A	GDB-H-W04D-01 GDBHW04D01 L6022-14 GDBHW04D01 12/11/95 12/19/95 12/19/95 Water MG/L	A			
CAS #	Parameter	L6024	VAL	L6024	VAL	L6022	VAL				
14808-79-8	Sulfate	360.		24.		21.					

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SUB846-DIOX		SAMPLE ID ----->	507-C-8004-01	GDB-C-B001-01	GDB-C-B008-01	GDB-H-W04D-01			
		ORIGINAL ID ----->	507CB00401	GDBC800101	/GDBC00801	GDBHW04D01			
		LAB SAMPLE ID ---->	107-202-6	107-202-7	107-202-5	T960119			
		ID FROM REPORT -->	507CB00401	GDBC800101	/GDBC00801	GDBHW04D01			
		SAMPLE DATE ----->	10/04/95	10/04/95		12/15/95			
		DATE EXTRACTED -->	10/13/95	10/13/95	10/13/95	01/03/96			
		DATE ANALYZED ---->	10/18/95	10/18/95	10/18/95	01/10/96			
		MATRIX ----->	Soil	Soil	Soil	Water			
		UNITS ----->	NG/KG	NG/KG	NG/KG	pg/l			
CAS #	Parameter	L5557	VAL	L5557	VAL	L5557	VAL	L5557	VAL
67562-39-4	1234678-HpCDF	17.3		1.5	U	3.		4.7	U
60851-34-5	234678-HxCDF	0.57	U	0.4	U	0.38	U	3.6	U
1746-01-6	2378-TCDD	0.2	U	0.2	U	0.2	U	2.7	U
40321-76-4	12378-PeCDD	0.3	U	1.4		0.3	U	4.5	U
39227-28-6	123478-HxCDD	0.3	U	3.3		0.3	U	5.5	U
57653-85-7	123678-HxCDD	0.52		4.9		0.21	EMPC	5.4	U
19408-74-3	123789-HxCDD	0.43		11.3		0.23	EMPC	5.	U
35822-46-9	1234678-HpCDD	11.1		192.		4.6		7.3	U
3268-87-9	OCDD	132.		3610.		47.4		10.3	U
51207-31-9	2378-TCDF	0.68		0.42	EMPC	0.91		2.6	U
57117-41-6	12378-PeCDF	0.3	U	0.2	U	0.2	U	3.4	U
57117-31-4	23478-PeCDF	0.2	U	0.2	U	0.2	U	3.2	U
70648-26-9	123478-HxCDF	0.26	EMPC	0.42		0.37		5.3	U
57117-44-9	123678-HxCDF	0.31		0.14	EMPC	0.16		3.9	U
72918-21-9	123789-HxCDF	0.2	U	0.2	U	0.2	U	5.6	U
55673-89-7	1234789-HpCDF	0.2	U	0.06	U	0.2	U	6.9	U
39001-02-0	OCDF	21.9		3.1	B	3.7		7.4	U
41903-57-5	Total Tetra-Dioxins	2.	EMPC	13.	EMPC	0.55		2.7	U
36088-22-9	Total Penta-Dioxins	1.2	EMPC	34.8	EMPC	0.41	EMPC	4.5	U
34465-46-8	Total Hexa-Dioxins	4.9		283.	EMPC	2.9	EMPC	5.3	U
37871-00-4	Total Hepta-Dioxins	21.4		646.		11.2		7.3	U
55722-27-5	Total Tetra-Furans	5.9	EMPC	1.8	EMPC	2.6	EMPC	2.6	U
30602-15-4	Total Penta-Furans	1.6		1.2	EMPC	0.89		3.3	U
55684-94-1	Total Hexa-Furans	8.4	EMPC	2.7	EMPC	3.	EMPC	3.6	
38998-75-3	Total Hepta-Furans	33.4		3.5	EMPC	5.3		5.6	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-HERB		SAMPLE ID ----->	507-C-B004-01	GDB-C-B001-01	GDB-C-B008-01	GDB-H-W040-01			
		ORIGINAL ID ----->	507CB00401	GDBC00101	GDBC00801	GDBHW04001			
		LAB SAMPLE ID ---->	L5530-5	L5530-6	L5530-4	L6022-18			
		ID FROM REPORT -->	507CB00401	GDBC00101	GDBC00801	GDBHW04001			
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	12/11/95			
		DATE EXTRACTED -->	10/16/95	10/16/95	10/16/95	12/18/95			
		DATE ANALYZED ---->	10/25/95	10/25/95	10/25/95	12/27/95			
		MATRIX ----->	Soil	Soil	Soil	Water			
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/L			
CAS #	Parameter	L5530	VAL	L5530	VAL	L5530	VAL	L6022	VAL
94-75-7	2,4-D	170.	U	230.	UJ	170.	U	4.	U
93-72-1	2,4,5-TP (Silvex)	55.	U	75.	UJ	55.	U	0.56	U
93-76-5	2,4,5-T	55.	U	75.	UJ	55.	U	0.66	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SUB46-META		SAMPLE ID -----> 507-S-8001-01		507-S-8001-02		507-S-8002-01		507-S-8002-02		507-S-8003-01		507-S-8003-02	
		ORIGINAL ID -----> 507S800101		507S800102		507S800201		507S800202		507S800301		507S800302	
		LAB SAMPLE ID ----> L5540-89		L5540-90		L5540-107		L5540-108		L5540-109		L5540-110	
		ID FROM REPORT --> 507S800101		507S800102		507S800201		507S800202		507S800301		507S800302	
		SAMPLE DATE -----> 10/04/95		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95	
		DATE EXTRACTED --> 10/12/95		10/12/95		10/12/95		10/12/95		10/12/95		10/12/95	
		DATE ANALYZED ----> 10/22/95		10/22/95		10/22/95		10/22/95		10/22/95		10/22/95	
		MATRIX -----> Soil		Soil		Soil		Soil		Soil		Soil	
		UNITS -----> MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
CAS #	Parameter	L5540S	VAL	L5540S	VAL	L5540S	VAL	L5540S	VAL	L5540S	VAL	L5540S	VAL
7429-90-5	Aluminum (Al)	7510.		2990.		8100.		2330.		7300.		4790.	
7440-36-0	Antimony (Sb)	12.5	U	12.	U	11.5	U	12.2	U	11.9	U	12.4	U
7440-38-2	Arsenic (As)	3.	J	0.94	U	4.7		0.96	U	5.4		1.2	J
7440-39-3	Barium (Ba)	35.7	J	13.8	J	52.8		13.7	J	51.2		25.6	J
7440-41-7	Beryllium (Be)	0.38	J	0.24	U	0.38	J	0.24	U	0.35	J	0.3	J
7440-43-9	Cadmium (Cd)	1.2	U	1.2	U	1.1	U	1.2	U	1.2	U	1.2	U
7440-70-2	Calcium (Ca)	944.	J	286.	J	4390.		969.	J	3580.		535.	J
7440-47-3	Chromium (Cr)	9.1		2.9		9.3		3.3		18.1		4.6	
7440-48-4	Cobalt (Co)	1.5	U	1.4	U	1.4	U	1.4	U	1.4	U	1.5	U
7440-50-8	Copper (Cu)	9.4		0.92	J	20.3		2.6	J	13.9		4.9	J
7439-89-6	Iron (Fe)	3930.		1320.		5050.		976.		8020.		1770.	
7439-92-1	Lead (Pb)	61.6	J	3.3	J	194.	J	12.2	J	130.	J	6.7	J
7439-95-4	Magnesium (Mg)	375.	J	159.	J	532.	J	161.	J	543.	J	265.	J
7439-96-5	Manganese (Mn)	115.		10.5		280.		22.7		197.		19.	
7439-97-6	Mercury (Hg)	0.12	U	0.12	U	0.16		0.12	U	0.16		0.12	U
7440-02-0	Nickel (Ni)	5.	J	4.5	J	8.5	J	3.4	U	7.9	J	3.4	U
7440-09-7	Potassium (K)	128.	UJ	123.	UJ	203.	J	125.	UJ	146.	J	126.	UJ
7782-49-2	Selenium (Se)	0.73	U	0.71	U	0.68	U	0.72	U	0.7	U	0.72	U
7440-22-4	Silver (Ag)	1.6	J	0.71	U	0.81	J	1.5	J	1.2	J	0.73	U
7440-23-5	Sodium (Na)	211.	J	172.	J	233.	J	205.	J	220.	J	183.	J
7440-28-0	Thallium (Tl)	0.97	U	0.94	U	0.9	U	0.96	U	0.93	U	0.95	U
7440-62-2	Vanadium (V)	7.4	J	0.94	UJ	9.6	J	0.96	UJ	10.5	J	3.5	J
7440-66-6	Zinc (Zn)	60.9		6.3		182.		11.3		118.		11.6	
7440-31-5	Tin (Sn)	9.1	U	8.7	U	8.4	U	8.9	U	8.6	U	9.	U
57-12-5	Cyanide (CN)	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-META		SAMPLE ID -----> 507-S-B004-01	507-C-B004-01	507-S-B004-02	507-S-B005-01	507-S-B005-02	GDB-S-B001-01						
		ORIGINAL ID -----> 507SB00401	507CB00401	507SB00402	507SB00501	507SB00502	GDBSB00101						
		LAB SAMPLE ID ----> L5540-115	L5530-2	L5540-116	L5540-111	L5540-114	L5540-124						
		ID FROM REPORT --> 507SB00401	507CB00401	507SB00402	507SB00501	507SB00502	GDBSB00101						
		SAMPLE DATE -----> 10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95						
		DATE EXTRACTED --> 10/12/95	10/11/95	10/12/95	10/12/95	10/12/95	10/12/95						
		DATE ANALYZED ----> 10/22/95	10/22/95	10/22/95	10/22/95	10/22/95	10/22/95						
		MATRIX -----> Soil	Soil	Soil	Soil	Soil	Soil						
		UNITS -----> MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG						
CAS #	Parameter	L5540S	VAL	L5530S	VAL	L5540S	VAL	L5540S	VAL	L5540S	VAL		
7429-90-5	Aluminum (Al)	6600.		5180.		3970.		7470.		6530.		55500.	
7440-36-0	Antimony (Sb)	11.5	U	11.5	U	12.2	U	11.8	U	12.	U	15.7	U
7440-38-2	Arsenic (As)	3.4		4.3		1.1	J	1.7	J	1.4	J	12.3	
7440-39-3	Barium (Ba)	23.6	J	19.6	J	20.5	J	44.5	J	41.7	J	57.7	J
7440-41-7	Beryllium (Be)	0.25	J	0.24	J	0.24	U	0.44	J	0.3	J	1.7	
7440-43-9	Cadmium (Cd)	1.1	U	1.1	U	1.2	U	1.2	U	1.2	U	1.5	U
7440-70-2	Calcium (Ca)	508.	J	388.	J	313.	J	2630.		1280.		5380.	
7440-47-3	Chromium (Cr)	7.2		5.		4.5		6.		7.4		74.3	
7440-48-4	Cobalt (Co)	1.5	J	1.4	U	1.4	U	3.3	J	2.7	J	11.4	J
7440-50-8	Copper (Cu)	4.6	J	3.3	J	1.7	J	3.	J	2.8	J	37.5	
7439-89-6	Iron (Fe)	3150.		2700.		1920.		3360.		2560.		48700.	
7439-92-1	Lead (Pb)	17.1	J	17.3		3.6	J	9.2	J	3.8	J	63.	J
7439-95-4	Magnesium (Mg)	304.	J	247.	J	271.	J	398.	J	383.	J	6990.	
7439-96-5	Manganese (Mn)	57.7		43.3		9.9		258.		48.4		420.	
7439-97-6	Mercury (Hg)	0.11	U	0.11	U	0.12	U	0.12	U	0.12	U	0.38	
7440-02-0	Nickel (Ni)	5.	J	5.8	J	3.8	J	4.3	J	3.6	J	29.4	
7440-09-7	Potassium (K)	117.	UJ	138.	J	125.	UJ	161.	J	275.	J	3570.	J
7782-49-2	Selenium (Se)	0.69	U	0.77	J	0.7	U	0.69	U	0.71	U	1.7	
7440-22-4	Silver (Ag)	0.68	U	1.	U	0.72	U	0.69	U	0.7	U	0.93	U
7440-23-5	Sodium (Na)	193.	J	181.	J	198.	J	206.	J	187.	J	6670.	
7440-28-0	Thallium (Tl)	0.92	U	0.91	U	0.94	U	0.93	U	0.95	U	1.3	U
7440-62-2	Vanadium (V)	7.5	J	4.9	J	4.4	J	5.4	J	5.2	J	101.	
7440-66-6	Zinc (Zn)	15.2		9.8		7.8		14.4		12.4		148.	
7440-31-5	Tin (Sn)	8.3	U	8.3	U	8.9	U	8.6	U	8.7	U	11.4	U
57-12-5	Cyanide (CN)	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SUB46-META		SAMPLE ID ----->	GDB-C-B001-01	GDB-S-B001-02	GDB-S-B002-01	GDB-S-B002-02	GDB-S-B003-01	GDB-S-B004-01	
		ORIGINAL ID ----->	GDBC00101	GDBS00102	GDBS00201	GDBS00202	GDBS00301	GDBS00401	
		LAB SAMPLE ID ---->	L5530-3	L5540-125	L5540-122	L5540-123	L5540-88	L5540-119	
		ID FROM REPORT -->	GDBC00101	GDBS00102	GDBS00201	GDBS00202	GDBS00301	GDBS00401	
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	
		DATE EXTRACTED -->	10/11/95	10/12/95	10/12/95	10/12/95	10/12/95	10/12/95	
		DATE ANALYZED ---->	10/22/95	10/22/95	10/22/95	10/22/95	10/22/95	10/22/95	
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil	
		UNITS ----->	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	
CAS #	Parameter	L5530S	VAL	L5540S	VAL	L5540S	VAL	L5540S	VAL
7429-90-5	Aluminum (Al)	40300.		55600.		39500.		11500.	6320.
7440-36-0	Antimony (Sb)	15.1	U	25.3	U	13.3	U	12.7	10.4
7440-38-2	Arsenic (As)	26.9		33.9		22.1		9.	1.7
7440-39-3	Barium (Ba)	50.9	J	65.	J	94.7	J	29.6	32.2
7440-41-7	Beryllium (Be)	1.2	J	1.7	J	1.2	J	0.44	0.2
7440-43-9	Cadmium (Cd)	1.5	U	2.5	U	1.3	U	1.2	1.
7440-70-2	Calcium (Ca)	11400.		24900.		10400.		11400.	792.
7440-47-3	Chromium (Cr)	53.3		75.7		54.8		20.	9.
7440-48-4	Cobalt (Co)	7.	J	10.6	J	9.4	J	2.	1.4
7440-50-8	Copper (Cu)	33.5	J	47.		122.		14.2	9.4
7439-89-6	Iron (Fe)	42600.		49100.		38000.		11500.	2630.
7439-92-1	Lead (Pb)	50.2		78.6	J	310.	J	79.6	48.3
7439-95-4	Magnesium (Mg)	5490.		9070.		4380.		1480.	299.
7439-96-5	Manganese (Mn)	579.		744.		454.		178.	62.
7439-97-6	Mercury (Hg)	0.39		2.		0.77		1.3	0.1
7440-02-0	Nickel (Ni)	23.6		25.		19.8		10.6	3.4
7440-09-7	Potassium (K)	2500.		4720.	J	2260.	J	791.	430.
7782-49-2	Selenium (Se)	0.9	U	2.1	J	1.9		0.75	0.62
7440-22-4	Silver (Ag)	1.	U	1.5	U	0.78	U	1.1	0.61
7440-23-5	Sodium (Na)	5490.		12600.		366.	J	298.	179.
7440-28-0	Thallium (Tl)	1.2	U	2.	U	1.1	U	1.	0.83
7440-62-2	Vanadium (V)	78.9		102.		71.9		22.7	8.6
7440-66-6	Zinc (Zn)	132.		199.		266.		88.2	64.2
7440-31-5	Tin (Sn)	14.8	J	20.4	J	9.6	U	9.4	8.2
57-12-5	Cyanide (CN)	??????????		??????????		??????????		??????????	??????????

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-META		SAMPLE ID ----->	GDB-S-B004-02	GDB-S-B005-01	GDB-S-B005-02	GDB-S-B006-01	GDB-S-B006-02	GDB-S-B007-01	
		ORIGINAL ID ----->	GDBS800402	GDBS800501	GDBS800502	GDBS800601	GDBS800602	GDBS800701	
		LAB SAMPLE ID ---->	L5540-121	L5540-128	L5540-129	L5540-126	L5540-127	L5540-103	
		ID FROM REPORT -->	GDBS800402	GDBS800501	GDBS800502	GDBS800601	GDBS800602	GDBS800701	
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	
		DATE EXTRACTED -->	10/12/95	10/12/95	10/12/95	10/12/95	10/12/95	10/12/95	
		DATE ANALYZED ---->	10/22/95	10/22/95	10/22/95	10/22/95	10/22/95	10/22/95	
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil	
		UNITS ----->	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	
CAS #	Parameter	L5540S	VAL	L5540S	VAL	L5540S	VAL	L5540S	VAL
7429-90-5	Aluminum (Al)	3530.		9910.		3790.		10200.	
7440-36-0	Antimony (Sb)	10.6	U	10.8	U	12.	U	11.2	U
7440-38-2	Arsenic (As)	0.84	U	5.3		0.96	U	4.	
7440-39-3	Barium (Ba)	20.1	J	56.5		22.2	J	34.9	J
7440-41-7	Beryllium (Be)	0.21	U	0.57	J	0.23	U	0.35	J
7440-43-9	Cadmium (Cd)	1.	U	1.1	U	1.2	U	1.1	U
7440-70-2	Calcium (Ca)	425.	J	1640.		329.	J	835.	J
7440-47-3	Chromium (Cr)	4.4		14.1		4.5		14.6	
7440-48-4	Cobalt (Co)	1.2	U	5.4	J	1.4	U	2.1	J
7440-50-8	Copper (Cu)	1.3	J	38.4		2.1	J	21.2	
7439-89-6	Iron (Fe)	2170.		6980.		2300.		6260.	
7439-92-1	Lead (Pb)	2.2	J	44.9	J	2.4	J	47.8	J
7439-95-4	Magnesium (Mg)	288.	J	581.	J	252.	J	429.	J
7439-96-5	Manganese (Mn)	20.6		192.		46.1		81.3	
7439-97-6	Mercury (Hg)	0.11	U	0.11	U	0.12	U	0.11	U
7440-02-0	Nickel (Ni)	2.9	U	11.1		3.3	U	5.1	J
7440-09-7	Potassium (K)	108.	UJ	350.	J	216.	J	219.	J
7782-49-2	Selenium (Se)	0.63	U	0.78	J	0.72	U	0.66	U
7440-22-4	Silver (Ag)	0.62	U	0.63	U	0.7	U	0.66	U
7440-23-5	Sodium (Na)	191.	J	248.	J	207.	J	213.	J
7440-28-0	Thallium (Tl)	0.84	U	0.85	U	0.96	U	0.88	U
7440-62-2	Vanadium (V)	4.2	J	17.		4.9	J	17.6	
7440-66-6	Zinc (Zn)	7.2		194.		6.		86.4	
7440-31-5	Tin (Sn)	7.7	U	13.7	J	8.7	U	8.1	U
57-12-5	Cyanide (CN)	??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SUB46-META		SAMPLE ID ----->	GDB-S-8007-02	GDB-S-8008-01	GDB-C-8008-01	GDB-S-8008-02	GDB-S-8009-01	GDB-S-8009-02					
		ORIGINAL ID ----->	GDBSB00702	GDBSB00801	GDBCB00801	GDBSB00802	GDBSB00901	GDBSB00902					
		LAB SAMPLE ID ---->	L5540-104	L5540-101	L5530-1	L5540-102	L5540-105	L5540-106					
		ID FROM REPORT -->	GDBSB00702	GDBSB00801	GDBCB00801	GDBSB00802	GDBSB00901	GDBSB00902					
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95					
		DATE EXTRACTED -->	10/12/95	10/12/95	10/11/95	10/12/95	10/12/95	10/12/95					
		DATE ANALYZED ---->	10/22/95	10/22/95	10/22/95	10/22/95	10/22/95	10/22/95					
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil					
		UNITS ----->	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG					
CAS #	Parameter	L5540S	VAL	L5540S	VAL	L5530S	VAL	L5540S	VAL	L5540S	VAL		
7429-90-5	Aluminum (Al)	10100.		8250.		8520.		1970.		7250.		4930.	
7440-36-0	Antimony (Sb)	12.2	U	10.7	U	10.8	U	10.6	U	11.1	U	11.2	U
7440-38-2	Arsenic (As)	3.4		2.	J	2.	J	0.83	U	4.2		1.2	J
7440-39-3	Barium (Ba)	38.1	J	40.4	J	41.6	J	13.2	J	29.4	J	23.1	J
7440-41-7	Beryllium (Be)	0.29	J	0.43	J	0.45	J	0.21	U	0.28	J	0.22	U
7440-43-9	Cadmium (Cd)	1.2	U	1.	U	1.1	U	1.	U	1.1	U	1.1	U
7440-70-2	Calcium (Ca)	580.	J	2020.		1380.		331.	J	3400.		589.	J
7440-47-3	Chromium (Cr)	10.4		6.		5.9		2.6		11.		4.4	
7440-48-4	Cobalt (Co)	3.	J	1.3	U	1.3	U	1.2	U	1.3	U	1.3	U
7440-50-8	Copper (Cu)	2.4	J	5.8		5.9	J	1.1	J	10.1		1.7	J
7439-89-6	Iron (Fe)	7520.		2910.		3220.		1470.		3460.		3380.	
7439-92-1	Lead (Pb)	5.5	J	13.5	J	12.7		1.4	J	58.	J	3.2	J
7439-95-4	Magnesium (Mg)	573.	J	341.	J	345.	J	147.	J	342.	J	319.	J
7439-96-5	Manganese (Mn)	135.		298.		306.		45.7		157.		31.2	
7439-97-6	Mercury (Hg)	0.12	U	0.11	U	0.11	U	0.11	U	0.12		0.11	U
7440-02-0	Nickel (Ni)	7.1	J	7.2	J	5.8	J	2.9	U	7.6	J	3.1	U
7440-09-7	Potassium (K)	176.	J	109.	UJ	110.	U	108.	UJ	145.	J	114.	UJ
7782-49-2	Selenium (Se)	0.71	U	0.62	U	0.64	U	0.63	U	0.65	U	0.65	U
7440-22-4	Silver (Ag)	1.5	J	0.63	U	0.84	U	1.2	J	0.81	J	1.7	J
7440-23-5	Sodium (Na)	183.	J	165.	J	180.	J	159.	J	201.	J	170.	J
7440-28-0	Thallium (Tl)	0.95	U	0.83	U	0.86	U	0.83	U	0.87	U	0.87	U
7440-62-2	Vanadium (V)	12.2	J	6.6	J	7.7	J	0.83	UJ	6.5	J	3.3	J
7440-66-6	Zinc (Zn)	14.		19.3		21.4		4.5		30.1		7.6	
7440-31-5	Tin (Sn)	8.9	U	10.6	J	7.9	U	7.7	U	8.1	U	8.1	U
57-12-5	Cyanide (CN)	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SM846-META		GDB-S-B010-01		GDB-S-B010-02		GDB-S-B011-01		GDB-S-B011-02		GDB-S-B012-01		GDB-S-B012-02	
SAMPLE ID ----->		GDBS801001		GDBS801002		GDBS801101		GDBS801102		GDBS801201		GDBS801202	
ORIGINAL ID ----->		L5540-130		L5540-131		L5540-99		L5540-100		L5540-97		L5540-98	
LAB SAMPLE ID ---->		GDBS801001		GDBS801002		GDBS801101		GDBS801102		GDBS801201		GDBS801202	
ID FROM REPORT -->		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95	
SAMPLE DATE ----->		10/12/95		10/12/95		10/12/95		10/12/95		10/12/95		10/12/95	
DATE EXTRACTED -->		10/22/95		10/22/95		10/22/95		10/22/95		10/22/95		10/22/95	
DATE ANALYZED ---->		Soil		Soil		Soil		Soil		Soil		Soil	
MATRIX ----->		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
UNITS ----->		A		A		A		A		A		A	
CAS #	Parameter	L5540S	VAL										
7429-90-5	Aluminum (Al)	8350.		9640.		24000.		6630.		7550.		11200.	
7440-36-0	Antimony (Sb)	12.1	U	14.6	U	15.3	U	13.9	U	11.1	U	11.1	U
7440-38-2	Arsenic (As)	6.7		4.7		28.7		11.7		2.1	J	1.7	J
7440-39-3	Barium (Ba)	56.7		19.7	J	46.7	J	14.8	J	14.9	J	47.3	
7440-41-7	Beryllium (Be)	0.34	J	0.29	U	0.88	J	0.39	J	0.22	U	0.48	J
7440-43-9	Cadmium (Cd)	1.2	U	1.4	U	1.5	U	1.4	U	1.1	U	1.1	U
7440-70-2	Calcium (Ca)	115000.		182000.		7470.		982.	J	406.	J	559.	J
7440-47-3	Chromium (Cr)	35.7		48.1		38.9		11.4		6.6		5.9	
7440-48-4	Cobalt (Co)	3.2	J	1.9	J	5.3	J	1.6	U	1.3	U	1.3	U
7440-50-8	Copper (Cu)	18.3		14.1		28.2		1.1	J	3.8	J	1.8	J
7439-89-6	Iron (Fe)	6110.		6470.		28300.		26000.		2760.		3380.	
7439-92-1	Lead (Pb)	76.1	J	9.	J	75.	J	4.1	J	12.9	J	3.4	J
7439-95-4	Magnesium (Mg)	3640.		6120.		3680.		1500.		226.	J	407.	J
7439-96-5	Manganese (Mn)	39.3		37.5		371.		53.8		27.2		99.2	
7439-97-6	Mercury (Hg)	0.12	U	0.15	U	1.5		0.14	U	0.11	U	0.11	U
7440-02-0	Nickel (Ni)	18.8		20.6		16.4		6.5	J	4.7	J	7.5	J
7440-09-7	Potassium (K)	1010.	J	970.	J	1540.	J	609.	J	113.	UJ	114.	UJ
7782-49-2	Selenium (Se)	2.8		3.8		0.9	U	0.81	U	0.66	U	0.67	U
7440-22-4	Silver (Ag)	0.71	U	0.86	U	1.7	J	1.3	J	0.65	U	1.4	J
7440-23-5	Sodium (Na)	574.	J	844.	J	837.	J	1600.		174.	J	166.	J
7440-28-0	Thallium (Tl)	0.94	U	1.2	U	1.2	U	1.1	U	0.88	U	0.89	U
7440-62-2	Vanadium (V)	24.5		28.3		51.6		16.2		6.6	J	4.6	J
7440-66-6	Zinc (Zn)	61.7		70.2		178.		8.8		18.2		8.1	
7440-31-5	Tin (Sn)	8.8	U	10.6	U	12.5	J	10.1	U	8.1	U	8.2	J
57-12-5	Cyanide (CN)	???????????		???????????		???????????		???????????		???????????		???????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-META		SAMPLE ID ----->	GDB-S-B013-01	GDB-S-B013-02	GDB-S-B014-01	GDB-S-B014-02	GDB-S-B015-01	GDB-S-B015-02	
		ORIGINAL ID ----->	GDBSB01301	GDBSB01302	GDBSB01401	GDBSB01402	GDBSB01501	GDBSB01502	
		LAB SAMPLE ID ---->	L5540-95	L5540-96	L5540-91	L5540-94	L5540-117	L5540-118	
		ID FROM REPORT -->	GDBSB01301	GDBSB01302	GDBSB01401	GDBSB01402	GDBSB01501	GDBSB01502	
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	
		DATE EXTRACTED -->	10/12/95	10/12/95	10/12/95	10/12/95	10/12/95	10/12/95	
		DATE ANALYZED -->	10/22/95	10/22/95	10/22/95	10/22/95	10/22/95	10/22/95	
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil	
		UNITS ----->	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	
CAS #	Parameter	L5540S	VAL	L5540S	VAL	L5540S	VAL	L5540S	VAL
7429-90-5	Aluminum (Al)	13100.		14900.		11200.		10700.	
7440-36-0	Antimony (Sb)	12.1	U	13.5	U	10.9	U	12.8	J
7440-38-2	Arsenic (As)	12.3		10.8		3.5		0.89	U
7440-39-3	Barium (Ba)	36.2	J	23.1	J	59.		44.2	
7440-41-7	Beryllium (Be)	0.46	J	0.55	J	0.59	J	0.31	J
7440-43-9	Cadmium (Cd)	1.2	U	1.3	U	1.1	U	1.1	U
7440-70-2	Calcium (Ca)	31500.		7340.		614.	J	59900.	
7440-47-3	Chromium (Cr)	29.3		23.7		10.1		22.1	
7440-48-4	Cobalt (Co)	2.7	J	2.7	J	1.7	J	2.7	J
7440-50-8	Copper (Cu)	23.3		15.8		10.2		29.6	J
7439-89-6	Iron (Fe)	11700.		15100.		5290.		10400.	
7439-92-1	Lead (Pb)	50.9	J	24.4	J	43.7	J	25.7	J
7439-95-4	Magnesium (Mg)	2020.		1620.		538.	J	1030.	J
7439-96-5	Manganese (Mn)	162.		152.		243.		224.	
7439-97-6	Mercury (Hg)	0.25		0.18		0.11	U	0.27	
7440-02-0	Nickel (Ni)	14.		13.7		8.	J	10.9	
7440-09-7	Potassium (K)	562.	J	471.	J	218.	J	481.	J
7782-49-2	Selenium (Se)	0.69	U	0.81	U	0.66	U	1.6	
7440-22-4	Silver (Ag)	1.7	J	1.8	J	0.72	J	0.66	U
7440-23-5	Sodium (Na)	428.	J	290.	J	193.	J	638.	J
7440-28-0	Thallium (Tl)	0.93	U	1.1	U	0.88	U	0.89	U
7440-62-2	Vanadium (V)	25.6		31.4		10.1	J	15.8	
7440-66-6	Zinc (Zn)	135.		66.4		30.5		166.	
7440-31-5	Tin (Sn)	10.1	J	9.8	U	7.9	U	8.8	U
57-12-5	Cyanide (CN)	??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-META		SAMPLE ID ----->	GDB-G-W001-01	GDB-G-W002-01	GDB-G-W003-01	GDB-G-W004-01	GDB-G-W010-01	GDB-G-W040-01					
		ORIGINAL ID ----->	GDBGW00101	GDBGW00201	GDBGW00301	GDBGW00401	GDBGW01001	GDBGW04001					
		LAB SAMPLE ID ----->	L6024-77	L6024-78	L6024-79	L6024-81	L6024-76	L6024-83					
		ID FROM REPORT ----->	GDBGW00101	GDBGW00201	GDBGW00301	GDBGW00401	GDBGW01001	GDBGW04001					
		SAMPLE DATE ----->	12/09/95	12/09/95	12/10/95	12/10/95	12/09/95	12/11/95					
		DATE EXTRACTED ----->	12/22/95	12/22/95	12/22/95	12/26/95	12/22/95	12/22/95					
		DATE ANALYZED ----->	12/26/95	12/26/95	12/26/95	12/27/95	12/26/95	12/26/95					
		MATRIX ----->	Water	Water	Water	Water	Water	Water					
		UNITS ----->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L					
CAS #	Parameter	L6024	VAL	L6024	VAL	L6024	VAL	L6024	VAL	L6024	VAL		
7429-90-5	Aluminum (Al)	109.	J	87.4	J	92.6	J	185.	J	21.	U	56.7	J
7440-36-0	Antimony (Sb)	51.	U	51.	U	51.	U	51.	U	51.	U	51.	U
7440-38-2	Arsenic (As)	7.6	J	8.1	J	15.5	J	4.	U	4.	U	4.	U
7440-39-3	Barium (Ba)	89.7	J	21.1	J	38.2	J	22.9	J	106.	J	14.	U
7440-41-7	Beryllium (Be)	1.	U	1.	U	1.	U	1.	U	1.	U	1.	U
7440-43-9	Cadmium (Cd)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
7440-70-2	Calcium (Ca)	467000.	J	95300.	J	154000.	J	13700.	J	327000.	J	50700.	J
7440-47-3	Chromium (Cr)	4.	U	11.	U	4.	U	4.	U	4.	U	4.	U
7440-48-4	Cobalt (Co)	6.	U	6.	U	6.	U	6.	U	6.	U	6.	U
7440-50-8	Copper (Cu)	3.	U	3.	U	3.	U	3.	U	3.	U	3.	U
7439-89-6	Iron (Fe)	588.		299.		8070.		231.		40.2	U	184.	
7439-92-1	Lead (Pb)	30.	UJ	15.	U	3.	U	3.	U	15.	UJ	3.4	
7439-95-4	Magnesium (Mg)	771000.	J	182000.	J	108000.	J	8740.	J	405000.	J	5800.	J
7439-96-5	Manganese (Mn)	2060.		763.		794.		60.2		504.		58.8	
7439-97-6	Mercury (Hg)	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
7440-02-0	Nickel (Ni)	14.	U	14.	U	14.	U	14.	U	14.	U	14.4	J
7440-09-7	Potassium (K)	214000.		89600.		55100.		1450.	J	124000.		3640.	J
7782-49-2	Selenium (Se)	3.	UJ	3.	UJ	3.	UJ	3.	U	3.	UJ	3.	U
7440-22-4	Silver (Ag)	3.	U	3.	U	3.	U	3.	U	3.	U	3.	U
7440-23-5	Sodium (Na)	6200000.	J	1990000.	J	1010000.	J	29600.	J	3290000.	J	74200.	J
7440-28-0	Thallium (Tl)	40.	UJ	40.	UJ	40.	UJ	4.	U	40.	UJ	4.	U
7440-62-2	Vanadium (V)	12.9	J	4.	U	4.	U	4.	U	4.	U	4.	U
7440-66-6	Zinc (Zn)	3.	U	8.1	J	5.9	J	16.9	J	5.6	U	9.1	J
7440-31-5	Tin (Sn)	???????????		???????????		???????????		???????????		???????????		???????????	
57-12-5	Cyanide (CN)	???????????		???????????		???????????		???????????		???????????		???????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-META		SAMPLE ID ----->	GDB-H-W04D-01				
		ORIGINAL ID ----->	GDBHW04D01				
		LAB SAMPLE ID ---->	L6022-12				
		ID FROM REPORT -->	GDBHW04D01				
		SAMPLE DATE ----->	12/11/95				
		DATE EXTRACTED -->	12/22/95				
		DATE ANALYZED ---->	12/26/95				
		MATRIX ----->	Water				
		UNITS ----->	UG/L	A			
CAS #	Parameter	L6022W	VAL				
7429-90-5	Aluminum (Al)	45.1	J				
7440-36-0	Antimony (Sb)	51.	U				
7440-38-2	Arsenic (As)	4.	U				
7440-39-3	Barium (Ba)	14.	UJ				
7440-41-7	Beryllium (Be)	1.	UJ				
7440-43-9	Cadmium (Cd)	5.	U				
7440-70-2	Calcium (Ca)	50100.	J				
7440-47-3	Chromium (Cr)	4.	J				
7440-48-4	Cobalt (Co)	6.	UJ				
7440-50-8	Copper (Cu)	3.	U				
7439-89-6	Iron (Fe)	128.	J				
7439-92-1	Lead (Pb)	3.	UR				
7439-95-4	Magnesium (Mg)	5720.	J				
7439-96-5	Manganese (Mn)	57.6	J				
7439-97-6	Mercury (Hg)	0.2	U				
7440-02-0	Nickel (Ni)	14.	UJ				
7440-09-7	Potassium (K)	3290.	J				
7782-49-2	Selenium (Se)	3.	UR				
7440-22-4	Silver (Ag)	3.	U				
7440-23-5	Sodium (Na)	73000.					
7440-28-0	Thallium (Tl)	4.	UR				
7440-62-2	Vanadium (V)	4.	U				
7440-66-6	Zinc (Zn)	3.9	J				
7440-31-5	Tin (Sn)	???????????					
57-12-5	Cyanide (CN)	???????????					

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SUB46-CP P		SAMPLE ID -----> 507-C-8004-01		GDB-C-8001-01		GDB-C-8008-01		GDB-H-W04D-01	
		ORIGINAL ID -----> 507C800401		GDBC800101		GDBC800801		GDBHW04D01	
		LAB SAMPLE ID ----> L5530-5		L5530-6		L5530-4		L6022-17	
		ID FROM REPORT --> 507C800401		GDBC800101		GDBC800801		GDBHW04D01	
		SAMPLE DATE -----> 10/04/95		10/04/95		10/04/95		12/11/95	
		DATE EXTRACTED --> 10/17/95		10/17/95		10/17/95		12/18/95	
		DATE ANALYZED ----> 10/24/95		10/24/95		10/24/95		12/21/95	
		MATRIX -----> Soil		Soil		Soil		Water	
		UNITS -----> UG/KG		UG/KG		UG/KG		UG/L	
CAS #	Parameter	L5530	VAL	L5530	VAL	L5530	VAL	L6022	VAL
60-51-5	Dimethoate	55.	U	75.	U	55.	U	3.	UJ
298-04-4	Disulfoton	55.	U	75.	U	55.	U	2.	U
52-85-7	Famphur	55.	U	75.	U	55.	U	3.	U
56-38-2	Parathion	55.	U	75.	U	55.	U	3.	U
298-00-0	Methyl parathion	55.	U	75.	U	55.	U	3.	U
298-02-2	Phorate	55.	UJ	75.	UJ	55.	UJ	2.	U
3689-24-5	Sulfotep	55.	UJ	75.	UJ	55.	UJ	3.	U
297-97-2	Thionazin	55.	UJ	75.	UJ	55.	UJ	3.	U
126-68-1	O,O,O-Triethylphosphorothioate	55.	U	75.	U	55.	U	3.	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-PEST		SAMPLE ID ----->	507-C-B004-01	GDB-S-B001-01	GDB-C-B001-01	GDB-S-B001-02	GDB-S-B002-01	GDB-S-B002-02			
		ORIGINAL ID ----->	507CB00401	GDBS800101	GDBC800101	GDBS800102	GDBS800201	GDBS800202			
		LAB SAMPLE ID ---->	L5530-5	L5540-80	L5530-6	L5540-81	L5540-78	L5540-79			
		ID FROM REPORT -->	507CB00401	GDBS800101	GDBC800101	GDBS800102	GDBS800201	GDBS800202			
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95			
		DATE EXTRACTED -->	10/16/95	10/15/95	10/16/95	10/15/95	10/18/95	10/18/95			
		DATE ANALYZED ---->	11/03/95	10/23/95	11/04/95	10/23/95	10/27/95	10/27/95			
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil			
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG			
CAS #	Parameter	L5530	VAL	L5540	VAL	L5530	VAL	L5540	VAL	L5540	VAL
319-84-6	alpha-BHC	1.9	U	2.7	U	2.6	U	4.3	U	2.2	U
319-85-7	beta-BHC	1.9	U	2.7	U	2.6	UJ	4.3	U	2.2	U
58-89-9	gamma-BHC (Lindane)	1.9	U	2.7	U	2.6	U	4.3	U	2.2	U
319-86-8	delta-BHC	1.9	U	2.7	U	2.6	UJ	4.3	U	2.2	U
76-44-8	Heptachlor	1.9	U	2.7	U	2.6	U	4.3	U	2.2	U
309-00-2	Aldrin	1.9	U	2.7	U	2.6	UJ	4.3	U	2.2	U
1024-57-3	Heptachlor epoxide	1.9	U	2.7	U	2.6	UJ	4.3	U	2.2	U
5103-74-2	gamma-Chlordane	1.9	U	1.6	J	2.6	UJ	4.3	U	2.2	U
959-98-8	Endosulfan I	1.9	U	2.7	U	2.6	U	4.3	U	2.2	U
5103-71-9	alpha-Chlordane	1.9	U	2.7	U	2.6	UJ	4.3	U	2.2	U
72-55-9	4,4'-DDE	21.		8.2		5.	UJ	8.3	U	4.3	U
50-29-3	4,4'-DDT	13.		11.	U	5.	U	8.3	U	8.3	U
60-57-1	Dieldrin	3.6	U	5.3	U	5.	U	8.3	U	4.3	U
72-20-8	Endrin	3.6	U	5.3	U	5.	U	8.3	U	4.3	U
33213-65-9	Endosulfan II	3.6	U	5.3	U	5.	UJ	8.3	U	4.3	U
72-54-8	4,4'-DDD	1.7	J	5.3	U	5.	U	8.3	U	4.3	U
7421-93-4	Endrin aldehyde	3.6	U	5.3	U	5.	UJ	8.3	U	4.3	U
1031-07-8	Endosulfan sulfate	3.6	U	5.3	U	5.	UJ	8.3	U	4.3	U
72-43-5	Methoxychlor	19.	U	27.	U	26.	U	43.	U	22.	U
8001-35-2	Toxaphene	190.	U	270.	U	260.	U	430.	U	220.	U
12674-11-2	Aroclor-1016	14.	U	21.	U	20.	U	33.	U	17.	U
11104-28-2	Aroclor-1221	14.	U	21.	U	20.	U	33.	U	17.	U
11141-16-5	Aroclor-1232	14.	U	21.	U	20.	U	33.	U	17.	U
53469-21-9	Aroclor-1242	14.	U	21.	U	20.	U	33.	U	17.	U
12672-29-6	Aroclor-1248	14.	U	21.	U	20.	U	33.	U	17.	U
11097-69-1	Aroclor-1254	14.	U	21.	U	20.	U	33.	U	17.	U
11096-82-5	Aroclor-1260	14.	U	21.	U	20.	U	33.	U	17.	U
57-74-9	Chlordane	44.	U	64.	U	60.	U	100.	U	52.	U
465-73-6	Isodrin	1.9	U	??????????		2.6	U	??????????		??????????	
143-50-0	Kepone	1.9	U	??????????		2.6	UJ	??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SMB46-PEST		GDB-S-8003-01		GDB-S-8004-01		GDB-S-8004-02		GDB-S-8005-01		GDB-S-8005-02		GDB-S-8006-01	
SAMPLE ID ----->		GDB-S-8003-01		GDB-S-8004-01		GDB-S-8004-02		GDB-S-8005-01		GDB-S-8005-02		GDB-S-8006-01	
ORIGINAL ID ----->		GDBS800301		GDBS800401		GDBS800402		GDBS800501		GDBS800502		GDBS800601	
LAB SAMPLE ID ---->		L5540-44		L5540-75		L5540-77		L5540-84		L5540-85		L5540-82	
ID FROM REPORT -->		GDBS800301		GDBS800401		GDBS800402		GDBS800501		GDBS800502		GDBS800601	
SAMPLE DATE ----->		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95	
DATE EXTRACTED -->		10/18/95		10/15/95		10/18/95		10/15/95		10/15/95		10/15/95	
DATE ANALYZED ---->		10/26/95		10/23/95		10/27/95		10/24/95		10/24/95		10/23/95	
MATRIX ----->		Soil		Soil		Soil		Soil		Soil		Soil	
UNITS ----->		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
CAS #	Parameter	L5540	VAL										
319-84-6	alpha-BHC	2.2	U	1.7	U	1.9	U	1.9	U	2.	U	1.9	U
319-85-7	beta-BHC	2.2	U	1.7	U	1.9	U	1.9	U	2.	U	1.9	U
58-89-9	gamma-BHC (Lindane)	2.2	U	1.7	U	1.9	U	1.9	U	2.	U	1.9	U
319-86-8	delta-BHC	2.2	U	1.7	U	1.9	U	1.9	U	2.	U	1.9	U
76-44-8	Heptachlor	2.2	U	1.7	U	1.9	U	1.9	U	2.	U	6.6	
309-00-2	Aldrin	2.2	U	1.7	U	1.9	U	1.9	U	2.	U	1.9	U
1024-57-3	Heptachlor epoxide	2.2	U	1.7	U	1.9	U	1.9	U	2.	U	31.	
5103-74-2	gamma-Chlordane	2.2	U	1.7	U	1.9	U	1.9	U	2.	U	42.	
959-98-8	Endosulfan I	2.2	U	1.7	U	1.9	U	1.9	U	2.	U	1.9	U
5103-71-9	alpha-Chlordane	2.2	U	1.7	U	1.9	U	1.9	U	2.	U	12.	
72-55-9	4,4'-DDE	3.6	J	30.		2.2	J	390.	D	5.2		94.	
50-29-3	4,4'-DDT	4.3	U	15.	U	3.6	U	200.	D	8.	U	91.	
60-57-1	Dieldrin	4.3	U	3.3	U	3.6	U	3.6	U	4.	U	3.6	U
72-20-8	Endrin	4.3	U	3.3	U	3.6	U	3.6	U	4.	U	3.6	U
33213-65-9	Endosulfan II	4.3	U	3.3	U	3.6	U	3.6	U	4.	U	3.6	U
72-54-8	4,4'-DDD	4.3	U	3.3	U	3.6	U	18.		4.5		24.	
7421-93-4	Endrin aldehyde	4.3	U	3.3	U	3.6	U	3.6	U	4.	U	3.6	U
1031-07-8	Endosulfan sulfate	4.3	U	3.3	U	3.6	U	3.6	U	4.	U	3.6	U
72-43-5	Methoxychlor	22.	U	17.	U	19.	U	19.	U	20.	U	19.	U
8001-35-2	Toxaphene	220.	U	170.	U	190.	U	190.	U	200.	U	190.	U
12674-11-2	Aroclor-1016	17.	U	13.	U	14.	U	14.	U	16.	U	14.	U
11104-28-2	Aroclor-1221	17.	U	13.	U	14.	U	14.	U	16.	U	14.	U
11141-16-5	Aroclor-1232	17.	U	13.	U	14.	U	14.	U	16.	U	14.	U
53469-21-9	Aroclor-1242	17.	U	13.	U	14.	U	14.	U	16.	U	14.	U
12672-29-6	Aroclor-1248	17.	U	13.	U	14.	U	14.	U	16.	U	14.	U
11097-69-1	Aroclor-1254	17.	U	13.	U	14.	U	14.	U	16.	U	14.	U
11096-82-5	Aroclor-1260	17.	U	13.	U	14.	U	14.	U	16.	U	14.	U
57-74-9	Chlordane	52.	U	40.	U	44.	U	44.	U	48.	U	44.	U
465-73-6	Isodrin	??????????		??????????		??????????		??????????		??????????		??????????	
143-50-0	Kepone	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-PEST		GDB-S-B006-02		GDB-S-B007-01		GDB-S-B007-02		GDB-S-B008-01		GDB-C-B008-01		GDB-S-B008-02	
SAMPLE ID ----->		GDB-S-B006-02		GDB-S-B007-01		GDB-S-B007-02		GDB-S-B008-01		GDB-C-B008-01		GDB-S-B008-02	
ORIGINAL ID ----->		GDBS800602		GDBS800701		GDBS800702		GDBS800801		GDBC800801		GDBS800802	
LAB SAMPLE ID ---->		L5540-83		L5540-59		L5540-60		L5540-57		L5530-4		L5540-58	
ID FROM REPORT -->		GDBS800602		GDBS800701		GDBS800702		GDBS800801		GDBC800801		GDBS800802	
SAMPLE DATE ----->		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95	
DATE EXTRACTED -->		10/15/95		10/18/95		10/18/95		10/18/95		10/16/95		10/18/95	
DATE ANALYZED ---->		10/23/95		10/26/95		10/27/95		10/26/95		11/04/95		10/26/95	
MATRIX ----->		Soil		Soil		Soil		Soil		Soil		Soil	
UNITS ----->		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5530	VAL	L5540	VAL
319-84-6	alpha-BHC	2.	U	2.	U	2.	U	1.9	U	1.7	U	1.7	U
319-85-7	beta-BHC	2.	U	2.	U	2.	U	1.9	U	1.7	UJ	1.7	U
58-89-9	gamma-BHC (Lindane)	2.	U	2.	U	2.	U	1.9	U	1.7	U	1.7	U
319-86-8	delta-BHC	2.	U	2.	U	2.	U	1.9	U	1.7	UJ	1.7	U
76-44-8	Heptachlor	2.	U	2.	U	2.	U	1.9	U	1.7	U	1.7	U
309-00-2	Aldrin	2.	U	2.	U	2.	U	1.9	U	1.7	UJ	1.7	U
1024-57-3	Heptachlor epoxide	2.	U	2.	U	2.	U	2.1	U	3.2	J	1.7	U
5103-74-2	gamma-Chlordane	2.	U	2.	U	2.	U	1.9	U	1.7	UJ	1.7	U
959-98-8	Endosulfan I	2.	U	2.	U	2.	U	1.9	U	1.7	U	1.7	U
5103-71-9	alpha-Chlordane	2.	U	2.	U	2.	U	1.9	U	1.7	UJ	1.7	U
72-55-9	4,4'-DDE	4.	U	66.		4.	U	72.		78.	J	2.7	J
50-29-3	4,4'-DDT	4.	U	70.		4.	U	32.		44.	J	3.3	U
60-57-1	Dieldrin	4.	U	4.	U	4.	U	3.6	U	3.3	U	3.3	U
72-20-8	Endrin	4.	U	4.	U	4.	U	3.6	U	3.3	U	3.3	U
33213-65-9	Endosulfan II	4.	U	4.	U	4.	U	3.6	U	3.3	UJ	3.3	U
72-54-8	4,4'-DDD	4.	U	4.	U	4.	U	3.6	U	2.6	J	3.3	U
7421-93-4	Endrin aldehyde	4.	U	4.	U	4.	U	3.6	U	3.3	UJ	3.3	U
1031-07-8	Endosulfan sulfate	4.	U	4.	U	4.	U	3.6	U	3.3	UJ	3.3	U
72-43-5	Methoxychlor	20.	U	20.	U	20.	U	19.	U	17.	U	17.	U
8001-35-2	Toxaphene	200.	U	200.	U	200.	U	190.	U	170.	U	170.	U
12674-11-2	Aroclor-1016	16.	U	16.	U	16.	U	14.	U	13.	U	13.	U
11104-28-2	Aroclor-1221	16.	U	16.	U	16.	U	14.	U	13.	U	13.	U
11141-16-5	Aroclor-1232	16.	U	16.	U	16.	U	14.	U	13.	U	13.	U
53469-21-9	Aroclor-1242	16.	U	16.	U	16.	U	14.	U	13.	U	13.	U
12672-29-6	Aroclor-1248	16.	U	16.	U	16.	U	14.	U	13.	U	13.	U
11097-69-1	Aroclor-1254	16.	U	16.	U	16.	U	14.	U	13.	U	13.	U
11096-82-5	Aroclor-1260	16.	U	16.	U	16.	U	14.	U	13.	U	13.	U
57-74-9	Chlordane	48.	U	48.	U	48.	U	44.	U	40.	U	40.	U
465-73-6	Isodrin	??????????		??????????		??????????		??????????		1.7	U	??????????	
143-50-0	Kepon	??????????		??????????		??????????		??????????		1.7	UJ	??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SM846-PEST		GDB-S-B009-01		GDB-S-B009-02		GDB-S-B010-01		GDB-S-B010-02		GDB-S-B011-01		GDB-S-B011-02	
SAMPLE ID ----->		GDBS800901		GDBS800902		GDBS801001		GDBS801002		GDBS801101		GDBS801102	
ORIGINAL ID ----->		L5540-61		L5540-62		L5540-86		L5540-87		L5540-55		L5540-56	
LAB SAMPLE ID ---->		GDBS800901		GDBS800902		GDBS801001		GDBS801002		GDBS801101		GDBS801102	
ID FROM REPORT -->		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95	
SAMPLE DATE ----->		10/18/95		10/18/95		10/15/95		10/15/95		10/18/95		10/18/95	
DATE EXTRACTED -->		10/27/95		10/27/95		10/24/95		10/24/95		10/26/95		10/26/95	
DATE ANALYZED ---->		Soil		Soil		Soil		Soil		Soil		Soil	
MATRIX ----->		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
UNITS ----->		A		A		A		A		A		A	
CAS #	Parameter	L5540	VAL										
319-84-6	alpha-BHC	1.9	U	1.9	U	2.	U	2.6	U	2.6	U	2.4	U
319-85-7	beta-BHC	1.9	U	1.9	U	2.	U	2.6	U	2.6	U	2.4	U
58-89-9	gamma-BHC (Lindane)	1.9	U	1.9	U	2.	U	2.6	U	2.6	U	2.4	U
319-86-8	delta-BHC	1.9	U	1.9	U	2.	U	2.6	U	2.6	U	2.4	U
76-44-8	Heptachlor	1.9	U	1.9	U	2.	U	2.6	U	2.6	U	2.4	U
309-00-2	Aldrin	1.9	U	1.9	U	2.	U	2.6	U	2.6	U	2.4	U
1024-57-3	Heptachlor epoxide	5.9		1.9	U	2.	U	2.6	U	2.6	U	2.4	U
5103-74-2	gamma-Chlordane	1.6	J	1.9	U	1.1	J	2.6	U	2.6	U	2.4	U
959-98-8	Endosulfan I	1.9	U	1.9	U	2.	U	2.6	U	2.6	U	2.4	U
5103-71-9	alpha-Chlordane	1.9	U	1.9	U	2.	U	2.6	U	2.6	U	2.4	U
72-55-9	4,4'-DDE	69.		1.3	J	420.	D	6.5		5.	U	4.6	U
50-29-3	4,4'-DDT	32.		3.6	U	57.		5.	U	16.	U	4.6	U
60-57-1	Dieldrin	3.6	U	3.6	U	4.	U	5.	U	5.	U	4.6	U
72-20-8	Endrin	3.6	U	3.6	U	4.	U	5.	U	5.	U	4.6	U
33213-65-9	Endosulfan II	3.6	U	3.6	U	4.	U	5.	U	5.	U	4.6	U
72-54-8	4,4'-DDD	4.1		3.6	U	4.	U	5.	U	5.	U	4.6	U
7421-93-4	Endrin aldehyde	3.6	U	3.6	U	4.	U	5.	U	5.	U	4.6	U
1031-07-8	Endosulfan sulfate	3.6	U	3.6	U	4.	U	5.	U	5.	U	4.6	U
72-43-5	Methoxychlor	19.	U	19.	U	20.	U	26.	U	26.	U	24.	U
8001-35-2	Toxaphene	190.	U	190.	U	200.	U	260.	U	260.	U	240.	U
12674-11-2	Aroclor-1016	14.	U	14.	U	16.	U	20.	U	20.	U	18.	U
11104-28-2	Aroclor-1221	14.	U	14.	U	16.	U	20.	U	20.	U	18.	U
11141-16-5	Aroclor-1232	14.	U	14.	U	16.	U	20.	U	20.	U	18.	U
53469-21-9	Aroclor-1242	14.	U	14.	U	16.	U	20.	U	20.	U	18.	U
12672-29-6	Aroclor-1248	14.	U	14.	U	16.	U	20.	U	20.	U	18.	U
11097-69-1	Aroclor-1254	14.	U	14.	U	16.	U	20.	U	20.	U	18.	U
11096-82-5	Aroclor-1260	14.	U	14.	U	16.	U	20.	U	20.	U	18.	U
57-74-9	Chlordane	44.	U	44.	U	48.	U	60.	U	60.	U	56.	U
465-73-6	Isodrin	??????????		??????????		??????????		??????????		??????????		??????????	
143-50-0	Kepone	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-PEST		GDB-S-8012-01		GDB-S-8012-02		GDB-S-8013-01		GDB-S-8013-02		GDB-S-8014-01		GDB-S-8014-02	
SAMPLE ID ----->		GDB-S-8012-01		GDB-S-8012-02		GDB-S-8013-01		GDB-S-8013-02		GDB-S-8014-01		GDB-S-8014-02	
ORIGINAL ID ----->		GDBS801201		GDBS801202		GDBS801301		GDBS801302		GDBS801401		GDBS801402	
LAB SAMPLE ID ---->		L5540-53		L5540-54		L5540-51		L5540-52		L5540-47		L5540-50	
ID FROM REPORT -->		GDBS801201		GDBS801202		GDBS801301		GDBS801302		GDBS801401		GDBS801402	
SAMPLE DATE ----->		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95	
DATE EXTRACTED -->		10/18/95		10/18/95		10/18/95		10/18/95		10/18/95		10/18/95	
DATE ANALYZED ---->		10/26/95		10/26/95		10/26/95		10/26/95		10/26/95		10/26/95	
MATRIX ----->		Soil		Soil		Soil		Soil		Soil		Soil	
UNITS ----->		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
CAS #	Parameter	L5540	VAL										
319-84-6	alpha-BHC	1.9	U	1.9	U	2.	U	2.4	U	1.9	U	2.	U
319-85-7	beta-BHC	1.9	U	1.9	U	2.	U	2.4	U	1.9	U	2.	U
58-89-9	gamma-BHC (Lindane)	1.9	U	1.9	U	2.	U	2.4	U	1.9	U	2.	U
319-86-8	delta-BHC	1.9	U	1.9	U	2.	U	2.4	U	1.9	U	2.	U
76-44-8	Heptachlor	1.9	U	1.9	U	2.	U	2.4	U	1.9	U	2.	U
309-00-2	Aldrin	1.9	U	1.9	U	2.	U	2.4	U	1.9	U	2.	U
1024-57-3	Heptachlor epoxide	1.9	U	1.9	U	2.	U	2.4	U	0.77	J	2.	U
5103-74-2	gamma-Chlordane	1.9	U	1.9	U	2.	U	2.4	U	1.9	U	2.	U
959-98-8	Endosulfan I	1.9	U	1.9	U	2.	U	2.4	U	1.9	U	2.	U
5103-71-9	alpha-Chlordane	1.9	U	1.9	U	2.	U	2.4	U	1.9	U	2.	U
72-55-9	4,4'-DDE	3.6	U	3.6	U	470.	DJ	4.6	U	40.		4.	U
50-29-3	4,4'-DDT	4.4	U	3.6	U	67.	J	4.6	U	30.		4.	U
60-57-1	Dieldrin	1.3	J	3.6	U	4.	U	4.6	U	3.6	U	4.	U
72-20-8	Endrin	3.6	U	3.6	U	4.	U	4.6	U	3.6	U	4.	U
33213-65-9	Endosulfan II	3.6	U	3.6	U	4.	U	4.6	U	3.6	U	4.	U
72-54-8	4,4'-DDD	3.6	U	3.6	U	4.	U	4.6	U	2.3	J	4.	U
7421-93-4	Endrin aldehyde	3.6	U	3.6	U	4.	U	4.6	U	3.6	U	4.	U
1031-07-8	Endosulfan sulfate	3.6	U	3.6	U	4.	U	4.6	U	3.6	U	4.	U
72-43-5	Methoxychlor	19.	U	19.	U	20.	U	24.	U	19.	U	20.	U
8001-35-2	Toxaphene	190.	U	190.	U	200.	U	240.	U	190.	U	200.	U
12674-11-2	Aroclor-1016	14.	U	14.	U	16.	U	18.	U	14.	U	16.	U
11104-28-2	Aroclor-1221	14.	U	14.	U	16.	U	18.	U	14.	U	16.	U
11141-16-5	Aroclor-1232	14.	U	14.	U	16.	U	18.	U	14.	U	16.	U
53469-21-9	Aroclor-1242	14.	U	14.	U	16.	U	18.	U	14.	U	16.	U
12672-29-6	Aroclor-1248	14.	U	14.	U	16.	U	18.	U	14.	U	16.	U
11097-69-1	Aroclor-1254	14.	U	14.	U	16.	U	18.	U	14.	U	16.	U
11096-82-5	Aroclor-1260	14.	U	14.	U	16.	U	18.	U	14.	U	16.	U
57-74-9	Chlordane	44.	U	44.	U	48.	U	56.	U	44.	U	48.	U
465-73-6	Isodrin	??????????		??????????		??????????		??????????		??????????		??????????	
143-50-0	Kepone	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-PEST		GDB-S-8015-01		GDB-S-8015-02		GDB-G-W001-01		GDB-G-W002-01		GDB-G-W003-01		GDB-G-W004-01	
SAMPLE ID ----->		GDBS801501		GDBS801502		GDBGW00101		GDBGW00201		GDBGW00301		GDBGW00401	
ORIGINAL ID ----->		L5540-73		L5540-74		L6024-54		L6024-56		L6024-58		L6024-60	
LAB SAMPLE ID ---->		GDBS801501		GDBS801502		GDBGW00101		GDBGW00201		GDBGW00301		GDBGW00401	
ID FROM REPORT -->		10/04/95		10/04/95		12/09/95		12/09/95		12/10/95		12/10/95	
SAMPLE DATE ----->		10/18/95		10/18/95		12/15/95		12/15/95		12/15/95		12/15/95	
DATE EXTRACTED -->		10/27/95		10/27/95		12/20/95		12/20/95		12/19/95		12/19/95	
DATE ANALYZED ---->		Soil		Soil		Water		Water		Water		Water	
MATRIX ----->		UG/KG		UG/KG		UG/L		UG/L		UG/L		UG/L	
UNITS ----->		A		A		A		A		A		A	
CAS #	Parameter	L5540	VAL	L5540	VAL	L6024	VAL	L6024	VAL	L6024	VAL	L6024	VAL
319-84-6	alpha-BHC	1.9	U	2.	U	0.055	UJ	0.055	U	0.055	U	0.05	U
319-85-7	beta-BHC	1.9	U	2.	U	0.055	UJ	0.055	U	0.055	U	0.05	U
58-89-9	gamma-BHC (Lindane)	1.9	U	2.	U	0.055	UJ	0.055	U	0.055	U	0.05	U
319-86-8	delta-BHC	1.9	U	2.	U	0.055	UJ	0.055	U	0.055	U	0.05	U
76-44-8	Heptachlor	1.9	U	2.	U	0.055	UJ	0.055	U	0.055	U	0.05	U
309-00-2	Aldrin	1.9	U	2.	U	0.055	UJ	0.055	U	0.055	U	0.05	U
1024-57-3	Heptachlor epoxide	1.9	U	2.	U	0.055	UJ	0.055	U	0.055	U	0.05	U
5103-74-2	gamma-Chlordane	1.9	U	2.	U	0.055	UJ	0.055	U	0.055	U	0.05	U
959-98-8	Endosulfan I	1.9	U	2.	U	0.055	UJ	0.055	U	0.055	U	0.05	U
5103-71-9	alpha-Chlordane	1.9	U	2.	U	0.055	UJ	0.055	U	0.055	U	0.05	U
72-55-9	4,4'-DDE	16.	U	4.	U	0.11	UJ	0.11	U	0.11	U	0.1	U
50-29-3	4,4'-DDT	4.8	U	4.	U	0.11	UJ	0.11	U	0.11	U	0.1	U
60-57-1	Dieldrin	3.6	U	4.	U	0.11	UJ	0.11	U	0.11	U	0.1	U
72-20-8	Endrin	3.6	U	4.	U	0.11	UJ	0.11	U	0.11	U	0.1	U
33213-65-9	Endosulfan II	3.6	U	4.	U	0.11	UJ	0.11	U	0.11	U	0.1	U
72-54-8	4,4'-DDD	3.6	U	4.	U	0.11	UJ	0.11	U	0.11	U	0.1	U
7421-93-4	Endrin aldehyde	3.6	U	4.	U	0.11	UJ	0.11	U	0.11	U	0.1	U
1031-07-8	Endosulfan sulfate	3.6	U	4.	U	0.11	UJ	0.11	U	0.11	U	0.1	U
72-43-5	Methoxychlor	19.	U	20.	U	0.55	UJ	0.55	U	0.55	U	0.5	U
8001-35-2	Toxaphene	190.	U	200.	U	5.5	UJ	5.5	U	5.5	U	5.	U
12674-11-2	Aroclor-1016	14.	U	16.	U	1.1	UJ	1.1	U	1.1	U	1.	U
11104-28-2	Aroclor-1221	14.	U	16.	U	2.2	UJ	2.2	U	2.2	U	2.	U
11141-16-5	Aroclor-1232	14.	U	16.	U	1.1	UJ	1.1	U	1.1	U	1.	U
53469-21-9	Aroclor-1242	14.	U	16.	U	1.1	UJ	1.1	U	1.1	U	1.	U
12672-29-6	Aroclor-1248	14.	U	16.	U	1.1	UJ	1.1	U	1.1	U	1.	U
11097-69-1	Aroclor-1254	14.	U	16.	U	1.1	UJ	1.1	U	1.1	U	1.	U
11096-82-5	Aroclor-1260	14.	U	16.	U	1.1	UJ	1.1	U	1.1	U	1.	U
57-74-9	Chlordane	44.	U	48.	U	1.1	UJ	1.1	U	1.1	U	1.	U
465-73-6	Isodrin	???????????		???????????		???????????		???????????		???????????		???????????	
143-50-0	Kepone	???????????		???????????		???????????		???????????		???????????		???????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SUB46-PEST		SAMPLE ID -----> GDB-G-W01D-01		GDB-G-W04D-01		GDB-H-W04D-01				
	ORIGINAL ID ----->	GDBGW01D01		GDBGW04D01		GDBHW04D01				
	LAB SAMPLE ID ---->	L6024-52		L6024-66		L6022-9				
	ID FROM REPORT -->	GDBGW01D01		GDBGW04D01		GDBHW04D01				
	SAMPLE DATE ----->	12/09/95		12/11/95		12/11/95				
	DATE EXTRACTED -->	12/15/95		12/15/95		12/15/95				
	DATE ANALYZED ---->	12/20/95		12/19/95		12/19/95				
	MATRIX ----->	Water		Water		Water				
	UNITS ----->	UG/L	A	UG/L	A	UG/L	A			
CAS #	Parameter	L6024	VAL	L6024	VAL	L6022	VAL			
319-84-6	alpha-BHC	0.05	U	0.05	U	0.055	U			
319-85-7	beta-BHC	0.05	U	0.05	U	0.055	U			
58-89-9	gamma-BHC (Lindane)	0.05	U	0.05	U	0.055	U			
319-86-8	delta-BHC	0.05	U	0.05	U	0.055	U			
76-44-8	Heptachlor	0.05	U	0.05	U	0.055	U			
309-00-2	Aldrin	0.05	U	0.05	U	0.055	U			
1024-57-3	Heptachlor epoxide	0.05	U	0.05	U	0.055	U			
5103-74-2	gamma-Chlordane	0.05	U	0.05	U	0.055	U			
959-98-8	Endosulfan I	0.05	U	0.05	U	0.055	U			
5103-71-9	alpha-Chlordane	0.05	U	0.05	U	0.055	U			
72-55-9	4,4'-DDE	0.1	U	0.1	U	0.11	U			
50-29-3	4,4'-DDT	0.1	U	0.1	U	0.11	U			
60-57-1	Dieldrin	0.1	U	0.1	U	0.11	U			
72-20-8	Endrin	0.1	U	0.1	U	0.11	U			
33213-65-9	Endosulfan II	0.1	U	0.1	U	0.11	U			
72-54-8	4,4'-DDD	0.1	U	0.1	U	0.11	U			
7421-93-4	Endrin aldehyde	0.1	U	0.1	U	0.11	U			
1031-07-8	Endosulfan sulfate	0.1	U	0.1	U	0.11	U			
72-43-5	Methoxychlor	0.5	U	0.5	U	0.55	U			
8001-35-2	Toxaphene	5.	U	5.	U	5.5	U			
12674-11-2	Aroclor-1016	1.	U	1.	U	1.1	U			
11104-28-2	Aroclor-1221	2.	U	2.	U	2.2	U			
11141-16-5	Aroclor-1232	1.	U	1.	U	1.1	U			
53469-21-9	Aroclor-1242	1.	U	1.	U	1.1	U			
12672-29-6	Aroclor-1248	1.	U	1.	U	1.1	U			
11097-69-1	Aroclor-1254	1.	U	1.	U	1.1	U			
11096-82-5	Aroclor-1260	1.	U	1.	U	1.1	U			
57-74-9	Chlordane	1.	U	1.	U	1.1	U			
465-73-6	Isodrin	??????????		??????????		0.055	U			
143-50-0	Kepone	??????????		??????????		0.055	U			

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SMB46-SVOA		SAMPLE ID -----> 507-S-B001-01		507-S-B001-02		507-S-B002-01		507-S-B002-02		507-S-B003-01		507-S-B003-02	
		ORIGINAL ID -----> 507SB00101		507SB00102		507SB00201		507SB00202		507SB00301		507SB00302	
		LAB SAMPLE ID ---> L5540-45		L5540-46		L5540-63		L5540-64		L5540-65		L5540-66	
		ID FROM REPORT --> 507SB00101		507SB00102		507SB00201		507SB00202		507SB00301		507SB00302	
		SAMPLE DATE -----> 10/04/95		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95	
		DATE EXTRACTED --> 10/14/95		10/14/95		10/14/95		10/18/95		10/14/95		10/18/95	
		DATE ANALYZED ----> 10/20/95		10/19/95		10/20/95		10/22/95		10/20/95		10/22/95	
		MATRIX -----> Soil		Soil		Soil		Soil		Soil		Soil	
		UNITS -----> UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL
108-95-2	Phenol	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
111-44-4	bis(2-Chloroethyl)ether	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
95-57-8	2-Chlorophenol	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
541-73-1	1,3-Dichlorobenzene	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
106-46-7	1,4-Dichlorobenzene	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
100-51-6	Benzyl alcohol	1600.	U	1600.	U	1400.	U	1600.	U	1500.	U	1600.	U
95-50-1	1,2-Dichlorobenzene	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
95-48-7	2-Methylphenol (o-Cresol)	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
108-60-1	2,2'-oxybis(1-Chloropropane)	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
106-44-5	4-Methylphenol (p-Cresol)	??????????		??????????		??????????		??????????		??????????		??????????	
621-64-7	N-Nitroso-di-n-propylamine	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
67-72-1	Hexachloroethane	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
98-95-3	Nitrobenzene	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
78-59-1	Isophorone	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
88-75-5	2-Nitrophenol	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
105-67-9	2,4-Dimethylphenol	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
65-85-0	Benzoic acid	4100.	UJ	4000.	U	3700.	UJ	4000.	U	3900.	UJ	4000.	U
111-91-1	bis(2-Chloroethoxy)methane	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
120-83-2	2,4-Dichlorophenol	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
120-82-1	1,2,4-Trichlorobenzene	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
91-20-3	Naphthalene	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
106-47-8	4-Chloroaniline	1600.	U	1600.	U	1400.	U	1600.	U	1500.	U	1600.	U
87-68-3	Hexachlorobutadiene	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
59-50-7	4-Chloro-3-methylphenol	1600.	U	1600.	U	1400.	U	1600.	U	1500.	U	1600.	U
91-57-6	2-Methylnaphthalene	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
77-47-4	Hexachlorocyclopentadiene	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
88-06-2	2,4,6-Trichlorophenol	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
95-95-4	2,4,5-Trichlorophenol	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
91-58-7	2-Chloronaphthalene	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
88-74-4	2-Nitroaniline	4100.	U	4000.	U	3700.	U	4000.	U	3900.	U	4000.	U
131-11-3	Dimethyl phthalate	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
208-96-8	Acenaphthylene	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
606-20-2	2,6-Dinitrotoluene	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
99-09-2	3-Nitroaniline	4100.	U	4000.	U	3700.	U	4000.	U	3900.	U	4000.	U
83-32-9	Acenaphthene	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
51-28-5	2,4-Dinitrophenol	4100.	U	4000.	U	3700.	U	4000.	U	3900.	U	4000.	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SMB46-SV0A		SAMPLE ID ----->	507-S-B001-01	507-S-B001-02	507-S-B002-01	507-S-B002-02	507-S-B003-01	507-S-B003-02					
		ORIGINAL ID ----->	507S800101	507S800102	507S800201	507S800202	507S800301	507S800302					
		LAB SAMPLE ID ---->	L5540-45	L5540-46	L5540-63	L5540-64	L5540-65	L5540-66					
		ID FROM REPORT -->	507S800101	507S800102	507S800201	507S800202	507S800301	507S800302					
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95					
		DATE EXTRACTED -->	10/14/95	10/14/95	10/14/95	10/18/95	10/14/95	10/18/95					
		DATE ANALYZED -->	10/20/95	10/19/95	10/20/95	10/22/95	10/20/95	10/22/95					
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil					
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG					
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL		
100-02-7	4-Nitrophenol	4100.	U	4000.	U	3700.	U	4000.	U	3900.	U	4000.	U
132-64-9	Dibenzofuran	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
121-14-2	2,4-Dinitrotoluene	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
84-66-2	Diethylphthalate	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
7005-72-3	4-Chlorophenylphenylether	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
86-73-7	Fluorene	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
100-01-6	4-Nitroaniline	4100.	U	4000.	U	3700.	U	4000.	U	3900.	U	4000.	U
534-52-1	2-Methyl-4,6-Dinitrophenol	4100.	U	4000.	U	3700.	U	4000.	U	3900.	U	4000.	U
86-30-6	N-Nitrosodiphenylamine	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
101-55-3	4-Bromophenyl-phenylether	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
118-74-1	Hexachlorobenzene	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
87-86-5	Pentachlorophenol	4100.	U	4000.	U	3700.	U	4000.	U	3900.	U	4000.	U
85-01-8	Phenanthrene	820.	U	790.	U	240.	J	810.	U	410.	J	800.	U
120-12-7	Anthracene	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
86-74-8	Carbazole	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
84-74-2	Di-n-butylphthalate	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
206-44-0	Fluoranthene	820.	U	790.	U	480.	J	810.	U	2300.	U	800.	U
129-00-0	Pyrene	820.	U	790.	U	480.	J	810.	U	2500.	U	800.	U
85-68-7	Butylbenzylphthalate	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
91-94-1	3,3'-Dichlorobenzidine	1600.	U	1600.	U	1400.	U	1600.	U	1500.	U	1600.	U
56-55-3	Benzo(a)anthracene	820.	U	790.	U	270.	J	810.	U	1500.	U	800.	U
218-01-9	Chrysene	820.	U	790.	U	320.	J	810.	U	1400.	U	800.	U
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
117-84-0	Di-n-octyl phthalate	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
205-99-2	Benzo(b)fluoranthene	820.	U	790.	U	730.	U	810.	U	1200.	U	800.	U
207-08-9	Benzo(k)fluoranthene	820.	U	790.	U	730.	U	810.	U	950.	U	800.	U
50-32-8	Benzo(a)pyrene	820.	U	790.	U	230.	J	810.	U	1200.	U	800.	U
193-39-5	Indeno(1,2,3-cd)pyrene	820.	U	790.	U	150.	J	810.	U	630.	J	800.	U
53-70-3	Dibenz(a,h)anthracene	820.	U	790.	U	730.	U	810.	U	780.	U	800.	U
191-24-2	Benzo(g,h,i)perylene	820.	U	790.	U	730.	U	810.	U	580.	J	800.	U
95-53-4	o-Toluidine	??????????		??????????		??????????		??????????		??????????		??????????	
126-68-1	O,O,O-Triethylphosphorothioate	??????????		??????????		??????????		??????????		??????????		??????????	
1888-71-7	Hexachloropropene	??????????		??????????		??????????		??????????		??????????		??????????	
95-94-3	1,2,4,5-Tetrachlorobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
608-93-5	Pentachlorobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
91-59-8	2-Naphthylamine	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SV846-SV0A		SAMPLE ID ----->	507-s-B001-01	507-s-B001-02	507-s-B002-01	507-s-B002-02	507-s-B003-01	507-s-B003-02			
		ORIGINAL ID ----->	507S800101	507S800102	507S800201	507S800202	507S800301	507S800302			
		LAB SAMPLE ID --->	L5540-45	L5540-46	L5540-63	L5540-64	L5540-65	L5540-66			
		ID FROM REPORT -->	507S800101	507S800102	507S800201	507S800202	507S800301	507S800302			
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95			
		DATE EXTRACTED -->	10/14/95	10/14/95	10/14/95	10/18/95	10/14/95	10/18/95			
		DATE ANALYZED --->	10/20/95	10/19/95	10/20/95	10/22/95	10/20/95	10/22/95			
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil			
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG			
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL
134-32-7	1-Naphthylamine	??????????		??????????		??????????		??????????		??????????	
297-97-2	Thionazin	??????????		??????????		??????????		??????????		??????????	
99-55-8	5-Nitro-o-toluidine	??????????		??????????		??????????		??????????		??????????	
2303-16-4	Diallate	??????????		??????????		??????????		??????????		??????????	
298-02-2	Phorate	??????????		??????????		??????????		??????????		??????????	
62-44-2	Phenacetin	??????????		??????????		??????????		??????????		??????????	
60-51-5	Dimethoate	??????????		??????????		??????????		??????????		??????????	
92-67-1	4-Aminobiphenyl	??????????		??????????		??????????		??????????		??????????	
23950-58-5	Pronamide	??????????		??????????		??????????		??????????		??????????	
298-04-4	Disulfoton	??????????		??????????		??????????		??????????		??????????	
298-00-0	Methyl parathion	??????????		??????????		??????????		??????????		??????????	
56-38-2	Parathion	??????????		??????????		??????????		??????????		??????????	
140-57-8	Aramite	??????????		??????????		??????????		??????????		??????????	
60-11-7	p-(Dimethylamino)azobenzene	??????????		??????????		??????????		??????????		??????????	
510-15-6	Chlorobenzilate	??????????		??????????		??????????		??????????		??????????	
119-93-7	3,3-Dimethylbenzidine	??????????		??????????		??????????		??????????		??????????	
52-85-7	Famphur	??????????		??????????		??????????		??????????		??????????	
53-96-3	Acetamidofluorene	??????????		??????????		??????????		??????????		??????????	
57-97-6	7,12-Dimethylbenz(a)anthracene	??????????		??????????		??????????		??????????		??????????	
56-49-5	3-Methyl cholanthrene	??????????		??????????		??????????		??????????		??????????	
110-86-1	Pyridine	??????????		??????????		??????????		??????????		??????????	
76-01-7	Pentachloroethane	??????????		??????????		??????????		??????????		??????????	
62-75-9	N-Nitrosodimethylamine	??????????		??????????		??????????		??????????		??????????	
109-06-8	2-Picoline	??????????		??????????		??????????		??????????		??????????	
10595-95-6	N-Nitrosomethylethylamine	??????????		??????????		??????????		??????????		??????????	
66-27-3	Methyl methanesulfonate	??????????		??????????		??????????		??????????		??????????	
55-18-5	N-Nitrosodiethylamine	??????????		??????????		??????????		??????????		??????????	
62-50-0	Ethyl methanesulfonate	??????????		??????????		??????????		??????????		??????????	
62-53-3	Aniline	??????????		??????????		??????????		??????????		??????????	
930-55-2	N-Nitrosopyrrolidine	??????????		??????????		??????????		??????????		??????????	
59-89-2	N-Nitrosomorpholine	??????????		??????????		??????????		??????????		??????????	
108-39-4	3-Methylphenol (m-Cresol)	??????????		??????????		??????????		??????????		??????????	
98-86-2	Acetophenone	??????????		??????????		??????????		??????????		??????????	
87-65-0	2,6-Dichlorophenol	??????????		??????????		??????????		??????????		??????????	
100-75-4	N-Nitrosopiperidine	??????????		??????????		??????????		??????????		??????????	
924-16-3	N-Nitroso-di-n-butylamine	??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-SV0A		SAMPLE ID ----->	507-S-8001-01	507-S-8001-02	507-S-8002-01	507-S-8002-02	507-S-8003-01	507-S-8003-02			
		ORIGINAL ID ----->	507S800101	507S800102	507S800201	507S800202	507S800301	507S800302			
		LAB SAMPLE ID ---->	L5540-45	L5540-46	L5540-63	L5540-64	L5540-65	L5540-66			
		ID FROM REPORT -->	507S800101	507S800102	507S800201	507S800202	507S800301	507S800302			
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95			
		DATE EXTRACTED -->	10/14/95	10/14/95	10/14/95	10/18/95	10/14/95	10/18/95			
		DATE ANALYZED -->	10/20/95	10/19/95	10/20/95	10/22/95	10/20/95	10/22/95			
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil			
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG			
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL
120-58-1	Isosafrole	??????????		??????????		??????????		??????????		??????????	
94-59-7	Safrole	??????????		??????????		??????????		??????????		??????????	
130-15-4	1,4-Naphthoquinone	??????????		??????????		??????????		??????????		??????????	
99-65-0	1,3-Dinitrobenzene	??????????		??????????		??????????		??????????		??????????	
58-90-2	2,3,4,6-Tetrachlorophenol	??????????		??????????		??????????		??????????		??????????	
99-35-4	1,3,5-Trinitrobenzene	??????????		??????????		??????????		??????????		??????????	
82-68-8	Pentachloronitrobenzene	??????????		??????????		??????????		??????????		??????????	
88-85-7	Dinoseb	??????????		??????????		??????????		??????????		??????????	
56-57-5	4-Nitroquinoline 1-oxide	??????????		??????????		??????????		??????????		??????????	
3689-24-5	Sulfotep	??????????		??????????		??????????		??????????		??????????	
91-80-5	Methapyrilene	??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-SV0A		SAMPLE ID -----> 507-S-B004-01		507-S-B004-02		507-S-B005-01		507-S-B005-02		507-S-B006-01		507-S-B007-01	
		ORIGINAL ID -----> 507SB00401		507SB00402		507SB00501		507SB00502		507SB00601		507SB00701	
		LAB SAMPLE ID ----> L5540-71		L5540-72		L5540-67		L5540-70		25046.01		25046.02	
		ID FROM REPORT --> 507SB00401		507SB00402		507SB00501		507SB00502		507SB00601		507SB00701	
		SAMPLE DATE -----> 10/04/95		10/04/95		10/04/95		10/04/95		03/25/96		03/25/96	
		DATE EXTRACTED --> 10/18/95		10/18/95		10/18/95		10/18/95		03/29/96		03/29/96	
		DATE ANALYZED ----> 10/22/95		10/22/95		10/20/95		10/20/95		04/02/96		04/02/96	
		MATRIX -----> Soil		Soil		Soil		Soil		Soil		Soil	
		UNITS -----> UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	25046	VAL	25046	VAL
108-95-2	Phenol	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
111-44-4	bis(2-Chloroethyl)ether	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
95-57-8	2-Chlorophenol	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
541-73-1	1,3-Dichlorobenzene	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
106-46-7	1,4-Dichlorobenzene	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
100-51-6	Benzyl alcohol	1500.	U	1500.	U	1500.	U	1500.	U	760.	U	720.	U
95-50-1	1,2-Dichlorobenzene	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
95-48-7	2-Methylphenol (o-Cresol)	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
108-60-1	2,2'-oxybis(1-Chloropropane)	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
106-44-5	4-Methylphenol (p-Cresol)	??????????		??????????		??????????		??????????		760.	U	720.	U
621-64-7	N-Nitroso-di-n-propylamine	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
67-72-1	Hexachloroethane	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
98-95-3	Nitrobenzene	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
78-59-1	Isophorone	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
88-75-5	2-Nitrophenol	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
105-67-9	2,4-Dimethylphenol	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
65-85-0	Benzoic acid	3700.	U	3900.	U	3800.	UJ	3900.	UJ	3700.	U	3500.	U
111-91-1	bis(2-Chloroethoxy)methane	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
120-83-2	2,4-Dichlorophenol	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
120-82-1	1,2,4-Trichlorobenzene	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
91-20-3	Naphthalene	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
106-47-8	4-Chloroaniline	1500.	U	1500.	U	1500.	U	1500.	U	760.	U	720.	U
87-68-3	Hexachlorobutadiene	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
59-50-7	4-Chloro-3-methylphenol	1500.	U	1500.	U	1500.	U	1500.	U	760.	U	720.	U
91-57-6	2-Methylnaphthalene	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
77-47-4	Hexachlorocyclopentadiene	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
88-06-2	2,4,6-Trichlorophenol	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
95-95-4	2,4,5-Trichlorophenol	750.	U	780.	U	760.	U	770.	U	3700.	U	3500.	U
91-58-7	2-Chloronaphthalene	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
88-74-4	2-Nitroaniline	3700.	U	3900.	U	3800.	U	3900.	U	3700.	U	3500.	U
131-11-3	Dimethyl phthalate	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
208-96-8	Acenaphthylene	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
606-20-2	2,6-Dinitrotoluene	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
99-09-2	3-Nitroaniline	3700.	U	3900.	U	3800.	U	3900.	U	3700.	U	3500.	U
83-32-9	Acenaphthene	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
51-28-5	2,4-Dinitrophenol	3700.	U	3900.	U	3800.	U	3900.	U	3700.	U	3500.	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SUB46-SVOA		SAMPLE ID -----> 507-S-8004-01		507-S-8004-02		507-S-8005-01		507-S-8005-02		507-S-8006-01		507-S-8007-01	
		ORIGINAL ID -----> 507SB00401		507SB00402		507SB00501		507SB00502		507SB00601		507SB00701	
		LAB SAMPLE ID -----> L5540-71		L5540-72		L5540-67		L5540-70		25046.01		25046.02	
		ID FROM REPORT ---> 507SB00401		507SB00402		507SB00501		507SB00502		507SB00601		507SB00701	
		SAMPLE DATE -----> 10/04/95		10/04/95		10/04/95		10/04/95		03/25/96		03/25/96	
		DATE EXTRACTED ---> 10/18/95		10/18/95		10/18/95		10/18/95		03/29/96		03/29/96	
		DATE ANALYZED ---> 10/22/95		10/22/95		10/20/95		10/20/95		04/02/96		04/02/96	
		MATRIX -----> Soil		Soil		Soil		Soil		Soil		Soil	
		UNITS -----> UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	25046	VAL	25046	VAL
100-02-7	4-Nitrophenol	3700.	U	3900.	U	3800.	U	3900.	U	3700.	U	3500.	U
132-64-9	Dibenzofuran	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
121-14-2	2,4-Dinitrotoluene	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
84-66-2	Diethylphthalate	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
7005-72-3	4-Chlorophenylphenylether	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
86-73-7	Fluorene	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
100-01-6	4-Nitroaniline	3700.	U	3900.	U	3800.	U	3900.	U	3700.	U	3500.	U
534-52-1	2-Methyl-4,6-Dinitrophenol	3700.	U	3900.	U	3800.	U	3900.	U	3700.	U	3500.	U
86-30-6	N-Nitrosodiphenylamine	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
101-55-3	4-Bromophenyl-phenylether	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
118-74-1	Hexachlorobenzene	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
87-86-5	Pentachlorophenol	3700.	U	3900.	U	3800.	U	3900.	U	3700.	U	3500.	U
85-01-8	Phenanthrene	750.	U	780.	U	760.	U	770.	U	760.	U	170.	J
120-12-7	Anthracene	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
86-74-8	Carbazole	750.	U	780.	U	760.	U	770.	U	??????????		??????????	
84-74-2	Di-n-butylphthalate	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
206-44-0	Fluoranthene	750.	U	780.	U	760.	U	770.	U	210.	J	380.	J
129-00-0	Pyrene	750.	U	780.	U	760.	U	770.	U	150.	J	290.	J
85-68-7	Butylbenzylphthalate	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
91-94-1	3,3'-Dichlorobenzidine	1500.	U	1500.	U	1500.	U	1500.	U	1500.	U	1400.	U
56-55-3	Benzo(a)anthracene	750.	U	780.	U	760.	U	770.	U	160.	J	170.	J
218-01-9	Chrysene	750.	U	780.	U	760.	U	770.	U	180.	J	220.	J
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
117-84-0	Di-n-octyl phthalate	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
205-99-2	Benzo(b)fluoranthene	750.	U	780.	U	760.	U	770.	U	140.	J	150.	J
207-08-9	Benzo(k)fluoranthene	750.	U	780.	U	760.	U	770.	U	200.	J	220.	J
50-32-8	Benzo(a)pyrene	750.	U	780.	U	760.	U	770.	U	170.	J	150.	J
193-39-5	Indeno(1,2,3-cd)pyrene	750.	U	780.	U	760.	U	770.	U	120.	J	120.	J
53-70-3	Dibenz(a,h)anthracene	750.	U	780.	U	760.	U	770.	U	760.	U	720.	U
191-24-2	Benzo(g,h,i)perylene	750.	U	780.	U	760.	U	770.	U	170.	J	130.	J
95-53-4	o-Toluidine	??????????		??????????		??????????		??????????		??????????		??????????	
126-68-1	O,O,O-Triethylphosphorothioate	??????????		??????????		??????????		??????????		??????????		??????????	
1888-71-7	Hexachloropropene	??????????		??????????		??????????		??????????		??????????		??????????	
95-94-3	1,2,4,5-Tetrachlorobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
608-93-5	Pentachlorobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
91-59-8	2-Naphthylamine	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-SV0A		SAMPLE ID -----> ORIGINAL ID -----> LAB SAMPLE ID ----> ID FROM REPORT --> SAMPLE DATE -----> DATE EXTRACTED --> DATE ANALYZED ----> MATRIX -----> UNITS ----->	507-S-B004-01 507SB00401 L5540-71 507SB00401 10/04/95 10/18/95 10/22/95 Soil UG/KG	A	507-S-B004-02 507SB00402 L5540-72 507SB00402 10/04/95 10/18/95 10/22/95 Soil UG/KG	A	507-S-B005-01 507SB00501 L5540-67 507SB00501 10/04/95 10/18/95 10/20/95 Soil UG/KG	A	507-S-B005-02 507SB00502 L5540-70 507SB00502 10/04/95 10/18/95 10/20/95 Soil UG/KG	A	507-S-B006-01 507SB00601 25046.01 507SB00601 03/25/96 03/29/96 04/02/96 Soil UG/KG	A	507-S-B007-01 507SB00701 25046.02 507SB00701 03/25/96 03/29/96 04/02/96 Soil UG/KG	A
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	25046	VAL	25046	VAL	
134-32-7	1-Naphthylamine	??????????		??????????		??????????		??????????		??????????		??????????		
297-97-2	Thionazin	??????????		??????????		??????????		??????????		??????????		??????????		
99-55-8	5-Nitro-o-toluidine	??????????		??????????		??????????		??????????		??????????		??????????		
2303-16-4	Diallate	??????????		??????????		??????????		??????????		??????????		??????????		
298-02-2	Phorate	??????????		??????????		??????????		??????????		??????????		??????????		
62-44-2	Phenacetin	??????????		??????????		??????????		??????????		??????????		??????????		
60-51-5	Dimethoate	??????????		??????????		??????????		??????????		??????????		??????????		
92-67-1	4-Aminobiphenyl	??????????		??????????		??????????		??????????		??????????		??????????		
23950-58-5	Pronamide	??????????		??????????		??????????		??????????		??????????		??????????		
298-04-4	Disulfoton	??????????		??????????		??????????		??????????		??????????		??????????		
298-00-0	Methyl parathion	??????????		??????????		??????????		??????????		??????????		??????????		
56-38-2	Parathion	??????????		??????????		??????????		??????????		??????????		??????????		
140-57-8	Aramite	??????????		??????????		??????????		??????????		??????????		??????????		
60-11-7	p-(Dimethylamino)azobenzene	??????????		??????????		??????????		??????????		??????????		??????????		
510-15-6	Chlorobenzilate	??????????		??????????		??????????		??????????		??????????		??????????		
119-93-7	3,3-Dimethylbenzidine	??????????		??????????		??????????		??????????		??????????		??????????		
52-85-7	Famphur	??????????		??????????		??????????		??????????		??????????		??????????		
53-96-3	Acetamidofluorene	??????????		??????????		??????????		??????????		??????????		??????????		
57-97-6	7,12-Dimethylbenz(a)anthracene	??????????		??????????		??????????		??????????		??????????		??????????		
56-49-5	3-Methyl cholanthrene	??????????		??????????		??????????		??????????		??????????		??????????		
110-86-1	Pyridine	??????????		??????????		??????????		??????????		??????????		??????????		
76-01-7	Pentachloroethane	??????????		??????????		??????????		??????????		??????????		??????????		
62-75-9	N-Nitrosodimethylamine	??????????		??????????		??????????		??????????		??????????		??????????		
109-06-8	2-Picoline	??????????		??????????		??????????		??????????		??????????		??????????		
10595-95-6	N-Nitrosomethylethylamine	??????????		??????????		??????????		??????????		??????????		??????????		
66-27-3	Methyl methanesulfonate	??????????		??????????		??????????		??????????		??????????		??????????		
55-18-5	N-Nitrosodiethylamine	??????????		??????????		??????????		??????????		??????????		??????????		
62-50-0	Ethyl methanesulfonate	??????????		??????????		??????????		??????????		??????????		??????????		
62-53-3	Aniline	??????????		??????????		??????????		??????????		??????????		??????????		
930-55-2	N-Nitrosopyrrolidine	??????????		??????????		??????????		??????????		??????????		??????????		
59-89-2	N-Nitrosomorpholine	??????????		??????????		??????????		??????????		??????????		??????????		
108-39-4	3-Methylphenol (m-Cresol)	??????????		??????????		??????????		??????????		??????????		??????????		
98-86-2	Acetophenone	??????????		??????????		??????????		??????????		??????????		??????????		
87-65-0	2,6-Dichlorophenol	??????????		??????????		??????????		??????????		??????????		??????????		
100-75-4	N-Nitrosopiperidine	??????????		??????????		??????????		??????????		??????????		??????????		
924-16-3	N-Nitroso-di-n-butylamine	??????????		??????????		??????????		??????????		??????????		??????????		

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SUB46-SVOA	SAMPLE ID ----->	507-s-8004-01	507-s-8004-02	507-s-8005-01	507-s-8005-02	507-s-8006-01	507-s-8007-01
	ORIGINAL ID ----->	507SB00401	507SB00402	507SB00501	507SB00502	507SB00601	507SB00701
	LAB SAMPLE ID ---->	L5540-71	L5540-72	L5540-67	L5540-70	25046.01	25046.02
	ID FROM REPORT -->	507SB00401	507SB00402	507SB00501	507SB00502	507SB00601	507SB00701
	SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	03/25/96	03/25/96
	DATE EXTRACTED -->	10/18/95	10/18/95	10/18/95	10/18/95	03/29/96	03/29/96
	DATE ANALYZED ---->	10/22/95	10/22/95	10/20/95	10/20/95	04/02/96	04/02/96
	MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil
UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	

CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	25046	VAL	25046	VAL
120-58-1	Isosafrole	??????????		??????????		??????????		??????????		??????????		??????????	
94-59-7	Safrole	??????????		??????????		??????????		??????????		??????????		??????????	
130-15-4	1,4-Naphthoquinone	??????????		??????????		??????????		??????????		??????????		??????????	
99-65-0	1,3-Dinitrobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
58-90-2	2,3,4,6-Tetrachlorophenol	??????????		??????????		??????????		??????????		??????????		??????????	
99-35-4	1,3,5-Trinitrobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
82-68-8	Pentachloronitrobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
88-85-7	Dinoseb	??????????		??????????		??????????		??????????		??????????		??????????	
56-57-5	4-Nitroquinoline 1-oxide	??????????		??????????		??????????		??????????		??????????		??????????	
3689-24-5	Sulfotep	??????????		??????????		??????????		??????????		??????????		??????????	
91-80-5	Methapyrilene	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-SV0A		507-S-B008-01		507-S-B009-01		507-S-B010-01		507-S-B011-01		507-S-B012-01		507-S-B013-01	
SAMPLE ID ----->		507-S-B008-01		507-S-B009-01		507-S-B010-01		507-S-B011-01		507-S-B012-01		507-S-B013-01	
ORIGINAL ID ----->		507SB00801		507SB00901		507SB01001		507SB01101		507SB01201		507SB01301	
LAB SAMPLE ID ---->		25046.03		25046.04		25046.05		L7281-2		L7281-3		L7281-1	
ID FROM REPORT -->		507SB00801		507SB00901		507SB01001		507SB01101		507SB01201		507SB01301	
SAMPLE DATE ----->		03/25/96		03/25/96		03/25/96		06/19/96		06/19/96		06/19/96	
DATE EXTRACTED -->		03/29/96		03/29/96		03/29/96		06/26/96		06/26/96		06/26/96	
DATE ANALYZED ---->		04/02/96		04/02/96		04/02/96		07/03/96		07/03/96		07/02/96	
MATRIX ----->		Soil		Soil		Soil		Soil		Soil		Soil	
UNITS ----->		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
CAS #	Parameter	25046	VAL	25046	VAL	25046	VAL	L7281	VAL	L7281	VAL	L7281	VAL
108-95-2	Phenol	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
111-44-4	bis(2-Chloroethyl)ether	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
95-57-8	2-Chlorophenol	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
541-73-1	1,3-Dichlorobenzene	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
106-46-7	1,4-Dichlorobenzene	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
100-51-6	Benzyl alcohol	770.	U	780.	U	800.	U	1400.	U	1400.	U	1400.	U
95-50-1	1,2-Dichlorobenzene	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
95-48-7	2-Methylphenol (o-Cresol)	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
108-60-1	2,2'-oxybis(1-Chloropropane)	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
106-44-5	4-Methylphenol (p-Cresol)	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
621-64-7	N-Nitroso-di-n-propylamine	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
67-72-1	Hexachloroethane	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
98-95-3	Nitrobenzene	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
78-59-1	Isophorone	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
88-75-5	2-Nitrophenol	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
105-67-9	2,4-Dimethylphenol	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
65-85-0	Benzoic acid	3700.	U	82.	J	3900.	U	3500.	U	3500.	U	3500.	U
111-91-1	bis(2-Chloroethoxy)methane	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
120-83-2	2,4-Dichlorophenol	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
120-82-1	1,2,4-Trichlorobenzene	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
91-20-3	Naphthalene	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
106-47-8	4-Chloroaniline	770.	U	780.	U	800.	U	1400.	U	1400.	U	1400.	U
87-68-3	Hexachlorobutadiene	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
59-50-7	4-Chloro-3-methylphenol	770.	U	780.	U	800.	U	1400.	U	1400.	U	1400.	U
91-57-6	2-Methylnaphthalene	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
77-47-4	Hexachlorocyclopentadiene	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
88-06-2	2,4,6-Trichlorophenol	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
95-95-4	2,4,5-Trichlorophenol	3700.	U	3800.	U	3900.	U	710.	U	710.	U	690.	U
91-58-7	2-Chloronaphthalene	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
88-74-4	2-Nitroaniline	3700.	U	3800.	U	3900.	U	3500.	U	3500.	U	3500.	U
131-11-3	Dimethyl phthalate	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
208-96-8	Acenaphthylene	140.	J	780.	U	800.	U	710.	U	710.	U	690.	U
606-20-2	2,6-Dinitrotoluene	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
99-09-2	3-Nitroaniline	3700.	U	3800.	U	3900.	U	3500.	U	3500.	U	3500.	U
83-32-9	Acenaphthene	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
51-28-5	2,4-Dinitrophenol	3700.	U	3800.	U	3900.	U	3500.	U	3500.	U	3500.	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SMB46-SVOA		SAMPLE ID ----->	507-S-8008-01	507-S-8009-01	507-S-8010-01	507-S-8011-01	507-S-8012-01	507-S-8013-01					
		ORIGINAL ID ----->	507SB00801	507SB00901	507SB01001	507SB01101	507SB01201	507SB01301					
		LAB SAMPLE ID ---->	25046.03	25046.04	25046.05	L7281-2	L7281-3	L7281-1					
		ID FROM REPORT -->	507SB00801	507SB00901	507SB01001	507SB01101	507SB01201	507SB01301					
		SAMPLE DATE ----->	03/25/96	03/25/96	03/25/96	06/19/96	06/19/96	06/19/96					
		DATE EXTRACTED -->	03/29/96	03/29/96	03/29/96	06/26/96	06/26/96	06/26/96					
		DATE ANALYZED ---->	04/02/96	04/02/96	04/02/96	07/03/96	07/03/96	07/02/96					
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil					
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG					
CAS #	Parameter	25046	VAL	25046	VAL	25046	VAL	L7281	VAL	L7281	VAL	L7281	VAL
100-02-7	4-Nitrophenol	3700.	U	3800.	U	3900.	U	3500.	U	3500.	U	3500.	U
132-64-9	Dibenzofuran	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
121-14-2	2,4-Dinitrotoluene	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
84-66-2	Diethylphthalate	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
7005-72-3	4-Chlorophenylphenylether	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
86-73-7	Fluorene	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
100-01-6	4-Nitroaniline	3700.	U	3800.	U	3900.	U	3500.	U	3500.	U	3500.	U
534-52-1	2-Methyl-4,6-Dinitrophenol	3700.	U	3800.	U	3900.	U	3500.	U	3500.	U	3500.	U
86-30-6	N-Nitrosodiphenylamine	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
101-55-3	4-Bromophenyl-phenylether	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
118-74-1	Hexachlorobenzene	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
87-86-5	Pentachlorophenol	3700.	U	3800.	U	3900.	U	3500.	U	3500.	U	3500.	U
85-01-8	Phenanthrene	1100.	U	780.	U	800.	U	640.	J	150.	J	690.	U
120-12-7	Anthracene	200.	J	780.	U	800.	U	710.	U	710.	U	690.	U
86-74-8	Carbazole	??????????		??????????		??????????		710.	U	710.	U	690.	U
84-74-2	Di-n-butylphthalate	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
206-44-0	Fluoranthene	2100.	U	780.	U	800.	U	900.	J	450.	J	500.	J
129-00-0	Pyrene	1700.	U	780.	U	800.	U	720.	J	380.	J	470.	J
85-68-7	Butylbenzylphthalate	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
91-94-1	3,3'-Dichlorobenzidine	1500.	U	1600.	U	1600.	U	1400.	U	1400.	U	1400.	U
56-55-3	Benzo(a)anthracene	960.	U	780.	U	800.	U	350.	J	210.	J	380.	J
218-01-9	Chrysene	1100.	U	780.	U	800.	U	330.	J	280.	J	390.	J
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
117-84-0	Di-n-octyl phthalate	770.	U	780.	U	800.	U	710.	U	710.	U	690.	U
205-99-2	Benzo(b)fluoranthene	930.	U	780.	U	800.	U	310.	J	240.	J	310.	J
207-08-9	Benzo(k)fluoranthene	910.	U	780.	U	800.	U	710.	U	710.	U	690.	U
50-32-8	Benzo(a)pyrene	730.	J	780.	U	800.	U	360.	J	290.	J	330.	J
193-39-5	Indeno(1,2,3-cd)pyrene	560.	J	780.	U	800.	U	710.	U	710.	U	690.	U
53-70-3	Dibenz(a,h)anthracene	240.	J	780.	U	800.	U	710.	U	710.	U	690.	U
191-24-2	Benzo(g,h,i)perylene	610.	J	780.	U	800.	U	710.	U	710.	U	690.	U
95-53-4	o-Toluidine	??????????		??????????		??????????		710.	U	710.	U	690.	U
126-68-1	O,O,O-Triethylphosphorothioate	??????????		??????????		??????????		710.	U	710.	U	690.	U
1888-71-7	Hexachloropropene	??????????		??????????		??????????		710.	U	710.	U	690.	U
95-94-3	1,2,4,5-Tetrachlorobenzene	??????????		??????????		??????????		710.	U	710.	U	690.	U
608-93-5	Pentachlorobenzene	??????????		??????????		??????????		710.	U	710.	U	690.	U
91-59-8	2-Naphthylamine	??????????		??????????		??????????		710.	U	710.	U	690.	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-SV0A		SAMPLE ID -----> ORIGINAL ID -----> LAB SAMPLE ID ----> ID FROM REPORT --> SAMPLE DATE -----> DATE EXTRACTED --> DATE ANALYZED ----> MATRIX -----> UNITS ----->	507-S-B008-01 507SB00801 25046.03 507SB00801 03/25/96 03/29/96 04/02/96 Soil UG/KG	A	507-S-B009-01 507SB00901 25046.04 507SB00901 03/25/96 03/29/96 04/02/96 Soil UG/KG	A	507-S-B010-01 507SB01001 25046.05 507SB01001 03/25/96 03/29/96 04/02/96 Soil UG/KG	A	507-S-B011-01 507SB01101 L7281-2 507SB01101 06/19/96 06/26/96 07/03/96 Soil UG/KG	A	507-S-B012-01 507SB01201 L7281-3 507SB01201 06/19/96 06/26/96 07/03/96 Soil UG/KG	A	507-S-B013-01 507SB01301 L7281-1 507SB01301 06/19/96 06/26/96 07/02/96 Soil UG/KG	A
CAS #	Parameter	25046	VAL	25046	VAL	25046	VAL	L7281	VAL	L7281	VAL	L7281	VAL	
134-32-7	1-Naphthylamine	??????????		??????????		??????????		??????????		??????????		??????????		
297-97-2	Thionazin	??????????		??????????		??????????		??????????		??????????		??????????		
99-55-8	5-Nitro-o-toluidine	??????????		??????????		??????????		??????????		??????????		??????????		
2303-16-4	Diallate	??????????		??????????		??????????		??????????		??????????		??????????		
298-02-2	Phorate	??????????		??????????		??????????		??????????		??????????		??????????		
62-44-2	Phenacetin	??????????		??????????		??????????		??????????		??????????		??????????		
60-51-5	Dimethoate	??????????		??????????		??????????		??????????		??????????		??????????		
92-67-1	4-Aminobiphenyl	??????????		??????????		??????????		??????????		??????????		??????????		
23950-58-5	Pronamide	??????????		??????????		??????????		??????????		??????????		??????????		
298-04-4	Disulfoton	??????????		??????????		??????????		??????????		??????????		??????????		
298-00-0	Methyl parathion	??????????		??????????		??????????		??????????		??????????		??????????		
56-38-2	Parathion	??????????		??????????		??????????		??????????		??????????		??????????		
140-57-8	Aramite	??????????		??????????		??????????		??????????		??????????		??????????		
60-11-7	p-(Dimethylamino)azobenzene	??????????		??????????		??????????		??????????		??????????		??????????		
510-15-6	Chlorobenzilate	??????????		??????????		??????????		??????????		??????????		??????????		
119-93-7	3,3-Dimethylbenzidine	??????????		??????????		??????????		??????????		??????????		??????????		
52-85-7	Famphur	??????????		??????????		??????????		??????????		??????????		??????????		
53-96-3	Acetamidofluorene	??????????		??????????		??????????		??????????		??????????		??????????		
57-97-6	7,12-Dimethylbenz(a)anthracene	??????????		??????????		??????????		??????????		??????????		??????????		
56-49-5	3-Methyl cholanthrene	??????????		??????????		??????????		??????????		??????????		??????????		
110-86-1	Pyridine	??????????		??????????		??????????		??????????		??????????		??????????		
76-01-7	Pentachloroethane	??????????		??????????		??????????		??????????		??????????		??????????		
62-75-9	N-Nitrosodimethylamine	??????????		??????????		??????????		??????????		??????????		??????????		
109-06-8	2-Picoline	??????????		??????????		??????????		??????????		??????????		??????????		
10595-95-6	N-Nitrosomethylethylamine	??????????		??????????		??????????		??????????		??????????		??????????		
66-27-3	Methyl methanesulfonate	??????????		??????????		??????????		??????????		??????????		??????????		
55-18-5	N-Nitrosodiethylamine	??????????		??????????		??????????		??????????		??????????		??????????		
62-50-0	Ethyl methanesulfonate	??????????		??????????		??????????		??????????		??????????		??????????		
62-53-3	Aniline	??????????		??????????		??????????		??????????		??????????		??????????		
930-55-2	N-Nitrosopyrrolidine	??????????		??????????		??????????		??????????		??????????		??????????		
59-89-2	N-Nitrosomorpholine	??????????		??????????		??????????		??????????		??????????		??????????		
108-39-4	3-Methylphenol (m-Cresol)	??????????		??????????		??????????		??????????		??????????		??????????		
98-86-2	Acetophenone	??????????		??????????		??????????		??????????		??????????		??????????		
87-65-0	2,6-Dichlorophenol	??????????		??????????		??????????		??????????		??????????		??????????		
100-75-4	N-Nitrosopiperidine	??????????		??????????		??????????		??????????		??????????		??????????		
924-16-3	N-Nitroso-di-n-butylamine	??????????		??????????		??????????		??????????		??????????		??????????		

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SUB46-SVOA		SAMPLE ID ----->	507-S-8008-01	507-S-8009-01	507-S-8010-01	507-S-8011-01	507-S-8012-01	507-S-8013-01					
		ORIGINAL ID ----->	507SB00801	507SB00901	507SB01001	507SB01101	507SB01201	507SB01301					
		LAB SAMPLE ID --->	25046.03	25046.04	25046.05	L7281-2	L7281-3	L7281-1					
		ID FROM REPORT -->	507SB00801	507SB00901	507SB01001	507SB01101	507SB01201	507SB01301					
		SAMPLE DATE ----->	03/25/96	03/25/96	03/25/96	06/19/96	06/19/96	06/19/96					
		DATE EXTRACTED -->	03/29/96	03/29/96	03/29/96	06/26/96	06/26/96	06/26/96					
		DATE ANALYZED ---->	04/02/96	04/02/96	04/02/96	07/03/96	07/03/96	07/02/96					
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil					
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG					
CAS #	Parameter	25046	VAL	25046	VAL	25046	VAL	L7281	VAL	L7281	VAL	L7281	VAL
120-58-1	Isosafrole	??????????		??????????		??????????		??????????		??????????		??????????	
94-59-7	Safrole	??????????		??????????		??????????		??????????		??????????		??????????	
130-15-4	1,4-Naphthoquinone	??????????		??????????		??????????		??????????		??????????		??????????	
99-65-0	1,3-Dinitrobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
58-90-2	2,3,4,6-Tetrachlorophenol	??????????		??????????		??????????		??????????		??????????		??????????	
99-35-4	1,3,5-Trinitrobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
82-68-8	Pentachloronitrobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
88-85-7	Dinoseb	??????????		??????????		??????????		??????????		??????????		??????????	
56-57-5	4-Nitroquinoline 1-oxide	??????????		??????????		??????????		??????????		??????????		??????????	
3689-24-5	Sulfotep	??????????		??????????		??????????		??????????		??????????		??????????	
91-80-5	Methapyrilene	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SV846-SVOA	SAMPLE ID ----->	GDB-S-8001-01	GDB-S-8001-02	GDB-S-8002-01	GDB-S-8002-02	GDB-S-8003-01	GDB-S-8004-01
	ORIGINAL ID ----->	GDBSB00101	GDBSB00102	GDBSB00201	GDBSB00202	GDBSB00301	GDBSB00401
	LAB SAMPLE ID ---->	L5540-80	L5540-81	L5540-78	L5540-79	L5540-44	L5540-75
	ID FROM REPORT -->	GDBSB00101	GDBSB00102	GDBSB00201	GDBSB00202	GDBSB00301	GDBSB00401
	SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95
	DATE EXTRACTED -->	10/18/95	10/18/95	10/18/95	10/18/95	10/14/95	10/18/95
	DATE ANALYZED -->	10/22/95	10/22/95	10/22/95	10/22/95	10/20/95	10/22/95
	MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil
UNITS ----->	UG/KG	A	UG/KG	A	UG/KG	A	UG/KG

CAS #	Parameter	L5540	VAL								
108-95-2	Phenol	1000.	U	1600.	U	880.	U	1200.	U	810.	U
111-44-4	bis(2-Chloroethyl)ether	1000.	U	1600.	U	880.	U	1200.	U	810.	U
95-57-8	2-Chlorophenol	1000.	U	1600.	U	880.	U	1200.	U	810.	U
541-73-1	1,3-Dichlorobenzene	1000.	U	1600.	U	880.	U	1200.	U	810.	U
106-46-7	1,4-Dichlorobenzene	1000.	U	1600.	U	880.	U	1200.	U	810.	U
100-51-6	Benzyl alcohol	2000.	U	3200.	U	1700.	U	2400.	U	1600.	U
95-50-1	1,2-Dichlorobenzene	1000.	U	1600.	U	880.	U	1200.	U	810.	U
95-48-7	2-Methylphenol (o-Cresol)	1000.	U	1600.	U	880.	U	1200.	U	810.	U
108-60-1	2,2'-oxybis(1-Chloropropane)	1000.	U	1600.	U	880.	U	1200.	U	810.	U
106-44-5	4-Methylphenol (p-Cresol)	?????????		?????????		?????????		?????????		?????????	
621-64-7	N-Nitroso-di-n-propylamine	1000.	U	1600.	U	880.	U	1200.	U	810.	U
67-72-1	Hexachloroethane	1000.	U	1600.	U	880.	U	1200.	U	810.	U
98-95-3	Nitrobenzene	1000.	U	1600.	U	880.	U	1200.	U	810.	U
78-59-1	Isophorone	1000.	U	1600.	U	880.	U	1200.	U	810.	U
88-75-5	2-Nitrophenol	1000.	U	1600.	U	880.	U	1200.	U	810.	U
105-67-9	2,4-Dimethylphenol	1000.	U	1600.	U	880.	U	1200.	U	810.	U
65-85-0	Benzoic acid	5100.	U	8200.	U	4400.	U	6000.	U	4100.	UJ
111-91-1	bis(2-Chloroethoxy)methane	1000.	U	1600.	U	880.	U	1200.	U	810.	U
120-83-2	2,4-Dichlorophenol	1000.	U	1600.	U	880.	U	1200.	U	810.	U
120-82-1	1,2,4-Trichlorobenzene	1000.	U	1600.	U	880.	U	1200.	U	810.	U
91-20-3	Naphthalene	1000.	U	1600.	U	880.	U	1200.	U	810.	U
106-47-8	4-Chloroaniline	2000.	U	3200.	U	1700.	U	2400.	U	1600.	U
87-68-3	Hexachlorobutadiene	1000.	U	1600.	U	880.	U	1200.	U	810.	U
59-50-7	4-Chloro-3-methylphenol	2000.	U	3200.	U	1700.	U	2400.	U	1600.	U
91-57-6	2-Methylnaphthalene	1000.	U	1600.	U	880.	U	1200.	U	810.	U
77-47-4	Hexachlorocyclopentadiene	1000.	U	1600.	U	880.	U	1200.	U	810.	U
88-06-2	2,4,6-Trichlorophenol	1000.	U	1600.	U	880.	U	1200.	U	810.	U
95-95-4	2,4,5-Trichlorophenol	1000.	U	1600.	U	880.	U	1200.	U	810.	U
91-58-7	2-Chloronaphthalene	1000.	U	1600.	U	880.	U	1200.	U	810.	U
88-74-4	2-Nitroaniline	5100.	U	8200.	U	4400.	U	6000.	U	4100.	U
131-11-3	Dimethyl phthalate	1000.	U	1600.	U	880.	U	1200.	U	810.	U
208-96-8	Acenaphthylene	1000.	U	1600.	U	880.	U	1200.	U	810.	U
606-20-2	2,6-Dinitrotoluene	1000.	U	1600.	U	880.	U	1200.	U	810.	U
99-09-2	3-Nitroaniline	5100.	U	8200.	U	4400.	U	6000.	U	4100.	U
83-32-9	Acenaphthene	1000.	U	1600.	U	880.	U	1200.	U	810.	U
51-28-5	2,4-Dinitrophenol	5100.	U	8200.	U	4400.	U	6000.	U	4100.	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SN846-SVOA		SAMPLE ID ----->	GDB-S-B001-01	GDB-S-B001-02	GDB-S-B002-01	GDB-S-B002-02	GDB-S-B003-01	GDB-S-B004-01					
		ORIGINAL ID ----->	GDBSB00101	GDBSB00102	GDBSB00201	GDBSB00202	GDBSB00301	GDBSB00401					
		LAB SAMPLE ID ---->	L5540-80	L5540-81	L5540-78	L5540-79	L5540-44	L5540-75					
		ID FROM REPORT -->	GDBSB00101	GDBSB00102	GDBSB00201	GDBSB00202	GDBSB00301	GDBSB00401					
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95					
		DATE EXTRACTED -->	10/18/95	10/18/95	10/18/95	10/18/95	10/14/95	10/18/95					
		DATE ANALYZED ---->	10/22/95	10/22/95	10/22/95	10/22/95	10/20/95	10/22/95					
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil					
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG					
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL		
100-02-7	4-Nitrophenol	5100.	U	8200.	U	4400.	U	6000.	U	4100.	U	3500.	U
132-64-9	Dibenzofuran	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
121-14-2	2,4-Dinitrotoluene	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
84-66-2	Diethylphthalate	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
7005-72-3	4-Chlorophenylphenylether	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
86-73-7	Fluorene	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
100-01-6	4-Nitroaniline	5100.	U	8200.	U	4400.	U	6000.	U	4100.	U	3500.	U
534-52-1	2-Methyl-4,6-Dinitrophenol	5100.	U	8200.	U	4400.	U	6000.	U	4100.	U	3500.	U
86-30-6	N-Nitrosodiphenylamine	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
101-55-3	4-Bromophenyl-phenylether	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
118-74-1	Hexachlorobenzene	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
87-86-5	Pentachlorophenol	5100.	U	8200.	U	4400.	U	6000.	U	4100.	U	3500.	U
85-01-8	Phenanthrene	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
120-12-7	Anthracene	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
86-74-8	Carbazole	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
84-74-2	Di-n-butylphthalate	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
206-44-0	Fluoranthene	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
129-00-0	Pyrene	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
85-68-7	Butylbenzylphthalate	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
91-94-1	3,3'-Dichlorobenzidine	2000.	U	3200.	U	1700.	U	2400.	U	1600.	U	1400.	U
56-55-3	Benzo(a)anthracene	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
218-01-9	Chrysene	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
117-84-0	Di-n-octyl phthalate	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
205-99-2	Benzo(b)fluoranthene	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
207-08-9	Benzo(k)fluoranthene	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
50-32-8	Benzo(a)pyrene	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
193-39-5	Indeno(1,2,3-cd)pyrene	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
53-70-3	Dibenz(a,h)anthracene	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
191-24-2	Benzo(g,h,i)perylene	1000.	U	1600.	U	880.	U	1200.	U	810.	U	690.	U
95-53-4	o-Toluidine	??????????		??????????		??????????		??????????		??????????		??????????	
126-68-1	O,O,O-Triethylphosphorothioate	??????????		??????????		??????????		??????????		??????????		??????????	
1888-71-7	Hexachloropropene	??????????		??????????		??????????		??????????		??????????		??????????	
95-94-3	1,2,4,5-Tetrachlorobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
608-93-5	Pentachlorobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
91-59-8	2-Naphthylamine	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-SV0A		SAMPLE ID ----->	GDB-S-B001-01	GDB-S-B001-02	GDB-S-B002-01	GDB-S-B002-02	GDB-S-B003-01	GDB-S-B004-01	
		ORIGINAL ID ----->	GDBS800101	GDBS800102	GDBS800201	GDBS800202	GDBS800301	GDBS800401	
		LAB SAMPLE ID --->	L5540-80	L5540-81	L5540-78	L5540-79	L5540-44	L5540-75	
		ID FROM REPORT -->	GDBS800101	GDBS800102	GDBS800201	GDBS800202	GDBS800301	GDBS800401	
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	
		DATE EXTRACTED -->	10/18/95	10/18/95	10/18/95	10/18/95	10/14/95	10/18/95	
		DATE ANALYZED --->	10/22/95	10/22/95	10/22/95	10/22/95	10/20/95	10/22/95	
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil	
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL
134-32-7	1-Naphthylamine	??????????		??????????		??????????		??????????	
297-97-2	Thionazin	??????????		??????????		??????????		??????????	
99-55-8	5-Nitro-o-toluidine	??????????		??????????		??????????		??????????	
2303-16-4	Diallate	??????????		??????????		??????????		??????????	
298-02-2	Phorate	??????????		??????????		??????????		??????????	
62-44-2	Phenacetin	??????????		??????????		??????????		??????????	
60-51-5	Dimethoate	??????????		??????????		??????????		??????????	
92-67-1	4-Aminobiphenyl	??????????		??????????		??????????		??????????	
23950-58-5	Pronamide	??????????		??????????		??????????		??????????	
298-04-4	Disulfoton	??????????		??????????		??????????		??????????	
298-00-0	Methyl parathion	??????????		??????????		??????????		??????????	
56-38-2	Parathion	??????????		??????????		??????????		??????????	
140-57-8	Aramite	??????????		??????????		??????????		??????????	
60-11-7	p-(Dimethylamino)azobenzene	??????????		??????????		??????????		??????????	
510-15-6	Chlorobenzilate	??????????		??????????		??????????		??????????	
119-93-7	3,3-Dimethylbenzidine	??????????		??????????		??????????		??????????	
52-85-7	Famphur	??????????		??????????		??????????		??????????	
53-96-3	Acetamidofluorene	??????????		??????????		??????????		??????????	
57-97-6	7,12-Dimethylbenz(a)anthracene	??????????		??????????		??????????		??????????	
56-49-5	3-Methyl cholanthrene	??????????		??????????		??????????		??????????	
110-86-1	Pyridine	??????????		??????????		??????????		??????????	
76-01-7	Pentachloroethane	??????????		??????????		??????????		??????????	
62-75-9	N-Nitrosodimethylamine	??????????		??????????		??????????		??????????	
109-06-8	2-Picoline	??????????		??????????		??????????		??????????	
10595-95-6	N-Nitrosomethylethylamine	??????????		??????????		??????????		??????????	
66-27-3	Methyl methanesulfonate	??????????		??????????		??????????		??????????	
55-18-5	N-Nitrosodiethylamine	??????????		??????????		??????????		??????????	
62-50-0	Ethyl methanesulfonate	??????????		??????????		??????????		??????????	
62-53-3	Aniline	??????????		??????????		??????????		??????????	
930-55-2	N-Nitrosopyrrolidine	??????????		??????????		??????????		??????????	
59-89-2	N-Nitrosomorpholine	??????????		??????????		??????????		??????????	
108-39-4	3-Methylphenol (m-Cresol)	??????????		??????????		??????????		??????????	
98-86-2	Acetophenone	??????????		??????????		??????????		??????????	
87-65-0	2,6-Dichlorophenol	??????????		??????????		??????????		??????????	
100-75-4	N-Nitrosopiperidine	??????????		??????????		??????????		??????????	
924-16-3	N-Nitroso-di-n-butylamine	??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SMB46-SV0A		SAMPLE ID ----->	GDB-S-B001-01	GDB-S-B001-02	GDB-S-B002-01	GDB-S-B002-02	GDB-S-B003-01	GDB-S-B004-01	
		ORIGINAL ID ----->	GDBSB00101	GDBSB00102	GDBSB00201	GDBSB00202	GDBSB00301	GDBSB00401	
		LAB SAMPLE ID --->	L5540-80	L5540-81	L5540-78	L5540-79	L5540-44	L5540-75	
		ID FROM REPORT -->	GDBSB00101	GDBSB00102	GDBSB00201	GDBSB00202	GDBSB00301	GDBSB00401	
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	
		DATE EXTRACTED -->	10/18/95	10/18/95	10/18/95	10/18/95	10/14/95	10/18/95	
		DATE ANALYZED --->	10/22/95	10/22/95	10/22/95	10/22/95	10/20/95	10/22/95	
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil	
		UNITS ----->	UG/KG	A UG/KG	A UG/KG	A UG/KG	A UG/KG	A UG/KG	
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL
120-58-1	Isosafrole	??????????		??????????		??????????		??????????	
94-59-7	Safrole	??????????		??????????		??????????		??????????	
130-15-4	1,4-Naphthoquinone	??????????		??????????		??????????		??????????	
99-65-0	1,3-Dinitrobenzene	??????????		??????????		??????????		??????????	
58-90-2	2,3,4,6-Tetrachlorophenol	??????????		??????????		??????????		??????????	
99-35-4	1,3,5-Trinitrobenzene	??????????		??????????		??????????		??????????	
82-68-8	Pentachloronitrobenzene	??????????		??????????		??????????		??????????	
88-85-7	Dinoseb	??????????		??????????		??????????		??????????	
56-57-5	4-Nitroquinoline 1-oxide	??????????		??????????		??????????		??????????	
3689-24-5	Sulfotep	??????????		??????????		??????????		??????????	
91-80-5	Methapyrilene	??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SMB46-SVOA		SAMPLE ID -----> ORIGINAL ID -----> LAB SAMPLE ID ----> ID FROM REPORT --> SAMPLE DATE -----> DATE EXTRACTED --> DATE ANALYZED ----> MATRIX -----> UNITS ----->	GDB-S-B004-02 GDBSB00402 L5540-77 GDBSB00402 10/04/95 10/18/95 10/20/95 Soil UG/KG	A	GDB-S-B005-01 GDBSB00501 L5540-84 GDBSB00501 10/04/95 10/18/95 10/22/95 Soil UG/KG	A	GDB-S-B005-02 GDBSB00502 L5540-85 GDBSB00502 10/04/95 10/18/95 10/20/95 Soil UG/KG	A	GDB-S-B006-01 GDBSB00601 L5540-82 GDBSB00601 10/04/95 10/18/95 10/22/95 Soil UG/KG	A	GDB-S-B006-02 GDBSB00602 L5540-83 GDBSB00602 10/04/95 10/18/95 10/20/95 Soil UG/KG	A	GDB-S-B007-01 GDBSB00701 L5540-59 GDBSB00701 10/04/95 10/14/95 10/20/95 Soil UG/KG	A
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	
108-95-2	Phenol	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
111-44-4	bis(2-Chloroethyl)ether	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
95-57-8	2-Chlorophenol	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
541-73-1	1,3-Dichlorobenzene	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
106-46-7	1,4-Dichlorobenzene	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
100-51-6	Benzyl alcohol	1400.	U	1400.	U	1500.	U	1400.	U	1500.	U	1500.	U	
95-50-1	1,2-Dichlorobenzene	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
95-48-7	2-Methylphenol (o-Cresol)	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
108-60-1	2,2'-oxybis(1-Chloropropane)	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
106-44-5	4-Methylphenol (p-Cresol)	??????????		??????????		??????????		??????????		??????????		??????????		
621-64-7	N-Nitroso-di-n-propylamine	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
67-72-1	Hexachloroethane	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
98-95-3	Nitrobenzene	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
78-59-1	Isophorone	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
88-75-5	2-Nitrophenol	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
105-67-9	2,4-Dimethylphenol	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
65-85-0	Benzoic acid	3500.	UJ	3600.	U	3900.	UJ	3600.	U	3900.	UJ	3900.	UJ	
111-91-1	bis(2-Chloroethoxy)methane	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
120-83-2	2,4-Dichlorophenol	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
120-82-1	1,2,4-Trichlorobenzene	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
91-20-3	Naphthalene	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
106-47-8	4-Chloroaniline	1400.	U	1400.	U	1500.	U	1400.	U	1500.	U	1500.	U	
87-68-3	Hexachlorobutadiene	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
59-50-7	4-Chloro-3-methylphenol	1400.	U	1400.	U	1500.	U	1400.	U	1500.	U	1500.	U	
91-57-6	2-Methylnaphthalene	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
77-47-4	Hexachlorocyclopentadiene	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
88-06-2	2,4,6-Trichlorophenol	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
95-95-4	2,4,5-Trichlorophenol	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
91-58-7	2-Chloronaphthalene	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
88-74-4	2-Nitroaniline	3500.	U	3600.	U	3900.	U	3600.	U	3900.	U	3900.	U	
131-11-3	Dimethyl phthalate	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
208-96-8	Acenaphthylene	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
606-20-2	2,6-Dinitrotoluene	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
99-09-2	3-Nitroaniline	3500.	U	3600.	U	3900.	U	3600.	U	3900.	U	3900.	U	
83-32-9	Acenaphthene	690.	U	720.	U	780.	U	720.	U	780.	U	770.	U	
51-28-5	2,4-Dinitrophenol	3500.	U	3600.	U	3900.	U	3600.	U	3900.	U	3900.	U	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SMB46-SVOA		SAMPLE ID ----->	GDB-S-B004-02	GDB-S-B005-01	GDB-S-B005-02	GDB-S-B006-01	GDB-S-B006-02	GDB-S-B007-01			
		ORIGINAL ID ----->	GDBSB00402	GDBSB00501	GDBSB00502	GDBSB00601	GDBSB00602	GDBSB00701			
		LAB SAMPLE ID --->	L5540-77	L5540-84	L5540-85	L5540-82	L5540-83	L5540-59			
		ID FROM REPORT --->	GDBSB00402	GDBSB00501	GDBSB00502	GDBSB00601	GDBSB00602	GDBSB00701			
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95			
		DATE EXTRACTED -->	10/18/95	10/18/95	10/18/95	10/18/95	10/18/95	10/14/95			
		DATE ANALYZED --->	10/20/95	10/22/95	10/20/95	10/22/95	10/20/95	10/20/95			
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil			
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG			
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL
100-02-7	4-Nitrophenol	3500.	U	3600.	U	3900.	U	3600.	U	3900.	U
132-64-9	Dibenzofuran	690.	U	720.	U	780.	U	720.	U	780.	U
121-14-2	2,4-Dinitrotoluene	690.	U	720.	U	780.	U	720.	U	780.	U
84-66-2	Diethylphthalate	690.	U	720.	U	780.	U	720.	U	780.	U
7005-72-3	4-Chlorophenylphenylether	690.	U	720.	U	780.	U	720.	U	780.	U
86-73-7	Fluorene	690.	U	720.	U	780.	U	720.	U	780.	U
100-01-6	4-Nitroaniline	3500.	U	3600.	U	3900.	U	3600.	U	3900.	U
534-52-1	2-Methyl-4,6-Dinitrophenol	3500.	U	3600.	U	3900.	U	3600.	U	3900.	U
86-30-6	N-Nitrosodiphenylamine	690.	U	720.	U	780.	U	720.	U	780.	U
101-55-3	4-Bromophenyl-phenylether	690.	U	720.	U	780.	U	720.	U	780.	U
118-74-1	Hexachlorobenzene	690.	U	720.	U	780.	U	720.	U	780.	U
87-86-5	Pentachlorophenol	3500.	U	3600.	U	3900.	U	3600.	U	3900.	U
85-01-8	Phenanthrene	690.	U	720.	U	780.	J	780.	U	770.	U
120-12-7	Anthracene	690.	U	720.	U	780.	U	720.	U	780.	U
86-74-8	Carbazole	690.	U	720.	U	780.	U	720.	U	780.	U
84-74-2	Di-n-butylphthalate	690.	U	720.	U	780.	U	720.	U	780.	U
206-44-0	Fluoranthene	690.	U	720.	U	780.	U	430.	J	780.	U
129-00-0	Pyrene	690.	U	720.	U	780.	U	390.	J	780.	U
85-68-7	Butylbenzylphthalate	690.	U	720.	U	780.	U	720.	U	780.	U
91-94-1	3,3'-Dichlorobenzidine	1400.	U	1400.	U	1500.	U	1400.	U	1500.	U
56-55-3	Benzo(a)anthracene	690.	U	720.	U	780.	U	260.	J	780.	U
218-01-9	Chrysene	690.	U	720.	U	780.	U	280.	J	780.	U
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	690.	U	720.	U	780.	U	720.	U	780.	U
117-84-0	Di-n-octyl phthalate	690.	U	720.	U	780.	U	720.	U	780.	U
205-99-2	Benzo(b)fluoranthene	690.	U	720.	U	780.	U	220.	J	780.	U
207-08-9	Benzo(k)fluoranthene	690.	U	720.	U	780.	U	720.	U	780.	U
50-32-8	Benzo(a)pyrene	690.	U	720.	U	780.	U	210.	J	780.	U
193-39-5	Indeno(1,2,3-cd)pyrene	690.	U	720.	U	780.	U	140.	J	780.	U
53-70-3	Dibenz(a,h)anthracene	690.	U	720.	U	780.	U	720.	U	780.	U
191-24-2	Benzo(g,h,i)perylene	690.	U	720.	U	780.	U	720.	U	780.	U
95-53-4	o-Toluidine	??????????		??????????		??????????		??????????		??????????	
126-68-1	O,O,O-Triethylphosphorothioate	??????????		??????????		??????????		??????????		??????????	
1888-71-7	Hexachloropropene	??????????		??????????		??????????		??????????		??????????	
95-94-3	1,2,4,5-Tetrachlorobenzene	??????????		??????????		??????????		??????????		??????????	
608-93-5	Pentachlorobenzene	??????????		??????????		??????????		??????????		??????????	
91-59-8	2-Naphthylamine	??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-SV0A		SAMPLE ID ----->	GDB-S-B004-02	GDB-S-B005-01	GDB-S-B005-02	GDB-S-B006-01	GDB-S-B006-02	GDB-S-B007-01			
		ORIGINAL ID ----->	GDBS00402	GDBS00501	GDBS00502	GDBS00601	GDBS00602	GDBS00701			
		LAB SAMPLE ID ---->	L5540-77	L5540-84	L5540-85	L5540-82	L5540-83	L5540-59			
		ID FROM REPORT -->	GDBS00402	GDBS00501	GDBS00502	GDBS00601	GDBS00602	GDBS00701			
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95			
		DATE EXTRACTED -->	10/18/95	10/18/95	10/18/95	10/18/95	10/18/95	10/14/95			
		DATE ANALYZED -->	10/20/95	10/22/95	10/20/95	10/22/95	10/20/95	10/20/95			
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil			
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG			
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL
134-32-7	1-Naphthylamine	?????????		?????????		?????????		?????????		?????????	
297-97-2	Thionazin	?????????		?????????		?????????		?????????		?????????	
99-55-8	5-Nitro-o-toluidine	?????????		?????????		?????????		?????????		?????????	
2303-16-4	Diallate	?????????		?????????		?????????		?????????		?????????	
298-02-2	Phorate	?????????		?????????		?????????		?????????		?????????	
62-44-2	Phenacetin	?????????		?????????		?????????		?????????		?????????	
60-51-5	Dimethoate	?????????		?????????		?????????		?????????		?????????	
92-67-1	4-Aminobiphenyl	?????????		?????????		?????????		?????????		?????????	
23950-58-5	Pronamide	?????????		?????????		?????????		?????????		?????????	
298-04-4	Disulfoton	?????????		?????????		?????????		?????????		?????????	
298-00-0	Methyl parathion	?????????		?????????		?????????		?????????		?????????	
56-38-2	Parathion	?????????		?????????		?????????		?????????		?????????	
140-57-8	Aramite	?????????		?????????		?????????		?????????		?????????	
60-11-7	p-(Dimethylamino)azobenzene	?????????		?????????		?????????		?????????		?????????	
510-15-6	Chlorobenzilate	?????????		?????????		?????????		?????????		?????????	
119-93-7	3,3-Dimethylbenzidine	?????????		?????????		?????????		?????????		?????????	
52-85-7	Famphur	?????????		?????????		?????????		?????????		?????????	
53-96-3	Acetamidofluorene	?????????		?????????		?????????		?????????		?????????	
57-97-6	7,12-Dimethylbenz(a)anthracene	?????????		?????????		?????????		?????????		?????????	
56-49-5	3-Methyl cholanthrene	?????????		?????????		?????????		?????????		?????????	
110-86-1	Pyridine	?????????		?????????		?????????		?????????		?????????	
76-01-7	Pentachloroethane	?????????		?????????		?????????		?????????		?????????	
62-75-9	N-Nitrosodimethylamine	?????????		?????????		?????????		?????????		?????????	
109-06-8	2-Picoline	?????????		?????????		?????????		?????????		?????????	
10595-95-6	N-Nitrosomethylethylamine	?????????		?????????		?????????		?????????		?????????	
66-27-3	Methyl methanesulfonate	?????????		?????????		?????????		?????????		?????????	
55-18-5	N-Nitrosodiethylamine	?????????		?????????		?????????		?????????		?????????	
62-50-0	Ethyl methanesulfonate	?????????		?????????		?????????		?????????		?????????	
62-53-3	Aniline	?????????		?????????		?????????		?????????		?????????	
930-55-2	N-Nitrosopyrrolidine	?????????		?????????		?????????		?????????		?????????	
59-89-2	N-Nitrosomorpholine	?????????		?????????		?????????		?????????		?????????	
108-39-4	3-Methylphenol (m-Cresol)	?????????		?????????		?????????		?????????		?????????	
98-86-2	Acetophenone	?????????		?????????		?????????		?????????		?????????	
87-65-0	2,6-Dichlorophenol	?????????		?????????		?????????		?????????		?????????	
100-75-4	N-Nitrosopiperidine	?????????		?????????		?????????		?????????		?????????	
924-16-3	N-Nitroso-di-n-butylamine	?????????		?????????		?????????		?????????		?????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SUB46-SVOA	SAMPLE ID ----->	GDB-S-8004-02	GDB-S-8005-01	GDB-S-8005-02	GDB-S-8006-01	GDB-S-8006-02	GDB-S-8007-01
	ORIGINAL ID ----->	GDBS800402	GDBS800501	GDBS800502	GDBS800601	GDBS800602	GDBS800701
	LAB SAMPLE ID ---->	L5540-77	L5540-84	L5540-85	L5540-82	L5540-83	L5540-59
	ID FROM REPORT -->	GDBS800402	GDBS800501	GDBS800502	GDBS800601	GDBS800602	GDBS800701
	SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95
	DATE EXTRACTED -->	10/18/95	10/18/95	10/18/95	10/18/95	10/18/95	10/14/95
	DATE ANALYZED ---->	10/20/95	10/22/95	10/20/95	10/22/95	10/20/95	10/20/95
	MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil
	UNITS ----->	UG/KG	A UG/KG	A UG/KG	A UG/KG	A UG/KG	A UG/KG

CAS #	Parameter	L5540	VAL								
120-58-1	Isosafrole	??????????		??????????		??????????		??????????		??????????	
94-59-7	Safrole	??????????		??????????		??????????		??????????		??????????	
130-15-4	1,4-Naphthoquinone	??????????		??????????		??????????		??????????		??????????	
99-65-0	1,3-Dinitrobenzene	??????????		??????????		??????????		??????????		??????????	
58-90-2	2,3,4,6-Tetrachlorophenol	??????????		??????????		??????????		??????????		??????????	
99-35-4	1,3,5-Trinitrobenzene	??????????		??????????		??????????		??????????		??????????	
82-68-8	Pentachloronitrobenzene	??????????		??????????		??????????		??????????		??????????	
88-85-7	Dinoseb	??????????		??????????		??????????		??????????		??????????	
56-57-5	4-Nitroquinoline 1-oxide	??????????		??????????		??????????		??????????		??????????	
3689-24-5	Sulfotep	??????????		??????????		??????????		??????????		??????????	
91-80-5	Methapyrilene	??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-SVOA		GDB-S-8007-02		GDB-S-8008-01		GDB-S-8008-02		GDB-S-8009-01		GDB-S-8009-02		GDB-S-8010-01	
SAMPLE ID ----->		GDBS800702		GDBS800801		GDBS800802		GDBS800901		GDBS800902		GDBS801001	
ORIGINAL ID ----->		L5540-60		L5540-57		L5540-58		L5540-61		L5540-62		L5540-86	
LAB SAMPLE ID ---->		GDBS800702		GDBS800801		GDBS800802		GDBS800901		GDBS800902		GDBS801001	
ID FROM REPORT -->		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95	
SAMPLE DATE ----->		10/14/95		10/14/95		10/14/95		10/14/95		10/14/95		10/18/95	
DATE EXTRACTED -->		10/19/95		10/20/95		10/19/95		10/20/95		10/19/95		10/22/95	
DATE ANALYZED ---->		Soil		Soil		Soil		Soil		Soil		Soil	
MATRIX ----->		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
UNITS ----->		A		A		A		A		A		A	
CAS #	Parameter	L5540	VAL										
108-95-2	Phenol	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
111-44-4	bis(2-Chloroethyl)ether	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
95-57-8	2-Chlorophenol	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
541-73-1	1,3-Dichlorobenzene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
106-46-7	1,4-Dichlorobenzene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
100-51-6	Benzyl alcohol	1500.	U	1400.	U	1300.	U	1400.	U	1400.	U	1500.	U
95-50-1	1,2-Dichlorobenzene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
95-48-7	2-Methylphenol (o-Cresol)	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
108-60-1	2,2'-oxybis(1-Chloropropane)	770.	U	710.	U	680.	U	730.	U	710.	U	790.	UJ
106-44-5	4-Methylphenol (p-Cresol)	??????????		??????????		??????????		??????????		??????????		??????????	
621-64-7	N-Nitroso-di-n-propylamine	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
67-72-1	Hexachloroethane	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
98-95-3	Nitrobenzene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
78-59-1	Isophorone	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
88-75-5	2-Nitrophenol	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
105-67-9	2,4-Dimethylphenol	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
65-85-0	Benzoic acid	3800.	U	3500.	UJ	3400.	U	3600.	UJ	3600.	U	3900.	U
111-91-1	bis(2-Chloroethoxy)methane	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
120-83-2	2,4-Dichlorophenol	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
120-82-1	1,2,4-Trichlorobenzene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
91-20-3	Naphthalene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
106-47-8	4-Chloroaniline	1500.	U	1400.	U	1300.	U	1400.	U	1400.	U	1500.	U
87-68-3	Hexachlorobutadiene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
59-50-7	4-Chloro-3-methylphenol	1500.	U	1400.	U	1300.	U	1400.	U	1400.	U	1500.	U
91-57-6	2-Methylnaphthalene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
77-47-4	Hexachlorocyclopentadiene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
88-06-2	2,4,6-Trichlorophenol	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
95-95-4	2,4,5-Trichlorophenol	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
91-58-7	2-Chloronaphthalene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
88-74-4	2-Nitroaniline	3800.	U	3500.	U	3400.	U	3600.	U	3600.	U	3900.	U
131-11-3	Dimethyl phthalate	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
208-96-8	Acenaphthylene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
606-20-2	2,6-Dinitrotoluene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
99-09-2	3-Nitroaniline	3800.	U	3500.	U	3400.	U	3600.	U	3600.	U	3900.	U
83-32-9	Acenaphthene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
51-28-5	2,4-Dinitrophenol	3800.	U	3500.	U	3400.	U	3600.	U	3600.	U	3900.	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SUB46-SV0A		SAMPLE ID ----->	GDB-S-8007-02	GDB-S-8008-01	GDB-S-8008-02	GDB-S-8009-01	GDB-S-8009-02	GDB-S-8010-01					
		ORIGINAL ID ----->	GDBS800702	GDBS800801	GDBS800802	GDBS800901	GDBS800902	GDBS801001					
		LAB SAMPLE ID ---->	L5540-60	L5540-57	L5540-58	L5540-61	L5540-62	L5540-86					
		ID FROM REPORT -->	GDBS800702	GDBS800801	GDBS800802	GDBS800901	GDBS800902	GDBS801001					
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95					
		DATE EXTRACTED -->	10/14/95	10/14/95	10/14/95	10/14/95	10/14/95	10/18/95					
		DATE ANALYZED ---->	10/19/95	10/20/95	10/19/95	10/20/95	10/19/95	10/22/95					
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil					
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG					
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL		
100-02-7	4-Nitrophenol	3800.	U	3500.	U	3400.	U	3600.	U	3600.	U	3900.	U
132-64-9	Dibenzofuran	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
121-14-2	2,4-Dinitrotoluene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
84-66-2	Diethylphthalate	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
7005-72-3	4-Chlorophenylphenylether	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
86-73-7	Fluorene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
100-01-6	4-Nitroaniline	3800.	U	3500.	U	3400.	U	3600.	U	3600.	U	3900.	U
534-52-1	2-Methyl-4,6-Dinitrophenol	3800.	U	3500.	U	3400.	U	3600.	U	3600.	U	3900.	U
86-30-6	N-Nitrosodiphenylamine	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
101-55-3	4-Bromophenyl-phenylether	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
118-74-1	Hexachlorobenzene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
87-86-5	Pentachlorophenol	3800.	U	3500.	U	3400.	U	3600.	U	3600.	U	3900.	U
85-01-8	Phenanthrene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
120-12-7	Anthracene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
86-74-8	Carbazole	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
84-74-2	Di-n-butylphthalate	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
206-44-0	Fluoranthene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
129-00-0	Pyrene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
85-68-7	Butylbenzylphthalate	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
91-94-1	3,3'-Dichlorobenzidine	1500.	U	1400.	U	1300.	U	1400.	U	1400.	U	1500.	U
56-55-3	Benzo(a)anthracene	770.	U	160.	J	680.	U	730.	U	710.	U	790.	U
218-01-9	Chrysene	770.	U	160.	J	680.	U	730.	U	710.	U	790.	U
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
117-84-0	Di-n-octyl phthalate	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
205-99-2	Benzo(b)fluoranthene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
207-08-9	Benzo(k)fluoranthene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
50-32-8	Benzo(a)pyrene	770.	U	150.	J	680.	U	730.	U	710.	U	790.	U
193-39-5	Indeno(1,2,3-cd)pyrene	770.	U	130.	J	680.	U	730.	U	710.	U	790.	U
53-70-3	Dibenz(a,h)anthracene	770.	U	710.	U	680.	U	730.	U	710.	U	790.	U
191-24-2	Benzo(g,h,i)perylene	770.	U	170.	J	680.	U	730.	U	710.	U	790.	U
95-53-4	o-Toluidine	??????????		??????????		??????????		??????????		??????????		??????????	
126-68-1	O,O,O-Triethylphosphorothioate	??????????		??????????		??????????		??????????		??????????		??????????	
1888-71-7	Hexachloropropene	??????????		??????????		??????????		??????????		??????????		??????????	
95-94-3	1,2,4,5-Tetrachlorobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
608-93-5	Pentachlorobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
91-59-8	2-Naphthylamine	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-SVDA		SAMPLE ID ----->	GDB-S-B007-02	GDB-S-B008-01	GDB-S-B008-02	GDB-S-B009-01	GDB-S-B009-02	GDB-S-B010-01			
		ORIGINAL ID ----->	GDBS00702	GDBS00801	GDBS00802	GDBS00901	GDBS00902	GDBS01001			
		LAB SAMPLE ID ---->	L5540-60	L5540-57	L5540-58	L5540-61	L5540-62	L5540-86			
		ID FROM REPORT -->	GDBS00702	GDBS00801	GDBS00802	GDBS00901	GDBS00902	GDBS01001			
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95			
		DATE EXTRACTED -->	10/14/95	10/14/95	10/14/95	10/14/95	10/14/95	10/18/95			
		DATE ANALYZED ---->	10/19/95	10/20/95	10/19/95	10/20/95	10/19/95	10/22/95			
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil			
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG			
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL
134-32-7	1-Naphthylamine	??????????		??????????		??????????		??????????		??????????	
297-97-2	Thionazin	??????????		??????????		??????????		??????????		??????????	
99-55-8	5-Nitro-o-toluidine	??????????		??????????		??????????		??????????		??????????	
2303-16-4	Diallate	??????????		??????????		??????????		??????????		??????????	
298-02-2	Phorate	??????????		??????????		??????????		??????????		??????????	
62-44-2	Phenacetin	??????????		??????????		??????????		??????????		??????????	
60-51-5	Dimethoate	??????????		??????????		??????????		??????????		??????????	
92-67-1	4-Aminobiphenyl	??????????		??????????		??????????		??????????		??????????	
23950-58-5	Pronamide	??????????		??????????		??????????		??????????		??????????	
298-04-4	Disulfoton	??????????		??????????		??????????		??????????		??????????	
298-00-0	Methyl parathion	??????????		??????????		??????????		??????????		??????????	
56-38-2	Parathion	??????????		??????????		??????????		??????????		??????????	
140-57-8	Aramite	??????????		??????????		??????????		??????????		??????????	
60-11-7	p-(Dimethylamino)azobenzene	??????????		??????????		??????????		??????????		??????????	
510-15-6	Chlorobenzilate	??????????		??????????		??????????		??????????		??????????	
119-93-7	3,3-Dimethylbenzidine	??????????		??????????		??????????		??????????		??????????	
52-85-7	Famphur	??????????		??????????		??????????		??????????		??????????	
53-96-3	Acetamidofluorene	??????????		??????????		??????????		??????????		??????????	
57-97-6	7,12-Dimethylbenz(a)anthracene	??????????		??????????		??????????		??????????		??????????	
56-49-5	3-Methyl cholanthrene	??????????		??????????		??????????		??????????		??????????	
110-86-1	Pyridine	??????????		??????????		??????????		??????????		??????????	
76-01-7	Pentachloroethane	??????????		??????????		??????????		??????????		??????????	
62-75-9	N-Nitrosodimethylamine	??????????		??????????		??????????		??????????		??????????	
109-06-8	2-Picoline	??????????		??????????		??????????		??????????		??????????	
10595-95-6	N-Nitrosomethylethylamine	??????????		??????????		??????????		??????????		??????????	
66-27-3	Methyl methanesulfonate	??????????		??????????		??????????		??????????		??????????	
55-18-5	N-Nitrosodiethylamine	??????????		??????????		??????????		??????????		??????????	
62-50-0	Ethyl methanesulfonate	??????????		??????????		??????????		??????????		??????????	
62-53-3	Aniline	??????????		??????????		??????????		??????????		??????????	
930-55-2	N-Nitrosopyrrolidine	??????????		??????????		??????????		??????????		??????????	
59-89-2	N-Nitrosomorpholine	??????????		??????????		??????????		??????????		??????????	
108-39-4	3-Methylphenol (m-Cresol)	??????????		??????????		??????????		??????????		??????????	
98-86-2	Acetophenone	??????????		??????????		??????????		??????????		??????????	
87-65-0	2,6-Dichlorophenol	??????????		??????????		??????????		??????????		??????????	
100-75-4	N-Nitrosopiperidine	??????????		??????????		??????????		??????????		??????????	
924-16-3	N-Nitroso-di-n-butylamine	??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-SVOA		SAMPLE ID ----->	GDB-S-B007-02	GDB-S-B008-01	GDB-S-B008-02	GDB-S-B009-01	GDB-S-B009-02	GDB-S-B010-01	
		ORIGINAL ID ----->	GDBS800702	GDBS800801	GDBS800802	GDBS800901	GDBS800902	GDBS801001	
		LAB SAMPLE ID ---->	L5540-60	L5540-57	L5540-58	L5540-61	L5540-62	L5540-86	
		ID FROM REPORT -->	GDBS800702	GDBS800801	GDBS800802	GDBS800901	GDBS800902	GDBS801001	
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	
		DATE EXTRACTED -->	10/14/95	10/14/95	10/14/95	10/14/95	10/14/95	10/18/95	
		DATE ANALYZED ---->	10/19/95	10/20/95	10/19/95	10/20/95	10/19/95	10/22/95	
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil	
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL
120-58-1	Isosafrole	??????????		??????????		??????????		??????????	
94-59-7	Safrole	??????????		??????????		??????????		??????????	
130-15-4	1,4-Naphthoquinone	??????????		??????????		??????????		??????????	
99-65-0	1,3-Dinitrobenzene	??????????		??????????		??????????		??????????	
58-90-2	2,3,4,6-Tetrachlorophenol	??????????		??????????		??????????		??????????	
99-35-4	1,3,5-Trinitrobenzene	??????????		??????????		??????????		??????????	
82-68-8	Pentachloronitrobenzene	??????????		??????????		??????????		??????????	
88-85-7	Dinoseb	??????????		??????????		??????????		??????????	
56-57-5	4-Nitroquinoline 1-oxide	??????????		??????????		??????????		??????????	
3689-24-5	Sulfotep	??????????		??????????		??????????		??????????	
91-80-5	Methapyrilene	??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-SV0A		SAMPLE ID ----->	GDB-S-8010-02	GDB-S-8011-01	GDB-S-8011-02	GDB-S-8012-01	GDB-S-8012-02	GDB-S-8013-01					
		ORIGINAL ID ----->	GDBS801002	GDBS801101	GDBS801102	GDBS801201	GDBS801202	GDBS801301					
		LAB SAMPLE ID ---->	L5540-87	L5540-55	L5540-56	L5540-53	L5540-54	L5540-51					
		ID FROM REPORT -->	GDBS801002	GDBS801101	GDBS801102	GDBS801201	GDBS801202	GDBS801301					
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95					
		DATE EXTRACTED -->	10/18/95	10/14/95	10/14/95	10/14/95	10/14/95	10/14/95					
		DATE ANALYZED -->	10/23/95	10/19/95	10/20/95	10/19/95	10/19/95	10/20/95					
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil					
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG					
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL		
108-95-2	Phenol	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
111-44-4	bis(2-Chloroethyl)ether	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
95-57-8	2-Chlorophenol	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
541-73-1	1,3-Dichlorobenzene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
106-46-7	1,4-Dichlorobenzene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
100-51-6	Benzyl alcohol	1800.	U	1900.	U	1800.	U	1400.	U	1400.	U	1500.	U
95-50-1	1,2-Dichlorobenzene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
95-48-7	2-Methylphenol (o-Cresol)	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
108-60-1	2,2'-oxybis(1-Chloropropane)	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
106-44-5	4-Methylphenol (p-Cresol)	??????????		??????????		??????????		??????????		??????????		??????????	
621-64-7	N-Nitroso-di-n-propylamine	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
67-72-1	Hexachloroethane	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
98-95-3	Nitrobenzene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
78-59-1	Isophorone	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
88-75-5	2-Nitrophenol	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
105-67-9	2,4-Dimethylphenol	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
65-85-0	Benzoic acid	4700.	U	4900.	U	4600.	UJ	3600.	U	3600.	U	3900.	UJ
111-91-1	bis(2-Chloroethoxy)methane	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
120-83-2	2,4-Dichlorophenol	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
120-82-1	1,2,4-Trichlorobenzene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
91-20-3	Naphthalene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
106-47-8	4-Chloroaniline	1800.	U	1900.	U	1800.	U	1400.	U	1400.	U	1500.	U
87-68-3	Hexachlorobutadiene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
59-50-7	4-Chloro-3-methylphenol	1800.	U	1900.	U	1800.	U	1400.	U	1400.	U	1500.	U
91-57-6	2-Methylnaphthalene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
77-47-4	Hexachlorocyclopentadiene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
88-06-2	2,4,6-Trichlorophenol	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
95-95-4	2,4,5-Trichlorophenol	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
91-58-7	2-Chloronaphthalene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
88-74-4	2-Nitroaniline	4700.	U	4900.	U	4600.	U	3600.	U	3600.	U	3900.	U
131-11-3	Dimethyl phthalate	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
208-96-8	Acenaphthylene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
606-20-2	2,6-Dinitrotoluene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
99-09-2	3-Nitroaniline	4700.	U	4900.	U	4600.	U	3600.	U	3600.	U	3900.	U
83-32-9	Acenaphthene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
51-28-5	2,4-Dinitrophenol	4700.	U	4900.	U	4600.	U	3600.	U	3600.	U	3900.	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SUB46-SVDA		SAMPLE ID ----->	GDB-S-B010-02	GDB-S-B011-01	GDB-S-B011-02	GDB-S-B012-01	GDB-S-B012-02	GDB-S-B013-01					
		ORIGINAL ID ----->	GDBSB01002	GDBSB01101	GDBSB01102	GDBSB01201	GDBSB01202	GDBSB01301					
		LAB SAMPLE ID ---->	L5540-87	L5540-55	L5540-56	L5540-53	L5540-54	L5540-51					
		ID FROM REPORT -->	GDBSB01002	GDBSB01101	GDBSB01102	GDBSB01201	GDBSB01202	GDBSB01301					
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95					
		DATE EXTRACTED -->	10/18/95	10/14/95	10/14/95	10/14/95	10/14/95	10/14/95					
		DATE ANALYZED ---->	10/23/95	10/19/95	10/20/95	10/19/95	10/19/95	10/20/95					
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil					
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG					
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL		
100-02-7	4-Nitrophenol	4700.	U	4900.	U	4600.	U	3600.	U	3600.	U	3900.	U
132-64-9	Dibenzofuran	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
121-14-2	2,4-Dinitrotoluene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
84-66-2	Diethylphthalate	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
7005-72-3	4-Chlorophenylphenylether	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
86-73-7	Fluorene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
100-01-6	4-Nitroaniline	4700.	U	4900.	U	4600.	U	3600.	U	3600.	U	3900.	U
534-52-1	2-Methyl-4,6-Dinitrophenol	4700.	U	4900.	U	4600.	U	3600.	U	3600.	U	3900.	U
86-30-6	N-Nitrosodiphenylamine	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
101-55-3	4-Bromophenyl-phenylether	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
118-74-1	Hexachlorobenzene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
87-86-5	Pentachlorophenol	4700.	U	4900.	U	4600.	U	3600.	U	3600.	U	3900.	U
85-01-8	Phenanthrene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
120-12-7	Anthracene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
86-74-8	Carbazole	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
84-74-2	Di-n-butylphthalate	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
206-44-0	Fluoranthene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
129-00-0	Pyrene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
85-68-7	Butylbenzylphthalate	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
91-94-1	3,3'-Dichlorobenzidine	1800.	U	1900.	U	1800.	U	1400.	U	1400.	U	1500.	U
56-55-3	Benzo(a)anthracene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
218-01-9	Chrysene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
117-84-0	Di-n-octyl phthalate	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
205-99-2	Benzo(b)fluoranthene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
207-08-9	Benzo(k)fluoranthene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
50-32-8	Benzo(a)pyrene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
193-39-5	Indeno(1,2,3-cd)pyrene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
53-70-3	Dibenz(a,h)anthracene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
191-24-2	Benzo(g,h,i)perylene	940.	U	980.	U	910.	U	730.	U	730.	U	770.	U
95-53-4	o-Toluidine	??????????		??????????		??????????		??????????		??????????		??????????	
126-68-1	O,O,O-Triethylphosphorothioate	??????????		??????????		??????????		??????????		??????????		??????????	
1888-71-7	Hexachloropropene	??????????		??????????		??????????		??????????		??????????		??????????	
95-94-3	1,2,4,5-Tetrachlorobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
608-93-5	Pentachlorobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
91-59-8	2-Naphthylamine	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-SV0A		SAMPLE ID ----->	GDB-S-B010-02	GDB-S-B011-01	GDB-S-B011-02	GDB-S-B012-01	GDB-S-B012-02	GDB-S-B013-01			
		ORIGINAL ID ----->	GDBS01002	GDBS01101	GDBS01102	GDBS01201	GDBS01202	GDBS01301			
		LAB SAMPLE ID ---->	L5540-87	L5540-55	L5540-56	L5540-53	L5540-54	L5540-51			
		ID FROM REPORT -->	GDBS01002	GDBS01101	GDBS01102	GDBS01201	GDBS01202	GDBS01301			
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95			
		DATE EXTRACTED -->	10/18/95	10/14/95	10/14/95	10/14/95	10/14/95	10/14/95			
		DATE ANALYZED ---->	10/23/95	10/19/95	10/20/95	10/19/95	10/19/95	10/20/95			
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil			
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG			
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL
134-32-7	1-Naphthylamine	?????????		?????????		?????????		?????????		?????????	
297-97-2	Thionazin	?????????		?????????		?????????		?????????		?????????	
99-55-8	5-Nitro-o-toluidine	?????????		?????????		?????????		?????????		?????????	
2303-16-4	Diallate	?????????		?????????		?????????		?????????		?????????	
298-02-2	Phorate	?????????		?????????		?????????		?????????		?????????	
62-44-2	Phenacetin	?????????		?????????		?????????		?????????		?????????	
60-51-5	Dimethoate	?????????		?????????		?????????		?????????		?????????	
92-67-1	4-Aminobiphenyl	?????????		?????????		?????????		?????????		?????????	
23950-58-5	Pronamide	?????????		?????????		?????????		?????????		?????????	
298-04-4	Disulfoton	?????????		?????????		?????????		?????????		?????????	
298-00-0	Methyl parathion	?????????		?????????		?????????		?????????		?????????	
56-38-2	Parathion	?????????		?????????		?????????		?????????		?????????	
140-57-8	Aramite	?????????		?????????		?????????		?????????		?????????	
60-11-7	p-(Dimethylamino)azobenzene	?????????		?????????		?????????		?????????		?????????	
510-15-6	Chlorobenzilate	?????????		?????????		?????????		?????????		?????????	
119-93-7	3,3-Dimethylbenzidine	?????????		?????????		?????????		?????????		?????????	
52-85-7	Famphur	?????????		?????????		?????????		?????????		?????????	
53-96-3	Acetamidofluorene	?????????		?????????		?????????		?????????		?????????	
57-97-6	7,12-Dimethylbenz(a)anthracene	?????????		?????????		?????????		?????????		?????????	
56-49-5	3-Methyl cholanthrene	?????????		?????????		?????????		?????????		?????????	
110-86-1	Pyridine	?????????		?????????		?????????		?????????		?????????	
76-01-7	Pentachloroethane	?????????		?????????		?????????		?????????		?????????	
62-75-9	N-Nitrosodimethylamine	?????????		?????????		?????????		?????????		?????????	
109-06-8	2-Picoline	?????????		?????????		?????????		?????????		?????????	
10595-95-6	N-Nitrosomethylethylamine	?????????		?????????		?????????		?????????		?????????	
66-27-3	Methyl methanesulfonate	?????????		?????????		?????????		?????????		?????????	
55-18-5	N-Nitrosodiethylamine	?????????		?????????		?????????		?????????		?????????	
62-50-0	Ethyl methanesulfonate	?????????		?????????		?????????		?????????		?????????	
62-53-3	Aniline	?????????		?????????		?????????		?????????		?????????	
930-55-2	N-Nitrosopyrrolidine	?????????		?????????		?????????		?????????		?????????	
59-89-2	N-Nitrosomorpholine	?????????		?????????		?????????		?????????		?????????	
108-39-4	3-Methylphenol (m-Cresol)	?????????		?????????		?????????		?????????		?????????	
98-86-2	Acetophenone	?????????		?????????		?????????		?????????		?????????	
87-65-0	2,6-Dichlorophenol	?????????		?????????		?????????		?????????		?????????	
100-75-4	N-Nitrosopiperidine	?????????		?????????		?????????		?????????		?????????	
924-16-3	N-Nitroso-di-n-butylamine	?????????		?????????		?????????		?????????		?????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-SVDA		SAMPLE ID ----->	GDB-S-B010-02	GDB-S-B011-01	GDB-S-B011-02	GDB-S-B012-01	GDB-S-B012-02	GDB-S-B013-01			
		ORIGINAL ID ----->	GDBS01002	GDBS01101	GDBS01102	GDBS01201	GDBS01202	GDBS01301			
		LAB SAMPLE ID -->	L5540-87	L5540-55	L5540-56	L5540-53	L5540-54	L5540-51			
		ID FROM REPORT -->	GDBS01002	GDBS01101	GDBS01102	GDBS01201	GDBS01202	GDBS01301			
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95			
		DATE EXTRACTED -->	10/18/95	10/14/95	10/14/95	10/14/95	10/14/95	10/14/95			
		DATE ANALYZED -->	10/23/95	10/19/95	10/20/95	10/19/95	10/19/95	10/20/95			
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil			
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG			
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL
120-58-1	Isosafrole	??????????		??????????		??????????		??????????		??????????	
94-59-7	Safrole	??????????		??????????		??????????		??????????		??????????	
130-15-4	1,4-Naphthoquinone	??????????		??????????		??????????		??????????		??????????	
99-65-0	1,3-Dinitrobenzene	??????????		??????????		??????????		??????????		??????????	
58-90-2	2,3,4,6-Tetrachlorophenol	??????????		??????????		??????????		??????????		??????????	
99-35-4	1,3,5-Trinitrobenzene	??????????		??????????		??????????		??????????		??????????	
82-68-8	Pentachloronitrobenzene	??????????		??????????		??????????		??????????		??????????	
88-85-7	Dinoseb	??????????		??????????		??????????		??????????		??????????	
56-57-5	4-Nitroquinoline 1-oxide	??????????		??????????		??????????		??????????		??????????	
3689-24-5	Sulfotep	??????????		??????????		??????????		??????????		??????????	
91-80-5	Methapyrilene	??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SMB46-SVOA		SAMPLE ID ----->	GDB-S-B013-02	GDB-S-B014-01	GDB-S-B014-02	GDB-S-B015-01	GDB-S-B015-02	GDB-G-W001-01			
		ORIGINAL ID ----->	GDBS801302	GDBS801401	GDBS801402	GDBS801501	GDBS801502	GDBG00101			
		LAB SAMPLE ID ---->	L5540-52	L5540-47	L5540-50	L5540-73	L5540-74	L6024-36			
		ID FROM REPORT -->	GDBS801302	GDBS801401	GDBS801402	GDBS801501	GDBS801502	GDBG00101			
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	12/09/95			
		DATE EXTRACTED -->	10/14/95	10/14/95	10/14/95	10/18/95	10/18/95	12/14/95			
		DATE ANALYZED ---->	10/20/95	10/20/95	10/19/95	10/23/95	10/20/95	12/21/95			
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Water			
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/L			
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L6024	VAL
108-95-2	Phenol	880.	U	710.	U	790.	U	730.	U	770.	U
111-44-4	bis(2-Chloroethyl)ether	880.	U	710.	U	790.	U	730.	U	770.	U
95-57-8	2-Chlorophenol	880.	U	710.	U	790.	U	730.	U	770.	U
541-73-1	1,3-Dichlorobenzene	880.	U	710.	U	790.	U	730.	U	770.	U
106-46-7	1,4-Dichlorobenzene	880.	U	710.	U	790.	U	730.	U	770.	U
100-51-6	Benzyl alcohol	1700.	U	1400.	U	1500.	U	1400.	U	1500.	U
95-50-1	1,2-Dichlorobenzene	880.	U	710.	U	790.	U	730.	U	770.	U
95-48-7	2-Methylphenol (o-Cresol)	880.	U	710.	U	790.	U	730.	U	770.	U
108-60-1	2,2'-oxybis(1-Chloropropane)	880.	U	710.	U	790.	U	730.	UJ	770.	U
106-44-5	4-Methylphenol (p-Cresol)	??????????		??????????		??????????		??????????		??????????	
621-64-7	N-Nitroso-di-n-propylamine	880.	U	710.	U	790.	U	730.	U	770.	U
67-72-1	Hexachloroethane	880.	U	710.	U	790.	U	730.	U	770.	U
98-95-3	Nitrobenzene	880.	U	710.	U	790.	U	730.	U	770.	U
78-59-1	Isophorone	880.	U	710.	U	790.	U	730.	U	770.	U
88-75-5	2-Nitrophenol	880.	U	710.	U	790.	U	730.	U	770.	U
105-67-9	2,4-Dimethylphenol	880.	U	710.	U	790.	U	730.	U	770.	U
65-85-0	Benzoic acid	4400.	UJ	3600.	UJ	3900.	U	3700.	U	3900.	U
111-91-1	bis(2-Chloroethoxy)methane	880.	U	710.	U	790.	U	730.	U	770.	U
120-83-2	2,4-Dichlorophenol	880.	U	710.	U	790.	U	730.	U	770.	U
120-82-1	1,2,4-Trichlorobenzene	880.	U	710.	U	790.	U	730.	U	770.	U
91-20-3	Naphthalene	880.	U	710.	U	790.	U	730.	U	770.	U
106-47-8	4-Chloroaniline	1700.	U	1400.	U	1500.	U	1400.	U	1500.	U
87-68-3	Hexachlorobutadiene	880.	U	710.	U	790.	U	730.	U	770.	U
59-50-7	4-Chloro-3-methylphenol	1700.	U	1400.	U	1500.	U	1400.	U	1500.	U
91-57-6	2-Methylnaphthalene	880.	U	710.	U	790.	U	730.	U	770.	U
77-47-4	Hexachlorocyclopentadiene	880.	U	710.	U	790.	U	730.	U	770.	U
88-06-2	2,4,6-Trichlorophenol	880.	U	710.	U	790.	U	730.	U	770.	U
95-95-4	2,4,5-Trichlorophenol	880.	U	710.	U	790.	U	730.	U	770.	U
91-58-7	2-Chloronaphthalene	880.	U	710.	U	790.	U	730.	U	770.	U
88-74-4	2-Nitroaniline	4400.	U	3600.	U	3900.	U	3700.	U	3900.	U
131-11-3	Dimethyl phthalate	880.	U	710.	U	790.	U	730.	U	770.	U
208-96-8	Acenaphthylene	880.	U	710.	U	790.	U	730.	U	770.	U
606-20-2	2,6-Dinitrotoluene	880.	U	710.	U	790.	U	730.	U	770.	U
99-09-2	3-Nitroaniline	4400.	U	3600.	U	3900.	U	3700.	U	3900.	U
83-32-9	Acenaphthene	880.	U	710.	U	790.	U	730.	U	770.	U
51-28-5	2,4-Dinitrophenol	4400.	U	3600.	U	3900.	U	3700.	U	3900.	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SUB846-SV0A		SAMPLE ID ----->	GDB-S-8013-02	GDB-S-8014-01	GDB-S-8014-02	GDB-S-8015-01	GDB-S-8015-02	GDB-G-W001-01					
		ORIGINAL ID ----->	GDBSB01302	GDBSB01401	GDBSB01402	GDBSB01501	GDBSB01502	GDBGW00101					
		LAB SAMPLE ID ----->	L5540-52	L5540-47	L5540-50	L5540-73	L5540-74	L6024-36					
		ID FROM REPORT ----->	GDBSB01302	GDBSB01401	GDBSB01402	GDBSB01501	GDBSB01502	GDBGW00101					
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	12/09/95					
		DATE EXTRACTED ----->	10/14/95	10/14/95	10/14/95	10/18/95	10/18/95	12/14/95					
		DATE ANALYZED ----->	10/20/95	10/20/95	10/19/95	10/23/95	10/20/95	12/21/95					
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Water					
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/L					
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L6024	VAL		
100-02-7	4-Nitrophenol	4400.	U	3600.	U	3900.	U	3700.	U	3900.	U	50.	U
132-64-9	Dibenzofuran	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
121-14-2	2,4-Dinitrotoluene	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
84-66-2	Diethylphthalate	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
7005-72-3	4-Chlorophenylphenylether	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
86-73-7	Fluorene	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
100-01-6	4-Nitroaniline	4400.	U	3600.	U	3900.	U	3700.	U	3900.	U	20.	UJ
534-52-1	2-Methyl-4,6-Dinitrophenol	4400.	U	3600.	U	3900.	U	3700.	U	3900.	U	50.	U
86-30-6	N-Nitrosodiphenylamine	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
101-55-3	4-Bromophenyl-phenylether	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
118-74-1	Hexachlorobenzene	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
87-86-5	Pentachlorophenol	4400.	U	3600.	U	3900.	U	3700.	U	3900.	U	50.	U
85-01-8	Phenanthrene	210.	J	710.	U	790.	U	730.	U	770.	U	10.	U
120-12-7	Anthracene	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
86-74-8	Carbazole	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
84-74-2	Di-n-butylphthalate	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
206-44-0	Fluoranthene	400.	J	710.	U	790.	U	730.	U	770.	U	10.	U
129-00-0	Pyrene	410.	J	710.	U	790.	U	730.	U	770.	U	10.	U
85-68-7	Butylbenzylphthalate	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
91-94-1	3,3'-Dichlorobenzidine	1700.	U	1400.	U	1500.	U	1400.	U	1500.	U	20.	U
56-55-3	Benzo(a)anthracene	190.	J	710.	U	790.	U	730.	U	770.	U	10.	U
218-01-9	Chrysene	230.	J	710.	U	790.	U	730.	U	770.	U	10.	U
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
117-84-0	Di-n-octyl phthalate	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
205-99-2	Benzo(b)fluoranthene	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
207-08-9	Benzo(k)fluoranthene	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
50-32-8	Benzo(a)pyrene	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
193-39-5	Indeno(1,2,3-cd)pyrene	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
53-70-3	Dibenz(a,h)anthracene	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
191-24-2	Benzo(g,h,i)perylene	880.	U	710.	U	790.	U	730.	U	770.	U	10.	U
95-53-4	o-Toluidine	??????????		??????????		??????????		??????????		??????????		??????????	
126-68-1	O,O,O-Triethylphosphorothioate	??????????		??????????		??????????		??????????		??????????		??????????	
1888-71-7	Hexachloropropene	??????????		??????????		??????????		??????????		??????????		??????????	
95-94-3	1,2,4,5-Tetrachlorobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
608-93-5	Pentachlorobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
91-59-8	2-Naphthylamine	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-SV0A		SAMPLE ID ----->	GDB-S-8013-02	GDB-S-8014-01	GDB-S-8014-02	GDB-S-8015-01	GDB-S-8015-02	GDB-G-W001-01			
		ORIGINAL ID ----->	GDBS801302	GDBS801401	GDBS801402	GDBS801501	GDBS801502	GDBGW00101			
		LAB SAMPLE ID ---->	L5540-52	L5540-47	L5540-50	L5540-73	L5540-74	L6024-36			
		ID FROM REPORT -->	GDBS801302	GDBS801401	GDBS801402	GDBS801501	GDBS801502	GDBGW00101			
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	12/09/95			
		DATE EXTRACTED -->	10/14/95	10/14/95	10/14/95	10/18/95	10/18/95	12/14/95			
		DATE ANALYZED ---->	10/20/95	10/20/95	10/19/95	10/23/95	10/20/95	12/21/95			
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Water			
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/L			
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L6024	VAL
134-32-7	1-Naphthylamine	??????????		??????????		??????????		??????????		??????????	
297-97-2	Thionazin	??????????		??????????		??????????		??????????		??????????	
99-55-8	5-Nitro-o-toluidine	??????????		??????????		??????????		??????????		??????????	
2303-16-4	Diallate	??????????		??????????		??????????		??????????		??????????	
298-02-2	Phorate	??????????		??????????		??????????		??????????		??????????	
62-44-2	Phenacetin	??????????		??????????		??????????		??????????		??????????	
60-51-5	Dimethoate	??????????		??????????		??????????		??????????		??????????	
92-67-1	4-Aminobiphenyl	??????????		??????????		??????????		??????????		??????????	
23950-58-5	Pronamide	??????????		??????????		??????????		??????????		??????????	
298-04-4	Disulfoton	??????????		??????????		??????????		??????????		??????????	
298-00-0	Methyl parathion	??????????		??????????		??????????		??????????		??????????	
56-38-2	Parathion	??????????		??????????		??????????		??????????		??????????	
140-57-8	Aramite	??????????		??????????		??????????		??????????		??????????	
60-11-7	p-(Dimethylamino)azobenzene	??????????		??????????		??????????		??????????		??????????	
510-15-6	Chlorobenzilate	??????????		??????????		??????????		??????????		??????????	
119-93-7	3,3-Dimethylbenzidine	??????????		??????????		??????????		??????????		??????????	
52-85-7	Famphur	??????????		??????????		??????????		??????????		??????????	
53-96-3	Acetamidofluorene	??????????		??????????		??????????		??????????		??????????	
57-97-6	7,12-Dimethylbenz(a)anthracene	??????????		??????????		??????????		??????????		??????????	
56-49-5	3-Methyl cholanthrene	??????????		??????????		??????????		??????????		??????????	
110-86-1	Pyridine	??????????		??????????		??????????		??????????		??????????	
76-01-7	Pentachloroethane	??????????		??????????		??????????		??????????		??????????	
62-75-9	N-Nitrosodimethylamine	??????????		??????????		??????????		??????????		??????????	
109-06-8	2-Picoline	??????????		??????????		??????????		??????????		??????????	
10595-95-6	N-Nitrosomethylethylamine	??????????		??????????		??????????		??????????		??????????	
66-27-3	Methyl methanesulfonate	??????????		??????????		??????????		??????????		??????????	
55-18-5	N-Nitrosodiethylamine	??????????		??????????		??????????		??????????		??????????	
62-50-0	Ethyl methanesulfonate	??????????		??????????		??????????		??????????		??????????	
62-53-3	Aniline	??????????		??????????		??????????		??????????		??????????	
930-55-2	N-Nitrosopyrrolidine	??????????		??????????		??????????		??????????		??????????	
59-89-2	N-Nitrosomorpholine	??????????		??????????		??????????		??????????		??????????	
108-39-4	3-Methylphenol (m-Cresol)	??????????		??????????		??????????		??????????		??????????	
98-86-2	Acetophenone	??????????		??????????		??????????		??????????		??????????	
87-65-0	2,6-Dichlorophenol	??????????		??????????		??????????		??????????		??????????	
100-75-4	N-Nitrosopiperidine	??????????		??????????		??????????		??????????		??????????	
924-16-3	N-Nitroso-di-n-butylamine	??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-SVOA	SAMPLE ID ----->	GDB-S-8013-02	GDB-S-8014-01	GDB-S-8014-02	GDB-S-8015-01	GDB-S-8015-02	GDB-G-W001-01
	ORIGINAL ID ----->	GDBS801302	GDBS801401	GDBS801402	GDBS801501	GDBS801502	GDBGW00101
	LAB SAMPLE ID ---->	L5540-52	L5540-47	L5540-50	L5540-73	L5540-74	L6024-36
	ID FROM REPORT -->	GDBS801302	GDBS801401	GDBS801402	GDBS801501	GDBS801502	GDBGW00101
	SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	12/09/95
	DATE EXTRACTED -->	10/14/95	10/14/95	10/14/95	10/18/95	10/18/95	12/14/95
	DATE ANALYZED ---->	10/20/95	10/20/95	10/19/95	10/23/95	10/20/95	12/21/95
	MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Water
UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/L	

CAS #	Parameter	L5540	VAL	L6024	VAL								
120-58-1	Isosafrole	??????????		??????????		??????????		??????????		??????????		??????????	
94-59-7	Safrole	??????????		??????????		??????????		??????????		??????????		??????????	
130-15-4	1,4-Naphthoquinone	??????????		??????????		??????????		??????????		??????????		??????????	
99-65-0	1,3-Dinitrobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
58-90-2	2,3,4,6-Tetrachlorophenol	??????????		??????????		??????????		??????????		??????????		??????????	
99-35-4	1,3,5-Trinitrobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
82-68-8	Pentachloronitrobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
88-85-7	Dinoseb	??????????		??????????		??????????		??????????		??????????		??????????	
56-57-5	4-Nitroquinoline 1-oxide	??????????		??????????		??????????		??????????		??????????		??????????	
3689-24-5	Sulfotep	??????????		??????????		??????????		??????????		??????????		??????????	
91-80-5	Methapyrilene	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-SVDA		SAMPLE ID ----->	GDB-G-W002-01	GDB-G-W003-01	GDB-G-W004-01	GDB-G-W01D-01	GDB-G-W04D-01	GDB-H-W04D-01			
		ORIGINAL ID ----->	GDBGW00201	GDBGW00301	GDBGW00401	GDBGW01D01	GDBGW04D01	GDBHW04D01			
		LAB SAMPLE ID ----->	L6024-38	L6024-40	L6024-42	L6024-34	L6024-48	L6022-7			
		ID FROM REPORT -->	GDBGW00201	GDBGW00301	GDBGW00401	GDBGW01D01	GDBGW04D01	GDBHW04D01			
		SAMPLE DATE ----->	12/09/95	12/10/95	12/10/95	12/09/95	12/11/95	12/11/95			
		DATE EXTRACTED -->	12/14/95	12/17/95	12/17/95	12/14/95	12/17/95	12/18/95			
		DATE ANALYZED -->	12/21/95	12/28/95	12/28/95	12/21/95	12/28/95	01/08/96			
		MATRIX ----->	Water	Water	Water	Water	Water	Water			
		UNITS ----->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L			
CAS #	Parameter	L6024	VAL	L6024	VAL	L6024	VAL	L6024	VAL	L6022	VAL
108-95-2	Phenol	10.	U	10.	U	10.	U	10.	U	10.	U
111-44-4	bis(2-Chloroethyl)ether	10.	U	10.	U	10.	U	10.	U	10.	U
95-57-8	2-Chlorophenol	10.	U	10.	U	10.	U	10.	U	10.	U
541-73-1	1,3-Dichlorobenzene	10.	U	10.	U	10.	U	10.	U	???????????	
106-46-7	1,4-Dichlorobenzene	10.	U	10.	U	10.	U	10.	U	???????????	
100-51-6	Benzyl alcohol	20.	U	21.	U	21.	U	20.	U	21.	U
95-50-1	1,2-Dichlorobenzene	10.	U	10.	U	10.	U	10.	U	???????????	
95-48-7	2-Methylphenol (o-Cresol)	10.	U	10.	U	10.	U	10.	U	10.	U
108-60-1	2,2'-oxybis(1-Chloropropane)	10.	U	10.	U	10.	U	10.	U	10.	U
106-44-5	4-Methylphenol (p-Cresol)	10.	U	10.	U	10.	U	10.	U	???????????	
621-64-7	N-Nitroso-di-n-propylamine	10.	U	10.	U	10.	U	10.	U	10.	U
67-72-1	Hexachloroethane	10.	U	10.	U	10.	U	10.	U	10.	U
98-95-3	Nitrobenzene	10.	U	10.	U	10.	U	10.	U	10.	U
78-59-1	Isophorone	10.	U	10.	U	10.	U	10.	U	10.	U
88-75-5	2-Nitrophenol	10.	U	10.	U	10.	U	10.	U	10.	U
105-67-9	2,4-Dimethylphenol	10.	U	10.	U	10.	U	10.	U	10.	U
65-85-0	Benzoic acid	50.	UJ	52.	U	52.	UJ	50.	U	???????????	
111-91-1	bis(2-Chloroethoxy)methane	10.	U	10.	U	10.	U	10.	U	10.	U
120-83-2	2,4-Dichlorophenol	10.	U	10.	U	10.	U	10.	U	10.	U
120-82-1	1,2,4-Trichlorobenzene	10.	U	10.	U	10.	U	10.	U	???????????	
91-20-3	Naphthalene	10.	U	10.	U	10.	U	10.	U	10.	U
106-47-8	4-Chloroaniline	20.	U	21.	U	21.	U	20.	U	21.	U
87-68-3	Hexachlorobutadiene	10.	U	10.	U	10.	U	10.	U	10.	U
59-50-7	4-Chloro-3-methylphenol	20.	U	21.	U	21.	U	20.	U	19.	U
91-57-6	2-Methylnaphthalene	10.	U	10.	U	10.	U	10.	U	10.	U
77-47-4	Hexachlorocyclopentadiene	10.	U	10.	U	10.	U	10.	U	10.	U
88-06-2	2,4,6-Trichlorophenol	10.	U	10.	U	10.	U	10.	U	10.	U
95-95-4	2,4,5-Trichlorophenol	10.	U	10.	U	10.	U	10.	U	10.	U
91-58-7	2-Chloronaphthalene	10.	U	10.	U	10.	U	10.	U	10.	U
88-74-4	2-Nitroaniline	50.	U	52.	U	52.	U	50.	U	52.	U
131-11-3	Dimethyl phthalate	10.	U	10.	U	10.	U	10.	U	10.	U
208-96-8	Acenaphthylene	10.	U	10.	U	10.	U	10.	U	10.	U
606-20-2	2,6-Dinitrotoluene	10.	U	10.	U	10.	U	10.	U	10.	U
99-09-2	3-Nitroaniline	50.	U	52.	U	52.	U	50.	U	52.	U
83-32-9	Acenaphthene	10.	U	10.	U	10.	U	10.	U	10.	U
51-28-5	2,4-Dinitrophenol	50.	U	52.	U	52.	U	50.	U	52.	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-SVOA		SAMPLE ID ----->	GDB-G-W002-01	GDB-G-W003-01	GDB-G-W004-01	GDB-G-W01D-01	GDB-G-W04D-01	GDB-H-W04D-01			
		ORIGINAL ID ----->	GDBGW00201	GDBGW00301	GDBGW00401	GDBGW01D01	GDBGW04D01	GDBHW04D01			
		LAB SAMPLE ID ---->	L6024-38	L6024-40	L6024-42	L6024-34	L6024-48	L6022-7			
		ID FROM REPORT -->	GDBGW00201	GDBGW00301	GDBGW00401	GDBGW01D01	GDBGW04D01	GDBHW04D01			
		SAMPLE DATE ----->	12/09/95	12/10/95	12/10/95	12/09/95	12/11/95	12/11/95			
		DATE EXTRACTED -->	12/14/95	12/17/95	12/17/95	12/14/95	12/17/95	12/18/95			
		DATE ANALYZED ---->	12/21/95	12/28/95	12/28/95	12/21/95	12/28/95	01/08/96			
		MATRIX ----->	Water	Water	Water	Water	Water	Water			
		UNITS ----->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L			
CAS #	Parameter	L6024	VAL	L6024	VAL	L6024	VAL	L6024	VAL	L6022	VAL
100-02-7	4-Nitrophenol	50.	U	52.	U	52.	U	50.	U	52.	U
132-64-9	Dibenzofuran	10.	U	10.	U	10.	U	10.	U	10.	U
121-14-2	2,4-Dinitrotoluene	10.	U	10.	U	10.	U	10.	U	10.	U
84-66-2	Diethylphthalate	10.	U	10.	U	10.	U	10.	U	10.	U
7005-72-3	4-Chlorophenylphenylether	10.	U	10.	U	10.	U	10.	U	10.	U
86-73-7	Fluorene	10.	U	10.	U	10.	U	10.	U	10.	U
100-01-6	4-Nitroaniline	20.	UJ	21.	U	21.	U	20.	UJ	21.	U
534-52-1	2-Methyl-4,6-Dinitrophenol	50.	U	52.	U	52.	U	50.	U	52.	U
86-30-6	N-Nitrosodiphenylamine	10.	U	10.	U	10.	U	10.	U	10.	U
101-55-3	4-Bromophenyl-phenylether	10.	U	10.	U	10.	U	10.	U	10.	U
118-74-1	Hexachlorobenzene	10.	U	10.	U	10.	U	10.	U	10.	U
87-86-5	Pentachlorophenol	50.	U	52.	U	52.	U	50.	U	52.	U
85-01-8	Phenanthrene	10.	U	10.	U	10.	U	10.	U	10.	U
120-12-7	Anthracene	10.	U	10.	U	10.	U	10.	U	10.	U
86-74-8	Carbazole	10.	U	10.	U	10.	U	10.	U	??????????	
84-74-2	Di-n-butylphthalate	10.	U	10.	U	10.	U	10.	U	10.	U
206-44-0	Fluoranthene	10.	U	10.	U	10.	U	10.	U	10.	U
129-00-0	Pyrene	10.	U	10.	U	10.	U	10.	U	10.	U
85-68-7	Butylbenzylphthalate	10.	U	10.	U	10.	U	10.	U	10.	U
91-94-1	3,3'-Dichlorobenzidine	20.	U	21.	U	21.	U	20.	U	21.	U
56-55-3	Benzo(a)anthracene	10.	U	10.	U	10.	U	10.	U	10.	U
218-01-9	Chrysene	10.	U	10.	U	10.	U	10.	U	10.	U
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	10.	U	10.	U	10.	U	10.	U	10.	U
117-84-0	Di-n-octyl phthalate	10.	U	10.	U	10.	U	10.	U	10.	U
205-99-2	Benzo(b)fluoranthene	10.	U	10.	U	10.	U	10.	U	10.	U
207-08-9	Benzo(k)fluoranthene	10.	U	10.	U	10.	U	10.	U	10.	U
50-32-8	Benzo(a)pyrene	10.	U	10.	U	10.	U	10.	U	10.	U
193-39-5	Indeno(1,2,3-cd)pyrene	10.	U	10.	U	10.	U	10.	U	10.	U
53-70-3	Dibenz(a,h)anthracene	10.	U	10.	U	10.	U	10.	U	10.	U
191-24-2	Benzo(g,h,i)perylene	10.	U	10.	U	10.	U	10.	U	10.	U
95-53-4	o-Toluidine	??????????		??????????		??????????		??????????		31.	U
126-68-1	O,O,O-Triethylphosphorothioate	??????????		??????????		??????????		??????????		31.	U
1888-71-7	Hexachloropropene	??????????		??????????		??????????		??????????		10.	U
95-94-3	1,2,4,5-Tetrachlorobenzene	??????????		??????????		??????????		??????????		10.	U
608-93-5	Pentachlorobenzene	??????????		??????????		??????????		??????????		10.	U
91-59-8	2-Naphthylamine	??????????		??????????		??????????		??????????		52.	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SMB46-SVOA	SAMPLE ID ----->	GDB-G-W002-01	GDB-G-W003-01	GDB-G-W004-01	GDB-G-W01D-01	GDB-G-W04D-01	GDB-H-W04D-01
	ORIGINAL ID ----->	GDBGW00201	GDBGW00301	GDBGW00401	GDBGW01D01	GDBGW04D01	GDBHW04D01
	LAB SAMPLE ID ---->	L6024-38	L6024-40	L6024-42	L6024-34	L6024-48	L6022-7
	ID FROM REPORT -->	GDBGW00201	GDBGW00301	GDBGW00401	GDBGW01D01	GDBGW04D01	GDBHW04D01
	SAMPLE DATE ----->	12/09/95	12/10/95	12/10/95	12/09/95	12/11/95	12/11/95
	DATE EXTRACTED -->	12/14/95	12/17/95	12/17/95	12/14/95	12/17/95	12/18/95
	DATE ANALYZED ---->	12/21/95	12/28/95	12/28/95	12/21/95	12/28/95	01/08/96
	MATRIX ----->	Water	Water	Water	Water	Water	Water
UNITS ----->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	

CAS #	Parameter	L6024	VAL	L6022	VAL								
134-32-7	1-Naphthylamine	??????????		??????????		??????????		??????????		??????????		52.	U
297-97-2	Thionazin	??????????		??????????		??????????		??????????		??????????		21.	U
99-55-8	5-Nitro-o-toluidine	??????????		??????????		??????????		??????????		??????????		10.	U
2303-16-4	Diallate	??????????		??????????		??????????		??????????		??????????		21.	U
298-02-2	Phorate	??????????		??????????		??????????		??????????		??????????		21.	U
62-44-2	Phenacetin	??????????		??????????		??????????		??????????		??????????		31.	U
60-51-5	Dimethoate	??????????		??????????		??????????		??????????		??????????		21.	U
92-67-1	4-Aminobiphenyl	??????????		??????????		??????????		??????????		??????????		52.	U
23950-58-5	Pronamide	??????????		??????????		??????????		??????????		??????????		21.	U
298-04-4	Disulfoton	??????????		??????????		??????????		??????????		??????????		21.	U
298-00-0	Methyl parathion	??????????		??????????		??????????		??????????		??????????		21.	U
56-38-2	Parathion	??????????		??????????		??????????		??????????		??????????		10.	U
140-57-8	Aramite	??????????		??????????		??????????		??????????		??????????		31.	U
60-11-7	p-(Dimethylamino)azobenzene	??????????		??????????		??????????		??????????		??????????		31.	U
510-15-6	Chlorobenzilate	??????????		??????????		??????????		??????????		??????????		21.	U
119-93-7	3,3-Dimethylbenzidine	??????????		??????????		??????????		??????????		??????????		210.	U
52-85-7	Famphur	??????????		??????????		??????????		??????????		??????????		18.	U
53-96-3	Acetamidofluorene	??????????		??????????		??????????		??????????		??????????		21.	U
57-97-6	7,12-Dimethylbenz(a)anthracene	??????????		??????????		??????????		??????????		??????????		10.	U
56-49-5	3-Methyl cholanthrene	??????????		??????????		??????????		??????????		??????????		10.	U
110-86-1	Pyridine	??????????		??????????		??????????		??????????		??????????		15.	U
76-01-7	Pentachloroethane	??????????		??????????		??????????		??????????		??????????		10.	U
62-75-9	N-Nitrosodimethylamine	??????????		??????????		??????????		??????????		??????????		21.	U
109-06-8	2-Picoline	??????????		??????????		??????????		??????????		??????????		31.	U
10595-95-6	N-Nitrosomethylethylamine	??????????		??????????		??????????		??????????		??????????		31.	U
66-27-3	Methyl methanesulfonate	??????????		??????????		??????????		??????????		??????????		21.	U
55-18-5	N-Nitrosodiethylamine	??????????		??????????		??????????		??????????		??????????		31.	U
62-50-0	Ethyl methanesulfonate	??????????		??????????		??????????		??????????		??????????		21.	U
62-53-3	Aniline	??????????		??????????		??????????		??????????		??????????		31.	U
930-55-2	N-Nitrosopyrrolidine	??????????		??????????		??????????		??????????		??????????		12.	U
59-89-2	N-Nitrosomorpholine	??????????		??????????		??????????		??????????		??????????		42.	U
108-39-4	3-Methylphenol (m-Cresol)	??????????		??????????		??????????		??????????		??????????		31.	U
98-86-2	Acetophenone	??????????		??????????		??????????		??????????		??????????		21.	U
87-65-0	2,6-Dichlorophenol	??????????		??????????		??????????		??????????		??????????		31.	U
100-75-4	N-Nitrosopiperidine	??????????		??????????		??????????		??????????		??????????		10.	U
924-16-3	N-Nitroso-di-n-butylamine	??????????		??????????		??????????		??????????		??????????		21.	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SM846-SV0A		SAMPLE ID ----->	GDB-G-W002-01	GDB-G-W003-01	GDB-G-W004-01	GDB-G-W010-01	GDB-G-W040-01	GDB-H-W040-01			
		ORIGINAL ID ----->	GDBGW00201	GDBGW00301	GDBGW00401	GDBGW01001	GDBGW04001	GDBHW04001			
		LAB SAMPLE ID --->	L6024-38	L6024-40	L6024-42	L6024-34	L6024-48	L6022-7			
		ID FROM REPORT -->	GDBGW00201	GDBGW00301	GDBGW00401	GDBGW01001	GDBGW04001	GDBHW04001			
		SAMPLE DATE ----->	12/09/95	12/10/95	12/10/95	12/09/95	12/11/95	12/11/95			
		DATE EXTRACTED -->	12/14/95	12/17/95	12/17/95	12/14/95	12/17/95	12/18/95			
		DATE ANALYZED --->	12/21/95	12/28/95	12/28/95	12/21/95	12/28/95	01/08/96			
		MATRIX ----->	Water	Water	Water	Water	Water	Water			
		UNITS ----->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L			
CAS #	Parameter	L6024	VAL	L6024	VAL	L6024	VAL	L6024	VAL	L6022	VAL
120-58-1	Isosafrole	??????????		??????????		??????????		??????????		10.	U
94-59-7	Safrole	??????????		??????????		??????????		??????????		10.	U
130-15-4	1,4-Naphthoquinone	??????????		??????????		??????????		??????????		21.	U
99-65-0	1,3-Dinitrobenzene	??????????		??????????		??????????		??????????		21.	U
58-90-2	2,3,4,6-Tetrachlorophenol	??????????		??????????		??????????		??????????		31.	U
99-35-4	1,3,5-Trinitrobenzene	??????????		??????????		??????????		??????????		10.	U
82-68-8	Pentachloronitrobenzene	??????????		??????????		??????????		??????????		21.	U
88-85-7	Dinoseb	??????????		??????????		??????????		??????????		31.	U
56-57-5	4-Nitroquinoline 1-oxide	??????????		??????????		??????????		??????????		21.	U
3689-24-5	Sulfotep	??????????		??????????		??????????		??????????		21.	U
91-80-5	Methapyrilene	??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-VOA		SAMPLE ID -----> 507-S-B001-01		507-S-B001-02		507-S-B002-01		507-S-B002-02		507-S-B003-01		507-S-B003-02	
		ORIGINAL ID -----> 507SB00101		507SB00102		507SB00201		507SB00202		507SB00301		507SB00302	
		LAB SAMPLE ID -----> L5540-2		L5540-3		L5540-20		L5540-21		L5540-22		L5540-23	
		ID FROM REPORT --> 507SB00101		507SB00102		507SB00201		507SB00202		507SB00301		507SB00302	
		SAMPLE DATE -----> 10/04/95		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95	
		DATE ANALYZED -----> 10/17/95		10/17/95		10/17/95		10/17/95		10/17/95		10/17/95	
		MATRIX -----> Soil		Soil		Soil		Soil		Soil		Soil	
		UNITS -----> UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL
74-87-3	Chloromethane	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
75-01-4	Vinyl chloride	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
74-83-9	Bromomethane	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
75-00-3	Chloroethane	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
75-69-4	Trichlorofluoromethane	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
67-64-1	Acetone	12.	J	12.	U	11.	U	12.	U	12.	U	12.	U
75-35-4	1,1-Dichloroethene	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
75-15-0	Carbon disulfide	6.2	U	6.1	U	5.6	U	6.1	U	1.2	J	6.1	U
75-09-2	Methylene chloride	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
156-60-5	trans-1,2-Dichloroethene	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
108-05-4	Vinyl acetate	12.	U	12.	U	11.	U	12.	U	12.	U	12.	U
75-34-3	1,1-Dichloroethane	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
78-93-3	2-Butanone (MEK)	12.	U	12.	U	11.	U	12.	U	12.	U	12.	U
156-59-2	cis-1,2-Dichloroethene	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
67-66-3	Chloroform	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
71-55-6	1,1,1-Trichloroethane	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
56-23-5	Carbon tetrachloride	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
107-06-2	1,2-Dichloroethane	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
71-43-2	Benzene	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
79-01-6	Trichloroethene	1.8	J	6.1	U	5.6	U	1.7	J	2.9	J	6.1	U
78-87-5	1,2-Dichloropropane	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
75-27-4	Bromodichloromethane	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
110-75-8	2-Chloroethyl vinyl ether	25.	U	24.	U	23.	U	24.	U	24.	U	24.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	12.	U	12.	U	11.	U	12.	U	12.	U	12.	U
10061-01-5	cis-1,3-Dichloropropene	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
108-88-3	Toluene	1.9	J	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
10061-02-6	trans-1,3-Dichloropropene	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
591-78-6	2-Hexanone	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
79-00-5	1,1,2-Trichloroethane	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
127-18-4	Tetrachloroethene	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
124-48-1	Dibromochloromethane	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
108-90-7	Chlorobenzene	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
100-41-4	Ethylbenzene	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
1330-20-7	Xylene (Total)	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
95-47-6	o-Xylene	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
100-42-5	Styrene	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
75-25-2	Bromoform	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U

*** Validation Complete ***

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SUB46-VOA	SAMPLE ID ----->	507-s-8001-01	507-s-8001-02	507-s-8002-01	507-s-8002-02	507-s-8003-01	507-s-8003-02
	ORIGINAL ID ----->	507SB00101	507SB00102	507SB00201	507SB00202	507SB00301	507SB00302
	LAB SAMPLE ID ---->	L5540-2	L5540-3	L5540-20	L5540-21	L5540-22	L5540-23
	ID FROM REPORT -->	507SB00101	507SB00102	507SB00201	507SB00202	507SB00301	507SB00302
	SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95
	DATE ANALYZED ---->	10/17/95	10/17/95	10/17/95	10/17/95	10/17/95	10/17/95
	MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil
	UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG

CAS #	Parameter	L5540	VAL										
79-34-5	1,1,2,2-Tetrachloroethane	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
541-73-1	1,3-Dichlorobenzene	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
106-46-7	1,4-Dichlorobenzene	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
95-50-1	1,2-Dichlorobenzene	6.2	U	6.1	U	5.6	U	6.1	U	5.9	U	6.1	U
75-05-8	Acetonitrile	??????????		??????????		??????????		??????????		??????????		??????????	
107-02-8	Acrolein	??????????		??????????		??????????		??????????		??????????		??????????	
107-13-1	Acrylonitrile	??????????		??????????		??????????		??????????		??????????		??????????	
107-05-1	3-Chloropropene	??????????		??????????		??????????		??????????		??????????		??????????	
126-99-8	Chloroprene	??????????		??????????		??????????		??????????		??????????		??????????	
106-93-4	1, 2-Dibromoethane	??????????		??????????		??????????		??????????		??????????		??????????	
74-95-3	Methylene bromide	??????????		??????????		??????????		??????????		??????????		??????????	
75-71-8	Dichlorodifluoromethane	??????????		??????????		??????????		??????????		??????????		??????????	
123-91-1	1,4-Dioxane	??????????		??????????		??????????		??????????		??????????		??????????	
107-12-0	Propionitrile	??????????		??????????		??????????		??????????		??????????		??????????	
97-63-2	Ethyl methacrylate	??????????		??????????		??????????		??????????		??????????		??????????	
74-88-4	Methyl iodide	??????????		??????????		??????????		??????????		??????????		??????????	
78-83-1	Isobutyl alcohol	??????????		??????????		??????????		??????????		??????????		??????????	
126-98-7	Methacrylonitrile	??????????		??????????		??????????		??????????		??????????		??????????	
80-62-6	Methyl methacrylate	??????????		??????????		??????????		??????????		??????????		??????????	
630-20-6	1,1,1,2-Tetrachloroethane	??????????		??????????		??????????		??????????		??????????		??????????	
120-82-1	1,2,4-Trichlorobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
96-18-4	1,2,3-Trichloropropane	??????????		??????????		??????????		??????????		??????????		??????????	
96-12-8	1,2-Dibromo-3-Chloropropane	??????????		??????????		??????????		??????????		??????????		??????????	
110-57-6	trans-1,4-Dichloro-2-butene	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SUB846-VDA		SAMPLE ID -----> 507-S-8004-01		507-S-8004-02		507-S-8005-01		507-S-8005-02		GDB-S-8001-01		GDB-S-8001-02	
		ORIGINAL ID -----> 507S800401		507S800402		507S800501		507S800502		GDBS800101		GDBS800102	
		LAB SAMPLE ID ----> L5540-28		L5540-29		L5540-24		L5540-27		L5540-36		L5540-37	
		ID FROM REPORT --> 507S800401		507S800402		507S800501		507S800502		GDBS800101		GDBS800102	
		SAMPLE DATE -----> 10/04/95		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95	
		DATE ANALYZED ----> 10/16/95		10/16/95		10/16/95		10/17/95		10/17/95		10/16/95	
		MATRIX -----> Soil		Soil		Soil		Soil		Soil		Soil	
		UNITS -----> UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL
74-87-3	Chloromethane	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
75-01-4	Vinyl chloride	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
74-83-9	Bromomethane	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
75-00-3	Chloroethane	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	UJ
75-69-4	Trichlorofluoromethane	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	UJ
67-64-1	Acetone	9.5	J	12.	U	12.	U	11.	U	21.	J	610.	
75-35-4	1,1-Dichloroethene	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
75-15-0	Carbon disulfide	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	56.	
75-09-2	Methylene chloride	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
156-60-5	trans-1,2-Dichloroethene	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
108-05-4	Vinyl acetate	11.	U	12.	U	12.	U	11.	U	15.	UJ	24.	U
75-34-3	1,1-Dichloroethane	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
78-93-3	2-Butanone (MEK)	11.	U	12.	U	4.9	J	11.	U	15.	UJ	120.	
156-59-2	cis-1,2-Dichloroethene	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
67-66-3	Chloroform	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
71-55-6	1,1,1-Trichloroethane	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
56-23-5	Carbon tetrachloride	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
107-06-2	1,2-Dichloroethane	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
71-43-2	Benzene	5.7	U	1.3	J	5.8	U	5.7	U	7.6	UJ	12.	U
79-01-6	Trichloroethene	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
78-87-5	1,2-Dichloropropane	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
75-27-4	Bromodichloromethane	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
110-75-8	2-Chloroethyl vinyl ether	23.	U	24.	U	23.	U	23.	U	30.	UJ	48.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	11.	U	12.	U	12.	U	11.	U	15.	UJ	24.	U
10061-01-5	cis-1,3-Dichloropropene	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
108-88-3	Toluene	5.7	U	1.3	J	5.8	U	5.7	U	7.6	UJ	12.	U
10061-02-6	trans-1,3-Dichloropropene	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
591-78-6	2-Hexanone	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
79-00-5	1,1,2-Trichloroethane	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
127-18-4	Tetrachloroethene	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
124-48-1	Dibromochloromethane	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
108-90-7	Chlorobenzene	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
100-41-4	Ethylbenzene	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
1330-20-7	Xylene (Total)	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
95-47-6	o-Xylene	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
100-42-5	Styrene	5.7	U	6.	U	5.8	U	5.7	U	7.6	UJ	12.	U
75-25-2	Bromoform	5.7	UJ	6.	U	5.8	U	5.7	U	7.6	UJ	12.	UJ

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SM846-VOA	SAMPLE ID ----->	507-S-8004-01	507-S-8004-02	507-S-8005-01	507-S-8005-02	GDB-S-8001-01	GDB-S-8001-02
	ORIGINAL ID ----->	507SB00401	507SB00402	507SB00501	507SB00502	GDBSB00101	GDBSB00102
	LAB SAMPLE ID ---->	L5540-28	L5540-29	L5540-24	L5540-27	L5540-36	L5540-37
	ID FROM REPORT -->	507SB00401	507SB00402	507SB00501	507SB00502	GDBSB00101	GDBSB00102
	SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95
	DATE ANALYZED ---->	10/16/95	10/16/95	10/16/95	10/17/95	10/17/95	10/16/95
	MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil
UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	

CAS #	Parameter	L5540	VAL										
79-34-5	1,1,2,2-Tetrachloroethane	5.7	UJ	6.	U	5.8	U	5.7	U	7.6	UJ	12.	UJ
541-73-1	1,3-Dichlorobenzene	5.7	UJ	6.	U	5.8	U	5.7	U	7.6	UJ	12.	UJ
106-46-7	1,4-Dichlorobenzene	5.7	UJ	6.	U	5.8	U	5.7	U	7.6	UJ	12.	UJ
95-50-1	1,2-Dichlorobenzene	5.7	UJ	6.	U	5.8	U	5.7	U	7.6	UJ	12.	UJ
75-05-8	Acetonitrile	??????????		??????????		??????????		??????????		??????????		??????????	
107-02-8	Acrolein	??????????		??????????		??????????		??????????		??????????		??????????	
107-13-1	Acrylonitrile	??????????		??????????		??????????		??????????		??????????		??????????	
107-05-1	3-Chloropropene	??????????		??????????		??????????		??????????		??????????		??????????	
126-99-8	Chloroprene	??????????		??????????		??????????		??????????		??????????		??????????	
106-93-4	1, 2-Dibromoethane	??????????		??????????		??????????		??????????		??????????		??????????	
74-95-3	Methylene bromide	??????????		??????????		??????????		??????????		??????????		??????????	
75-71-8	Dichlorodifluoromethane	??????????		??????????		??????????		??????????		??????????		??????????	
123-91-1	1,4-Dioxane	??????????		??????????		??????????		??????????		??????????		??????????	
107-12-0	Propionitrile	??????????		??????????		??????????		??????????		??????????		??????????	
97-63-2	Ethyl methacrylate	??????????		??????????		??????????		??????????		??????????		??????????	
74-88-4	Methyl iodide	??????????		??????????		??????????		??????????		??????????		??????????	
78-83-1	Isobutyl alcohol	??????????		??????????		??????????		??????????		??????????		??????????	
126-98-7	Methacrylonitrile	??????????		??????????		??????????		??????????		??????????		??????????	
80-62-6	Methyl methacrylate	??????????		??????????		??????????		??????????		??????????		??????????	
630-20-6	1,1,1,2-Tetrachloroethane	??????????		??????????		??????????		??????????		??????????		??????????	
120-82-1	1,2,4-Trichlorobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
96-18-4	1,2,3-Trichloropropane	??????????		??????????		??????????		??????????		??????????		??????????	
96-12-8	1,2-Dibromo-3-Chloropropane	??????????		??????????		??????????		??????????		??????????		??????????	
110-57-6	trans-1,4-Dichloro-2-butene	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-VOA		SAMPLE ID ----->	GDB-S-B002-01 RE	GDB-S-B002-02	GDB-S-B003-01	GDB-S-B004-01	GDB-S-B004-02	GDB-S-B005-01			
		ORIGINAL ID ----->	GDBS00201	GDBS00202	GDBS00301	GDBS00401	GDBS00402	GDBS00501			
		LAB SAMPLE ID ---->	L5540-34RE	L5540-35	L5540-1	L5540-32	L5540-33	L5540-40			
		ID FROM REPORT -->	GDBS00201	GDBS00202	GDBS00301	GDBS00401	GDBS00402	GDBS00501			
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95			
		DATE ANALYZED ----->	10/17/95	10/17/95	10/16/95	10/18/95	10/17/95	10/16/95			
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil			
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG			
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL
74-87-3	Chloromethane	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
75-01-4	Vinyl chloride	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
74-83-9	Bromomethane	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
75-00-3	Chloroethane	6.6	UJ	8.8	UJ	6.1	UR	5.2	U	5.3	U
75-69-4	Trichlorofluoromethane	6.6	UJ	8.8	UJ	6.1	UJ	5.2	U	5.3	U
67-64-1	Acetone	10.	J	150.	J	12.	U	10.	U	7.7	J
75-35-4	1,1-Dichloroethene	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
75-15-0	Carbon disulfide	6.6	UJ	7.6	J	6.1	U	5.2	U	5.3	U
75-09-2	Methylene chloride	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
156-60-5	trans-1,2-Dichloroethene	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
108-05-4	Vinyl acetate	13.	UJ	18.	UJ	12.	U	10.	U	11.	U
75-34-3	1,1-Dichloroethane	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
78-93-3	2-Butanone (MEK)	13.	UJ	18.	UJ	12.	U	10.	U	11.	U
156-59-2	cis-1,2-Dichloroethene	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
67-66-3	Chloroform	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
71-55-6	1,1,1-Trichloroethane	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
56-23-5	Carbon tetrachloride	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
107-06-2	1,2-Dichloroethane	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
71-43-2	Benzene	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
79-01-6	Trichloroethene	2.5	J	8.8	UJ	6.1	U	5.1	J	5.3	U
78-87-5	1,2-Dichloropropane	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
75-27-4	Bromodichloromethane	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
110-75-8	2-Chloroethyl vinyl ether	27.	UJ	35.	UJ	24.	U	21.	U	21.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	13.	UJ	18.	UJ	12.	U	10.	U	11.	U
10061-01-5	cis-1,3-Dichloropropene	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
108-88-3	Toluene	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
10061-02-6	trans-1,3-Dichloropropene	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
591-78-6	2-Hexanone	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
79-00-5	1,1,2-Trichloroethane	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
127-18-4	Tetrachloroethene	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
124-48-1	Dibromochloromethane	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
108-90-7	Chlorobenzene	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
100-41-4	Ethylbenzene	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
1330-20-7	Xylene (Total)	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
95-47-6	o-Xylene	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
100-42-5	Styrene	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
75-25-2	Bromoform	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SMB46-VOA	SAMPLE ID ----->	GDB-S-B002-01 RE	GDB-S-B002-02	GDB-S-B003-01	GDB-S-B004-01	GDB-S-B004-02	GDB-S-B005-01
	ORIGINAL ID ----->	GDBS800201	GDBS800202	GDBS800301	GDBS800401	GDBS800402	GDBS800501
	LAB SAMPLE ID --->	L5540-34RE	L5540-35	L5540-1	L5540-32	L5540-33	L5540-40
	ID FROM REPORT -->	GDBS800201	GDBS800202	GDBS800301	GDBS800401	GDBS800402	GDBS800501
	SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95
	DATE ANALYZED --->	10/17/95	10/17/95	10/16/95	10/18/95	10/17/95	10/16/95
	MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil
UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	

CAS #	Parameter	L5540	VAL								
79-34-5	1,1,2,2-Tetrachloroethane	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
541-73-1	1,3-Dichlorobenzene	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
106-46-7	1,4-Dichlorobenzene	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
95-50-1	1,2-Dichlorobenzene	6.6	UJ	8.8	UJ	6.1	U	5.2	U	5.3	U
75-05-8	Acetonitrile	??????????		??????????		??????????		??????????		??????????	
107-02-8	Acrolein	??????????		??????????		??????????		??????????		??????????	
107-13-1	Acrylonitrile	??????????		??????????		??????????		??????????		??????????	
107-05-1	3-Chloropropene	??????????		??????????		??????????		??????????		??????????	
126-99-8	Chloroprene	??????????		??????????		??????????		??????????		??????????	
106-93-4	1, 2-Dibromoethane	??????????		??????????		??????????		??????????		??????????	
74-95-3	Methylene bromide	??????????		??????????		??????????		??????????		??????????	
75-71-8	Dichlorodifluoromethane	??????????		??????????		??????????		??????????		??????????	
123-91-1	1,4-Dioxane	??????????		??????????		??????????		??????????		??????????	
107-12-0	Propionitrile	??????????		??????????		??????????		??????????		??????????	
97-63-2	Ethyl methacrylate	??????????		??????????		??????????		??????????		??????????	
74-88-4	Methyl iodide	??????????		??????????		??????????		??????????		??????????	
78-83-1	Isobutyl alcohol	??????????		??????????		??????????		??????????		??????????	
126-98-7	Methacrylonitrile	??????????		??????????		??????????		??????????		??????????	
80-62-6	Methyl methacrylate	??????????		??????????		??????????		??????????		??????????	
630-20-6	1,1,1,2-Tetrachloroethane	??????????		??????????		??????????		??????????		??????????	
120-82-1	1,2,4-Trichlorobenzene	??????????		??????????		??????????		??????????		??????????	
96-18-4	1,2,3-Trichloropropane	??????????		??????????		??????????		??????????		??????????	
96-12-8	1,2-Dibromo-3-Chloropropane	??????????		??????????		??????????		??????????		??????????	
110-57-6	trans-1,4-Dichloro-2-butene	??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SM846-V0A	SAMPLE ID ----->	GDB-S-B005-02	GDB-S-B006-01	GDB-S-B006-02	GDB-S-B007-01	GDB-S-B007-02	GDB-S-B008-01
	ORIGINAL ID ----->	GDBSB00502	GDBSB00601	GDBSB00602	GDBSB00701	GDBSB00702	GDBSB00801
	LAB SAMPLE ID ---->	L5540-41	L5540-38	L5540-39	L5540-16	L5540-17	L5540-14
	ID FROM REPORT -->	GDBSB00502	GDBSB00601	GDBSB00602	GDBSB00701	GDBSB00702	GDBSB00801
	SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95
	DATE ANALYZED ---->	10/17/95	10/16/95	10/17/95	10/17/95	10/17/95	10/17/95
	MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil
UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	

CAS #	Parameter	L5540	VAL										
74-87-3	Chloromethane	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
75-01-4	Vinyl chloride	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
74-83-9	Bromomethane	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
75-00-3	Chloroethane	5.9	UJ	5.3	UJ	5.7	UJ	5.9	UR	5.9	UR	5.3	UR
75-69-4	Trichlorofluoromethane	5.9	UJ	5.3	U	5.7	U	5.9	UJ	5.9	UJ	5.3	UJ
67-64-1	Acetone	84.	J	19.		24.		12.	U	12.	U	11.	U
75-35-4	1,1-Dichloroethene	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
75-15-0	Carbon disulfide	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
75-09-2	Methylene chloride	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
156-60-5	trans-1,2-Dichloroethene	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
108-05-4	Vinyl acetate	12.	UJ	11.	U	11.	U	12.	U	12.	U	11.	U
75-34-3	1,1-Dichloroethane	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
78-93-3	2-Butanone (MEK)	18.	J	11.	U	11.	U	12.	U	12.	U	11.	U
156-59-2	cis-1,2-Dichloroethene	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
67-66-3	Chloroform	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
71-55-6	1,1,1-Trichloroethane	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
56-23-5	Carbon tetrachloride	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
107-06-2	1,2-Dichloroethane	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
71-43-2	Benzene	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
79-01-6	Trichloroethene	5.9	UJ	1.8	J	5.7	U	1.9	J	5.9	U	1.9	J
78-87-5	1,2-Dichloropropane	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
75-27-4	Bromodichloromethane	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
110-75-8	2-Chloroethyl vinyl ether	24.	UJ	21.	U	23.	U	24.	U	24.	U	21.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	12.	UJ	11.	U	11.	U	12.	U	12.	U	11.	U
10061-01-5	cis-1,3-Dichloropropene	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
108-88-3	Toluene	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
10061-02-6	trans-1,3-Dichloropropene	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
591-78-6	2-Hexanone	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
79-00-5	1,1,2-Trichloroethane	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
127-18-4	Tetrachloroethene	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
124-48-1	Dibromochloromethane	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
108-90-7	Chlorobenzene	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
100-41-4	Ethylbenzene	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
1330-20-7	Xylene (Total)	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
95-47-6	o-Xylene	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
100-42-5	Styrene	5.9	UJ	5.3	U	5.7	U	5.9	U	5.9	U	5.3	U
75-25-2	Bromoform	5.9	UJ	5.3	UJ	5.7	U	5.9	U	5.9	U	5.3	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-VOA		SAMPLE ID ----->	GDB-S-B005-02	GDB-S-B006-01	GDB-S-B006-02	GDB-S-B007-01	GDB-S-B007-02	GDB-S-B008-01			
		ORIGINAL ID ----->	GDBSB00502	GDBSB00601	GDBSB00602	GDBSB00701	GDBSB00702	GDBSB00801			
		LAB SAMPLE ID ---->	L5540-41	L5540-38	L5540-39	L5540-16	L5540-17	L5540-14			
		ID FROM REPORT -->	GDBSB00502	GDBSB00601	GDBSB00602	GDBSB00701	GDBSB00702	GDBSB00801			
		SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95			
		DATE ANALYZED ---->	10/17/95	10/16/95	10/16/95	10/17/95	10/17/95	10/17/95			
		MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil			
		UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG			
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL
79-34-5	1,1,2,2-Tetrachloroethane	5.9	UJ	5.3	UJ	5.7	U	5.9	U	5.9	U
541-73-1	1,3-Dichlorobenzene	5.9	UJ	5.3	UJ	5.7	U	5.9	U	5.9	U
106-46-7	1,4-Dichlorobenzene	5.9	UJ	5.3	UJ	5.7	U	5.9	U	5.9	U
95-50-1	1,2-Dichlorobenzene	5.9	UJ	5.3	UJ	5.7	U	5.9	U	5.9	U
75-05-8	Acetonitrile	??????????		??????????		??????????		??????????		??????????	
107-02-8	Acrolein	??????????		??????????		??????????		??????????		??????????	
107-13-1	Acrylonitrile	??????????		??????????		??????????		??????????		??????????	
107-05-1	3-Chloropropene	??????????		??????????		??????????		??????????		??????????	
126-99-8	Chloroprene	??????????		??????????		??????????		??????????		??????????	
106-93-4	1, 2-Dibromoethane	??????????		??????????		??????????		??????????		??????????	
74-95-3	Methylene bromide	??????????		??????????		??????????		??????????		??????????	
75-71-8	Dichlorodifluoromethane	??????????		??????????		??????????		??????????		??????????	
123-91-1	1,4-Dioxane	??????????		??????????		??????????		??????????		??????????	
107-12-0	Propionitrile	??????????		??????????		??????????		??????????		??????????	
97-63-2	Ethyl methacrylate	??????????		??????????		??????????		??????????		??????????	
74-88-4	Methyl iodide	??????????		??????????		??????????		??????????		??????????	
78-83-1	Isobutyl alcohol	??????????		??????????		??????????		??????????		??????????	
126-98-7	Methacrylonitrile	??????????		??????????		??????????		??????????		??????????	
80-62-6	Methyl methacrylate	??????????		??????????		??????????		??????????		??????????	
630-20-6	1,1,1,2-Tetrachloroethane	??????????		??????????		??????????		??????????		??????????	
120-82-1	1,2,4-Trichlorobenzene	??????????		??????????		??????????		??????????		??????????	
96-18-4	1,2,3-Trichloropropane	??????????		??????????		??????????		??????????		??????????	
96-12-8	1,2-Dibromo-3-Chloropropane	??????????		??????????		??????????		??????????		??????????	
110-57-6	trans-1,4-Dichloro-2-butene	??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SUB46-VOA		SAMPLE ID -----> GDB-S-B008-02		GDB-S-B009-01		GDB-S-B009-02		GDB-S-B010-01		GDB-S-B010-02		GDB-S-B011-01	
ORIGINAL ID ----->		GDBS800802		GDBS800901		GDBS800902		GDBS801001		GDBS801002		GDBS801101	
LAB SAMPLE ID ---->		L5540-15		L5540-18		L5540-19		L5540-42		L5540-43		L5540-12	
ID FROM REPORT -->		GDBS800802		GDBS800901		GDBS800902		GDBS801001		GDBS801002		GDBS801101	
SAMPLE DATE ----->		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95	
DATE ANALYZED ---->		10/17/95		10/17/95		10/17/95		10/17/95		10/17/95		10/17/95	
MATRIX ----->		Soil		Soil		Soil		Soil		Soil		Soil	
UNITS ----->		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL
74-87-3	Chloromethane	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
75-01-4	Vinyl chloride	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
74-83-9	Bromomethane	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
75-00-3	Chloroethane	5.2	UR	5.5	UR	5.5	UR	5.8	UJ	7.2	UJ	7.4	UR
75-69-4	Trichlorofluoromethane	5.2	UJ	5.5	UJ	5.5	UJ	5.8	UJ	7.2	UJ	7.4	UJ
67-64-1	Acetone	10.	U	11.	U	11.	U	12.	UJ	17.	J	12.	J
75-35-4	1,1-Dichloroethene	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
75-15-0	Carbon disulfide	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
75-09-2	Methylene chloride	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
156-60-5	trans-1,2-Dichloroethene	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
108-05-4	Vinyl acetate	10.	U	11.	U	11.	U	12.	UJ	14.	UJ	15.	U
75-34-3	1,1-Dichloroethane	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
78-93-3	2-Butanone (MEK)	10.	U	11.	U	11.	U	3.3	J	4.3	J	15.	U
156-59-2	cis-1,2-Dichloroethene	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
67-66-3	Chloroform	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
71-55-6	1,1,1-Trichloroethane	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
56-23-5	Carbon tetrachloride	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
107-06-2	1,2-Dichloroethane	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
71-43-2	Benzene	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
79-01-6	Trichloroethene	5.2	U	3.3	J	5.5	U	1.6	J	7.2	UJ	7.4	U
78-87-5	1,2-Dichloropropane	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
75-27-4	Bromodichloromethane	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
110-75-8	2-Chloroethyl vinyl ether	21.	U	22.	U	22.	U	23.	UJ	29.	UJ	29.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	10.	U	11.	U	11.	U	12.	UJ	14.	UJ	15.	U
10061-01-5	cis-1,3-Dichloropropene	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
108-88-3	Toluene	5.2	U	5.5	U	5.5	U	1.4	UJ	7.2	UJ	7.4	U
10061-02-6	trans-1,3-Dichloropropene	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
591-78-6	2-Hexanone	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
79-00-5	1,1,2-Trichloroethane	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	U
127-18-4	Tetrachloroethene	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	UJ
124-48-1	Dibromochloromethane	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	UJ
108-90-7	Chlorobenzene	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	UJ
100-41-4	Ethylbenzene	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	UJ
1330-20-7	Xylene (Total)	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	UJ
95-47-6	o-Xylene	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	UJ
100-42-5	Styrene	5.2	U	5.5	U	5.5	U	5.8	UJ	7.2	UJ	7.4	UJ
75-25-2	Bromoform	5.2	U	5.5	UJ	5.5	U	5.8	UJ	7.2	UJ	7.4	UJ

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SMB46-VDA	SAMPLE ID ----->	GDB-S-B008-02	GDB-S-B009-01	GDB-S-B009-02	GDB-S-B010-01	GDB-S-B010-02	GDB-S-B011-01
	ORIGINAL ID ----->	GDBS800802	GDBS800901	GDBS800902	GDBS801001	GDBS801002	GDBS801101
	LAB SAMPLE ID ---->	L5540-15	L5540-18	L5540-19	L5540-42	L5540-43	L5540-12
	ID FROM REPORT -->	GDBS800802	GDBS800901	GDBS800902	GDBS801001	GDBS801002	GDBS801101
	SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95	10/04/95
	DATE ANALYZED ---->	10/17/95	10/17/95	10/17/95	10/17/95	10/17/95	10/17/95
	MATRIX ----->	Soil	Soil	Soil	Soil	Soil	Soil
	UNITS ----->	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG

CAS #	Parameter	L5540	VAL										
79-34-5	1,1,2,2-Tetrachloroethane	5.2	U	5.5	UJ	5.5	U	5.8	UJ	7.2	UJ	7.4	UJ
541-73-1	1,3-Dichlorobenzene	5.2	U	5.5	UJ	5.5	U	5.8	UJ	7.2	UJ	7.4	UJ
106-46-7	1,4-Dichlorobenzene	5.2	U	5.5	UJ	5.5	U	5.8	UJ	7.2	UJ	7.4	UJ
95-50-1	1,2-Dichlorobenzene	5.2	U	5.5	UJ	5.5	U	5.8	UJ	7.2	UJ	7.4	UJ
75-05-8	Acetonitrile	??????????		??????????		??????????		??????????		??????????		??????????	
107-02-8	Acrolein	??????????		??????????		??????????		??????????		??????????		??????????	
107-13-1	Acrylonitrile	??????????		??????????		??????????		??????????		??????????		??????????	
107-05-1	3-Chloropropene	??????????		??????????		??????????		??????????		??????????		??????????	
126-99-8	Chloroprene	??????????		??????????		??????????		??????????		??????????		??????????	
106-93-4	1, 2-Dibromoethane	??????????		??????????		??????????		??????????		??????????		??????????	
74-95-3	Methylene bromide	??????????		??????????		??????????		??????????		??????????		??????????	
75-71-8	Dichlorodifluoromethane	??????????		??????????		??????????		??????????		??????????		??????????	
123-91-1	1,4-Dioxane	??????????		??????????		??????????		??????????		??????????		??????????	
107-12-0	Propionitrile	??????????		??????????		??????????		??????????		??????????		??????????	
97-63-2	Ethyl methacrylate	??????????		??????????		??????????		??????????		??????????		??????????	
74-88-4	Methyl iodide	??????????		??????????		??????????		??????????		??????????		??????????	
78-83-1	Isobutyl alcohol	??????????		??????????		??????????		??????????		??????????		??????????	
126-98-7	Methacrylonitrile	??????????		??????????		??????????		??????????		??????????		??????????	
80-62-6	Methyl methacrylate	??????????		??????????		??????????		??????????		??????????		??????????	
630-20-6	1,1,1,2-Tetrachloroethane	??????????		??????????		??????????		??????????		??????????		??????????	
120-82-1	1,2,4-Trichlorobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
96-18-4	1,2,3-Trichloropropane	??????????		??????????		??????????		??????????		??????????		??????????	
96-12-8	1,2-Dibromo-3-Chloropropane	??????????		??????????		??????????		??????????		??????????		??????????	
110-57-6	trans-1,4-Dichloro-2-butene	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SUB846-VDA		SAMPLE ID ----->		GDB-S-B011-02		GDB-S-B012-01		GDB-S-B012-02		GDB-S-B013-01		GDB-S-B013-02		GDB-S-B014-01	
		ORIGINAL ID ----->		GDBSB01102		GDBSB01201		GDBSB01202		GDBSB01301		GDBSB01302		GDBSB01401	
		LAB SAMPLE ID ----->		L5540-13		L5540-10		L5540-10		L5540-8		L5540-9		L5540-4	
		ID FROM REPORT ----->		GDBSB01102		GDBSB01201		GDBSB01202		GDBSB01301		GDBSB01302		GDBSB01401	
		SAMPLE DATE ----->		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95	
		DATE ANALYZED ----->		10/17/95		10/17/95		10/17/95		10/17/95		10/17/95		10/17/95	
		MATRIX ----->		Soil											
		UNITS ----->		UG/KG											
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL	L5540	VAL
74-87-3	Chloromethane	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
75-01-4	Vinyl chloride	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
74-83-9	Bromomethane	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
75-00-3	Chloroethane	6.9	UR	5.4	UR	5.6	UR	6.	U	6.7	U	5.4	UR		
75-69-4	Trichlorofluoromethane	6.9	UJ	5.4	UJ	5.6	UJ	6.	UJ	6.7	U	5.4	UJ		
67-64-1	Acetone	19.		11.	U	11.	U	12.	U	13.	U	11.	U		
75-35-4	1,1-Dichloroethene	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
75-15-0	Carbon disulfide	15.		5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
75-09-2	Methylene chloride	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
156-60-5	trans-1,2-Dichloroethene	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
108-05-4	Vinyl acetate	14.	U	11.	U	11.	U	12.	U	13.	U	11.	U		
75-34-3	1,1-Dichloroethane	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
78-93-3	2-Butanone (MEK)	14.	U	11.	U	11.	U	12.	U	13.	U	11.	U		
156-59-2	cis-1,2-Dichloroethene	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
67-66-3	Chloroform	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
71-55-6	1,1,1-Trichloroethane	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
56-23-5	Carbon tetrachloride	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
107-06-2	1,2-Dichloroethane	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
71-43-2	Benzene	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
79-01-6	Trichloroethene	6.9	U	5.4	U	5.6	U	1.3	J	6.7	U	5.4	U		
78-87-5	1,2-Dichloropropane	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
75-27-4	Bromodichloromethane	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
110-75-8	2-Chloroethyl vinyl ether	28.	U	22.	U	22.	U	24.	U	27.	U	22.	U		
108-10-1	4-Methyl-2-Pentanone (MIBK)	14.	U	11.	U	11.	U	12.	U	13.	U	11.	U		
10061-01-5	cis-1,3-Dichloropropene	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
108-88-3	Toluene	6.9	U	5.4	U	5.6	U	1.4	J	6.7	U	5.4	U		
10061-02-6	trans-1,3-Dichloropropene	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
591-78-6	2-Hexanone	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
79-00-5	1,1,2-Trichloroethane	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
127-18-4	Tetrachloroethene	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
124-48-1	Dibromochloromethane	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
108-90-7	Chlorobenzene	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
100-41-4	Ethylbenzene	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
1330-20-7	Xylene (Total)	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
95-47-6	o-Xylene	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
100-42-5	Styrene	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		
75-25-2	Bromoform	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U		

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SMB46-V0A		GDB-S-B011-02		GDB-S-B012-01		GDB-S-B012-02		GDB-S-B013-01		GDB-S-B013-02		GDB-S-B014-01	
SAMPLE ID ----->		GDBS01102		GDBS01201		GDBS01202		GDBS01301		GDBS01302		GDBS01401	
ORIGINAL ID ----->		L5540-13		L5540-10		L5540-11		L5540-8		L5540-9		L5540-4	
LAB SAMPLE ID ---->		GDBS01102		GDBS01201		GDBS01202		GDBS01301		GDBS01302		GDBS01401	
ID FROM REPORT -->		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95		10/04/95	
SAMPLE DATE ----->		10/17/95		10/17/95		10/17/95		10/17/95		10/17/95		10/17/95	
DATE ANALYZED ---->		Soil		Soil		Soil		Soil		Soil		Soil	
MATRIX ----->		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
UNITS ----->		A		A		A		A		A		A	
CAS #	Parameter	L5540	VAL										
79-34-5	1,1,2,2-Tetrachloroethane	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U
541-73-1	1,3-Dichlorobenzene	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U
106-46-7	1,4-Dichlorobenzene	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U
95-50-1	1,2-Dichlorobenzene	6.9	U	5.4	U	5.6	U	6.	U	6.7	U	5.4	U
75-05-8	Acetonitrile	??????????		??????????		??????????		??????????		??????????		??????????	
107-02-8	Acrolein	??????????		??????????		??????????		??????????		??????????		??????????	
107-13-1	Acrylonitrile	??????????		??????????		??????????		??????????		??????????		??????????	
107-05-1	3-Chloropropene	??????????		??????????		??????????		??????????		??????????		??????????	
126-99-8	Chloroprene	??????????		??????????		??????????		??????????		??????????		??????????	
106-93-4	1, 2-Dibromoethane	??????????		??????????		??????????		??????????		??????????		??????????	
74-95-3	Methylene bromide	??????????		??????????		??????????		??????????		??????????		??????????	
75-71-8	Dichlorodifluoromethane	??????????		??????????		??????????		??????????		??????????		??????????	
123-91-1	1,4-Dioxane	??????????		??????????		??????????		??????????		??????????		??????????	
107-12-0	Propionitrile	??????????		??????????		??????????		??????????		??????????		??????????	
97-63-2	Ethyl methacrylate	??????????		??????????		??????????		??????????		??????????		??????????	
74-88-4	Methyl iodide	??????????		??????????		??????????		??????????		??????????		??????????	
78-83-1	Isobutyl alcohol	??????????		??????????		??????????		??????????		??????????		??????????	
126-98-7	Methacrylonitrile	??????????		??????????		??????????		??????????		??????????		??????????	
80-62-6	Methyl methacrylate	??????????		??????????		??????????		??????????		??????????		??????????	
630-20-6	1,1,1,2-Tetrachloroethane	??????????		??????????		??????????		??????????		??????????		??????????	
120-82-1	1,2,4-Trichlorobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
96-18-4	1,2,3-Trichloropropane	??????????		??????????		??????????		??????????		??????????		??????????	
96-12-8	1,2-Dibromo-3-Chloropropane	??????????		??????????		??????????		??????????		??????????		??????????	
110-57-6	trans-1,4-Dichloro-2-butene	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-VOA		SAMPLE ID -----> GDB-S-B014-02		GDB-S-B015-01		GDB-S-B015-02		GDB-G-W001-01		GDB-G-W002-01		GDB-G-W003-01	
ORIGINAL ID ----->		GDBS801402		GDBS801501		GDBS801502		GDBGW00101		GDBGW00201		GDBGW00301	
LAB SAMPLE ID ----->		L5540-7		L5540-30		L5540-31		L6024-5		L6024-8		L6024-13	
ID FROM REPORT -->		GDBS801402		GDBS801501		GDBS801502		GDBGW00101		GDBGW00201		GDBGW00301	
SAMPLE DATE ----->		10/04/95		10/04/95		10/04/95		12/09/95		12/09/95		12/10/95	
DATE ANALYZED ----->		10/17/95		10/17/95		10/17/95		12/18/95		12/18/95		12/18/95	
MATRIX ----->		Soil		Soil		Soil		Water		Water		Water	
UNITS ----->		UG/KG		UG/KG		UG/KG		UG/L		UG/L		UG/L	
CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L6024	VAL	L6024	VAL	L6024	VAL
74-87-3	Chloromethane	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
75-00-3	Chloroethane	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
75-69-4	Trichlorofluoromethane	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
67-64-1	Acetone	12.	U	10.	J	12.	U	10.	U	10.	U	10.	U
75-35-4	1,1-Dichloroethene	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	6.	U	5.6	U	5.9	U	5.6	U	5.	U	5.	U
75-09-2	Methylene chloride	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
156-60-5	trans-1,2-Dichloroethene	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	12.	U	11.	U	12.	U	10.	U	10.	U	10.	U
75-34-3	1,1-Dichloroethane	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	12.	U	11.	U	12.	U	10.	U	10.	U	10.	U
156-59-2	cis-1,2-Dichloroethene	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
67-66-3	Chloroform	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
71-43-2	Benzene	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	6.	U	1.8	J	5.9	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	24.	U	22.	U	23.	U	20.	U	20.	U	20.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	12.	U	11.	U	12.	U	10.	U	10.	U	10.	U
10061-01-5	cis-1,3-Dichloropropene	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
108-88-3	Toluene	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
10061-02-6	trans-1,3-Dichloropropene	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	6.	U	5.6	U	5.9	U	10.	U	10.	U	10.	U
79-00-5	1,1,2-Trichloroethane	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
124-48-1	Dibromochloromethane	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
95-47-6	o-Xylene	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
100-42-5	Styrene	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	6.	U	5.6	U	5.9	U	5.	U	5.	U	5.	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SUB46-V0A	SAMPLE ID ----->	GDB-S-B014-02	GDB-S-B015-01	GDB-S-B015-02	GDB-G-W001-01	GDB-G-W002-01	GDB-G-W003-01
	ORIGINAL ID ----->	GDBS01402	GDBS01501	GDBS01502	GDBGW00101	GDBGW00201	GDBGW00301
	LAB SAMPLE ID ---->	L5540-7	L5540-30	L5540-31	L6024-5	L6024-8	L6024-13
	ID FROM REPORT -->	GDBS01402	GDBS01501	GDBS01502	GDBGW00101	GDBGW00201	GDBGW00301
	SAMPLE DATE ----->	10/04/95	10/04/95	10/04/95	12/09/95	12/09/95	12/10/95
	DATE ANALYZED ---->	10/17/95	10/17/95	10/17/95	12/18/95	12/18/95	12/18/95
	MATRIX ----->	Soil	Soil	Soil	Water	Water	Water
UNITS ----->	UG/KG	UG/KG	UG/KG	UG/L	UG/L	UG/L	

CAS #	Parameter	L5540	VAL	L5540	VAL	L5540	VAL	L6024	VAL	L6024	VAL	L6024	VAL
79-34-5	1,1,2,2-Tetrachloroethane	6.	U	5.6	UJ	5.9	U	5.	U	5.	U	5.	U
541-73-1	1,3-Dichlorobenzene	6.	U	5.6	UJ	5.9	U	5.	U	5.	U	5.	U
106-46-7	1,4-Dichlorobenzene	6.	U	5.6	UJ	5.9	U	5.	U	5.	U	5.	U
95-50-1	1,2-Dichlorobenzene	6.	U	5.6	UJ	5.9	U	5.	U	5.	U	5.	U
75-05-8	Acetonitrile	??????????		??????????		??????????		??????????		??????????		??????????	
107-02-8	Acrolein	??????????		??????????		??????????		??????????		??????????		??????????	
107-13-1	Acrylonitrile	??????????		??????????		??????????		??????????		??????????		??????????	
107-05-1	3-Chloropropene	??????????		??????????		??????????		??????????		??????????		??????????	
126-99-8	Chloroprene	??????????		??????????		??????????		??????????		??????????		??????????	
106-93-4	1, 2-Dibromoethane	??????????		??????????		??????????		??????????		??????????		??????????	
74-95-3	Methylene bromide	??????????		??????????		??????????		??????????		??????????		??????????	
75-71-8	Dichlorodifluoromethane	??????????		??????????		??????????		??????????		??????????		??????????	
123-91-1	1,4-Dioxane	??????????		??????????		??????????		??????????		??????????		??????????	
107-12-0	Propionitrile	??????????		??????????		??????????		??????????		??????????		??????????	
97-63-2	Ethyl methacrylate	??????????		??????????		??????????		??????????		??????????		??????????	
74-88-4	Methyl iodide	??????????		??????????		??????????		??????????		??????????		??????????	
78-83-1	Isobutyl alcohol	??????????		??????????		??????????		??????????		??????????		??????????	
126-98-7	Methacrylonitrile	??????????		??????????		??????????		??????????		??????????		??????????	
80-62-6	Methyl methacrylate	??????????		??????????		??????????		??????????		??????????		??????????	
630-20-6	1,1,1,2-Tetrachloroethane	??????????		??????????		??????????		??????????		??????????		??????????	
120-82-1	1,2,4-Trichlorobenzene	??????????		??????????		??????????		??????????		??????????		??????????	
96-18-4	1,2,3-Trichloropropane	??????????		??????????		??????????		??????????		??????????		??????????	
96-12-8	1,2-Dibromo-3-Chloropropane	??????????		??????????		??????????		??????????		??????????		??????????	
110-57-6	trans-1,4-Dichloro-2-butene	??????????		??????????		??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SW846-VOA		SAMPLE ID -----> GDB-G-W004-01		GDB-G-W01D-01		GDB-G-W04D-01		GDB-H-W04D-01	
		ORIGINAL ID -----> GDBGW00401		GDBGW01D01		GDBGW04D01		GDBHW04D01	
		LAB SAMPLE ID ----> L6024-16		L6024-2		L6024-25		L6022-1	
		ID FROM REPORT --> GDBGW00401		GDBGW01D01		GDBGW04D01		GDBHW04D01	
		SAMPLE DATE -----> 12/10/95		12/09/95		12/11/95		12/11/95	
		DATE ANALYZED ----> 12/19/95		12/18/95		12/18/95		12/22/95	
		MATRIX -----> Water		Water		Water		Water	
		UNITS -----> UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	L6024	VAL	L6024	VAL	L6024	VAL	L6022	VAL
74-87-3	Chloromethane	5.	U	5.	U	5.	U	10.	U
75-01-4	Vinyl chloride	5.	U	5.	U	5.	U	10.	U
74-83-9	Bromomethane	5.	UJ	5.	U	5.	U	10.	UR
75-00-3	Chloroethane	5.	U	5.	U	5.	U	10.	U
75-69-4	Trichlorofluoromethane	5.	U	5.	U	5.	U	5.	UJ
67-64-1	Acetone	10.	U	13.	U	10.	U	6.5	J
75-35-4	1,1-Dichloroethene	5.	U	5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	5.	U	5.	U	5.	U
156-60-5	trans-1,2-Dichloroethene	5.	U	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	10.	U	10.	U	10.	U	5.	U
75-34-3	1,1-Dichloroethane	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	10.	U	10.	U	10.	U	10.	U
156-59-2	cis-1,2-Dichloroethene	5.	U	5.	U	5.	U	??????????	
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	20.	U	20.	U	20.	U	??????????	
108-10-1	4-Methyl-2-Pentanone (MIBK)	10.	U	10.	U	10.	U	1.2	J
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	5.	U	5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	10.	U	10.	U	10.	U	10.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	5.	U	5.	U	5.	U	5.	U
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	5.	U
95-47-6	o-Xylene	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

SUB66-VOA		GDB-G-W004-01		GDB-G-W01D-01		GDB-G-W04D-01		GDB-H-W04D-01	
SAMPLE ID ----->		GDB-G-W004-01		GDB-G-W01D-01		GDB-G-W04D-01		GDB-H-W04D-01	
ORIGINAL ID ----->		GDBGW00401		GDBGW01D01		GDBGW04D01		GDBHW04D01	
LAB SAMPLE ID ---->		L6024-16		L6024-2		L6024-25		L6022-1	
ID FROM REPORT -->		GDBGW00401		GDBGW01D01		GDBGW04D01		GDBHW04D01	
SAMPLE DATE ----->		12/10/95		12/09/95		12/11/95		12/11/95	
DATE ANALYZED ---->		12/19/95		12/18/95		12/18/95		12/22/95	
MATRIX ----->		Water		Water		Water		Water	
UNITS ----->		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	L6024	VAL	L6024	VAL	L6024	VAL	L6022	VAL
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U
541-73-1	1,3-Dichlorobenzene	5.	U	5.	U	5.	U	5.	U
106-46-7	1,4-Dichlorobenzene	5.	U	5.	U	5.	U	5.	U
95-50-1	1,2-Dichlorobenzene	5.	U	5.	U	5.	U	5.	U
75-05-8	Acetonitrile	??????????		??????????		??????????		50.	UR
107-02-8	Acrolein	??????????		??????????		??????????		50.	U
107-13-1	Acrylonitrile	??????????		??????????		??????????		15.	U
107-05-1	3-Chloropropene	??????????		??????????		??????????		5.	U
126-99-8	Chloroprene	??????????		??????????		??????????		10.	U
106-93-4	1, 2-Dibromoethane	??????????		??????????		??????????		5.	U
74-95-3	Methylene bromide	??????????		??????????		??????????		5.	U
75-71-8	Dichlorodifluoromethane	??????????		??????????		??????????		5.	U
123-91-1	1,4-Dioxane	??????????		??????????		??????????		200.	UR
107-12-0	Propionitrile	??????????		??????????		??????????		10.	U
97-63-2	Ethyl methacrylate	??????????		??????????		??????????		5.	U
74-88-4	Methyl iodide	??????????		??????????		??????????		5.	U
78-83-1	Isobutyl alcohol	??????????		??????????		??????????		100.	U
126-98-7	Methacrylonitrile	??????????		??????????		??????????		5.	U
80-62-6	Methyl methacrylate	??????????		??????????		??????????		5.	U
630-20-6	1,1,1,2-Tetrachloroethane	??????????		??????????		??????????		5.	U
120-82-1	1,2,4-Trichlorobenzene	??????????		??????????		??????????		5.	U
96-18-4	1,2,3-Trichloropropane	??????????		??????????		??????????		5.	U
96-12-8	1,2-Dibromo-3-Chloropropane	??????????		??????????		??????????		??????????	
110-57-6	trans-1,4-Dichloro-2-butene	??????????		??????????		??????????		??????????	

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

TDS		SAMPLE ID ----->	GDB-G-W01D-01	GDB-G-W04D-01	GDB-H-W04D-01			
	ORIGINAL ID ----->	GDBGW01D01		GDBGW04D01		GDBHW04D01		
	LAB SAMPLE ID ---->	L6024-96		L6024-97		L6022-14		
	ID FROM REPORT -->	GDBGW01D01		GDBGW04D01		GDBHW04D01		
	SAMPLE DATE ----->	12/09/95		12/11/95		12/11/95		
	DATE EXTRACTED -->	12/15/95		12/15/95		12/15/95		
	DATE ANALYZED ---->	12/15/95		12/15/95		12/15/95		
	MATRIX ----->	Water		Water		Water		
	UNITS ----->	MG/L	A	MG/L	A	MG/L	A	
CAS #	Parameter	L6024	VAL	L6024	VAL	L6022	VAL	
9999900-07-2	Total Dissolved Solids (TDS)	11000.		430.		400.		

NAVBASE CHARLESTON
ZONE B RFI
ANALYTICAL RESULTS

TPH		SAMPLE ID ----->	GDB-H-W04D-01					
		ORIGINAL ID ----->	GDBHW04D01					
		LAB SAMPLE ID ---->	L6022-15					
		ID FROM REPORT -->	GDBHW04D01					
		SAMPLE DATE ----->	12/11/95					
		DATE EXTRACTED -->	12/18/95					
		DATE ANALYZED ---->	12/20/95					
		MATRIX ----->	Water					
		UNITS ----->	MG/L	A				
CAS #	Parameter	L6022	VAL					
9999900-02-6	TPH - Diesel Range Organics	1.	U					
9999900-02-5	TPH - Gasoline Range Organics	1.	U					

Appendix E
Analytical Data Validation



HEARTLAND

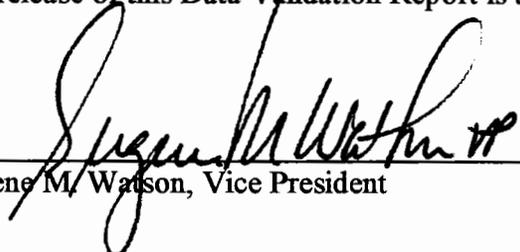
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: L5475
Date: January 26, 1996
Client Name: Ensafe, Inc.
Project/Site Name: Charleston Zone A
Date Sampled: October 4, 1995
Number of Samples: 4 Aqueous Sample(s) with 1 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level IV
Method(s) Utilized: SW846 Third Edition
Analytical Fractions: Metals

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:



Eugene M. Watson, Vice President



Date

SDG# L5475

Samples and Fractions Reviewed

Sample Identifications Analytical Fracti

ENSAFE ID	MATRIX	TAL	
<i>CNS</i> GW00101	WATER	X	
<i>CNS</i> GW00301	WATER	X	
<i>CNS</i> GW00501	WATER	X	
<i>CNS</i> GW00601	WATER	X	
Total Billable Samples (Water/Soil)			4 0

TAL= SW846 Metals

DATA ASSESSMENT NARRATIVE METALS

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5475

A validation was performed on the Metals Data from SDG L5475. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- Matrix Spike Recovery
- * ● Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- Serial Dilutions
- MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited contamination for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Iron	11.8 ug/l	no impact
Sodium	90.0 ug/l	no impact
Zinc	4.74 ug/l	CNSGW00101, 301 and 501.

The USEPA requires that all sample values below five times the preparation, field, DI or calibration blank contamination be qualified as estimated, "U". The field or DI water blanks exhibited contamination but had no impact on the data.

Matrix Spike Analysis

Specific Finding

The Matrix Spike analysis for Thallium was below the lower control limits. All positive and non-detect results for all water samples are qualified as estimated, "J" or "UJ".

Serial Dilution Analysis

Specific Finding

The Serial dilution analysis for Iron was outside the control limits. All positive results for all water samples are qualified as estimated, "J".

MSAs

Specific Finding

The post digestion spike recovery for GFAA was below the lower control limits. All positive and non-detect results for the listed samples below are qualified as estimated, "J" or "UJ".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Selenium	CNSGW00501	82
Thallium	CNSGW00501	77

Specific Finding

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B" per Ensafe's request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
CNSGW00101, 301 and 501.	Zn.	+	U
All samples	Tl.	+/U	J/UJ
All samples	Fe.	+	J
CNSGW00501.	Se and Tl.	+/U	J/UJ
All "B" results	all analytes	B	J



HEARTLAND

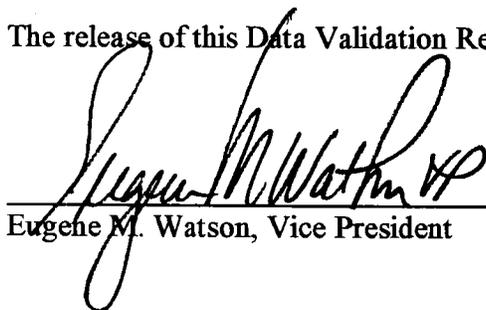
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: L5486
Date: January 26, 1996
Client Name: Ensafe, Inc.
Project/Site Name: Charleston Zone A
Date Sampled: September 29, 1995
Number of Samples: 5 Aqueous Sample(s) with 1 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level IV
Method(s) Utilized: SW846 Third Edition
Analytical Fractions: Volatiles, Semivolatiles, Pesticide/PCB's, Gasoline Range Organics, Diesel Range Organics, Metals, and Cyanide

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:



Eugene M. Watson, Vice President



Date

SDG# L5486

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

ENSAFE ID	MATRIX	VOA		SVOA		P/P		GRO		DRO		TAL		CN	
CNSGW00201	WATER	X		X		X						X		X	
CNSGW00401	WATER	X		X		X		X		X		X			
CNSTW00401	WATER	X													
CNSDW00401	WATER	X		X		X		X		X		X		X	
CNSGW00501	WATER	X													
Total Billable Samples (Water/Soil)		5	0	3	0	3	0	2	0	2	0	3	0	2	0

VOA= SW846 Volatiles

SV= SW846 Semivolatiles

P/P= SW846 Pesticide/PCB's

DRO= Diesel Range Organics

GRO= Gasoline Range Organics

TAL= SW846 Metals

CN= SW846 Cyanide

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT AND NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8260 Appendix IX; the National Functional Guidelines for Organic Data Review, June 1991, and DQO Level III. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG # L5486

A validation was performed on the Volatile Data from SDG L5486. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- * • Internal Standard Performance
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

**DATA ASSESSMENT AND NARRATIVE
VOLATILE ANALYSIS**

PAGE - 2

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, E2343, contained compounds with %Ds greater than 50% but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

CNGW00201 chloroethane
CNGW00401

The continuing calibration, E2359, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

CNSTW00401 chloroethane
CNSDW00401
CNSGW00501

The continuing calibration, E2359, contained compounds with %Ds greater than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and reject all non detects (R).

CNSTW00401 vinyl acetate
CNSDW00401
CNSGW00501

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
CNGW00201 CNGW00401	chloroethane	+/-	J/UJ
CNSTW00401 CNSDW00401 CNSGW00501	chloroethane	+/-	J/UJ
CNSTW00401 CNSDW00401 CNSGW00501	vinyl acetate	+/-	J/R

DL denotes the Form I qualifier supplied by the laboratory

QL denotes the qualifier used by the data validation firm

+ in the DL column denotes a positive result

- in the DL column denotes a non detect result

DATA ASSESSMENT AND NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8260 Appendix IX; the National Functional Guidelines for Organic Data Review, June 1991, and DQO Level III. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG # L5486

A validation was performed on the Volatile Data from SDG L5486. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- * • Internal Standard Performance
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

**DATA ASSESSMENT AND NARRATIVE
VOLATILE ANALYSIS**

PAGE - 2

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, E2343, contained compounds with %Ds greater than 50% but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

CNGW00201 chloroethane
CNGW00401

The continuing calibration, E2359, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

CNSTW00401 chloroethane
CNSDW00401
CNSGW00501

The continuing calibration, E2359, contained compounds with %Ds greater than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and reject all non detects (R).

CNSTW00401 vinyl acetate
CNSDW00401
CNSGW00501

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
CNGW00201 CNGW00401	chloroethane	+/-	J/UJ
CNSTW00401 CNSDW00401 CNSGW00501	chloroethane	+/-	J/UJ
CNSTW00401 CNSDW00401 CNSGW00501	vinyl acetate	+/-	J/R

DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8270 Appendix IX; National Functional Guidelines for Organic Data Review, and DQO Level III. All comments made within this report should be considered when examining the analytical results (Form I's).

SDG # L5486

A validation was performed on the Semivolatile Data from SDG L5486. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- * • Internal Standard Performance
- * • Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ANALYSIS

PAGE - 2

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, S0201002, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

CNSGW00201	benzyl alcohol
CNSGW00401	
CNSDW00401	

Surrogates

Surrogate recoveries for all samples and blanks did not meet QA/QC criteria. The SOW and the National Functional Guidelines allow one surrogate for each fraction to fall outside the QA/QC criteria as long as the recovery is greater than 10%.

Specific Finding:

Samples CNSGW00201 and CNSGW00201RE, exhibited low surrogate recoveries for two or more surrogates from the acid fraction. Qualify all positive results associated with the acid fraction as estimated (J) and all non detects as estimated (UJ).

Compound Identification/Quantitation

Specific Finding:

Reject all results for CNSGW00201RE, in favor of the original analysis due to non-compliant surrogate recoveries..

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D= Result value is based on the dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
CNSGW00201 CNSGW00401 CNSDW00401	benzyl alcohol	+/-	J/UJ
CNSGW00201 CNSGW00201RE	All associated analytes acid fraction	+/-	J/UJ
CNSGW00201RE	All analytes	+/-	R

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

CHLORINATED PESTICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5486

A validation was performed on the Chlorinated Pesticide Data from SDG L5486. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data did not require qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
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NO QUALIFICATIONS WERE REQUIRED

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

TPH AS GASOLINE AND DIESEL

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8015 modified for Gasoline and Diesel analysis; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5486

A validation was performed on the TPH Data from SDG L5486. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data did not require qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
------------------	-------------------	-----------	-----------

NO QUALIFICATIONS WERE REQUIRED

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE METALS

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5486W

A validation was performed on the Metals Data from SDG L5486W. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- Matrix Spike Recovery
- * ● Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- Serial Dilutions
- MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited contamination for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Iron	11.8 ug/l	CNSGW00201
Sodium	90.0 ug/l	no impact
Zinc	9.74 ug/l	CNSGW00201 and 401.

The USEPA requires that all sample values below five times the preparation, field, DI or calibration blank contamination be qualified as estimated, "U". The field or DI water blanks exhibited contamination but had no impact on the data.

Matrix Spike Analysis

Specific Finding

The Matrix Spike recovery for waters for Thallium was below the lower control limits. All positive and non-detect results are qualified as estimated, "J" or "UJ".

Serial Dilution Analysis

Specific Findings

The Serial Dilution for Iron was outside the control limits. All positive results are qualified as estimated, "J".

MSA Analysis

Specific Findings

The post digestion spike recovery for the GFAA analyses were below the lower control limits. All positive and non-detect results are qualified as estimated, "J" or "UJ".

<u>Analyte</u>	<u>Sample IDs</u>	<u>% Recovery</u>
Lead	CNSGW00201	74
Selenium	CNSGW00201	71

Specific Finding

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B" per Ensafé's request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
CNSGW00201	Fe.	+	U
CNSGW00201 and 401.	Zn.		
all samples	Tl.	+/U	J/UJ
all samples	Fe.	+	J
CNSGW00201	Pb and Se.	+/U	J/UJ
All "B" results	all analytes	B	J



HEARTLAND

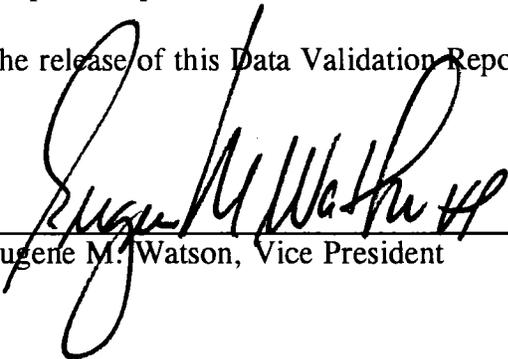
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: L5495
Date: January 23, 1996
Client Name: Ensafe
Project/Site Name: Charleston Zone A
Date Sampled: September 29, 1995
Number of Samples: 2 Aqueous Sample(s) with 2 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level IV
Method(s) Utilized: SW846 Third Edition Appendix IX
Analytical Fractions: Volatiles, Semivolatiles, Pesticides/PCB's, Gasoline Range Organics, Diesel Range Organics, Metals, Cyanide

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:



Eugene M. Watson, Vice President



Date

SDG# L5495

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

Ensafe ID	Matrix	VOA		SV		P/P		GRO		DRO		TAL		CN	
CNSFW00401	WATER	X		X		X		X		X		X		X	
LS1D474	WATER	X													
Total Billable Samples (Water/Soil)		2	0	1	0	1	0	1	0	1	0	1	0	1	0

- VOA = SW846 Volatiles
- SV = SW846 Semivolatiles
- P/P = SW846 Pesticide/PCB's
- GRO = SW846 Gasoline Range Organics
- DRO = SW846 Diesel Range Organics
- TAL = SW846 Metals
- CN = SW846 Cyanide

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT AND NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8260 Appendix IX; the National Functional Guidelines for Organic Data Review, June 1991, and DQO Level IV. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG # L5495

A validation was performed on the Volatile Data from SDG L5495. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- * • Internal Standard Performance
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 2

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, E2359, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

CNSFN00401	chloroethane acetonitrile
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The continuing calibration, E2359, contained compounds with RRFs less than 0.05. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and reject all non detects (R).

CNSFN00401	isobutanol 1,4-dioxane pentachloroethane
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System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

NJ = Presumptive evidence for the presence of the material at an estimated value

K = Result is biased high

L = Result is biased low

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
CNSFN00401	chloroethane acetonitrile	+/-	J/UJ
CNSFN00401	isobutanol 1,4-dioxane pentachloroethane	+/-	J/R

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8270 Appendix IX; National Functional Guidelines for Organic Data Review, and DQO Level IV. All comments made within this report should be considered when examining the analytical results (Form I's).

SDG # L5495

A validation was performed on the Volatile Data from SDG L5495. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- * • Internal Standard Performance
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ANALYSIS

PAGE - 2

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, S0201002/301003, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

CNSFW00401 methyl parathion

System Performance and Overall Assessment

The overall system performance was fair. The data package exhibited a contractual non compliances. The laboratory reported in the case narrative that the 120 ng std for one of the initial calibration was outside of calibration criteria, therefore, only a four point calibration was used. Method 8270 requires a minimum of a five point calibration for all compounds page 8270-11, section 5.4. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

NJ = Presumptive evidence for the presence of the material at an estimated value

K = Result is biased high

L = Result is biased low

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
CNSFW00401	methyl parathion	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLORS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5495

A validation was performed on the Pesticide/Aroclor Data from SDG L5495. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
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NO QUALIFICATIONS ARE REQUIRED.

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE

TPH AS GASOLINE AND DIESEL

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8015 modified for Gasoline and Diesel analysis; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5495

A validation was performed on the TPH Data from SDG L5495. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data did not require qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
------------------	-------------------	-----------	-----------

NO QUALIFICATIONS WERE REQUIRED.

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

Metals

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, calibration standards, blank analysis results and MS/MSD results. A minimum of ten percent of all laboratory calculations are recalculated by the reviewer. The data validation was performed by the "Laboratory Data Validation Functional Guideline for Evaluating Inorganic Analysis" February, 1994. All comments made within this report should be considered when examining the analytical results (Form Is).

This data package consisted of results from Ensafe, SDG# L5495W, the analysis of one (1) field water samples and no Matrix Spike, Matrix Spike Duplicate and Duplicate pair for TAL Metals and Cyanide. Overall, the inorganic data quality was fair. All protocol requirements were followed with the exception of the following problems.

Specific QA/QC deficiency Findings are listed numerically in the following categories:

Holding Times

The holding times were met as specified in the "Laboratory Data Validation Functional Guideline for Evaluating Inorganic Analysis", February, 1994.

Calibration

No deficiencies in this section.

Preparation and Field Blank

The preparation blank exhibited contamination but had no impact on the data.

Interferences

No significant interferences were observed.

Spike Recovery

1. The Matrix Spike recovery for Thallium was below the lower control limits. All positive and non-detect results are qualified as estimated, "J" or "UJ".

Metals Data Assessment Narrative (continued - Page 2)

Duplicate

No deficiencies in this section.

LCS

No deficiencies in this section.

Serial Dilution

2. The Serial dilution for Iron was outside the control limits. All positive results are qualified as estimated, "J".

MSA

No deficiencies in this section.

3. Ensafe requires that all data points with the "B" qualifier be changed to "J".

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE</u>	<u>DL</u>	<u>QL</u>	<u>SPECIFIC FINDING</u>
All water samples	Tl.	+/U	J/UJ	1
All water samples	Fe.	+	J	2
All water samples	all analytes	B	J	3

DL - denotes laboratory qualifier/reported value
+ denotes positive values
U denotes non-detect values

QL - denotes data validation qualifier



HEARTLAND

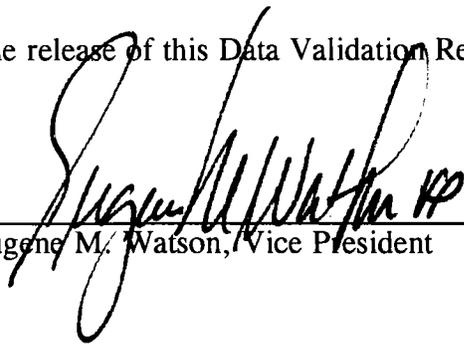
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: L5505
Date: January 23, 1996
Client Name: Ensafe
Project/Site Name: Charleston Zone A
Date Sampled: October 2, 1995
Number of Samples: 2 Aqueous Sample(s) with 2 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level IV
Method(s) Utilized: SW846 Third Edition Appendix IX
Analytical Fractions: Volatiles, Semivolatiles, Pesticides/PCB's, Gasoline Range Organics, Diesel Range Organics, Cyanide

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:



Eugene M. Watson, Vice President



Date

SDG# L5505

Samples and Fractions Reviewed

Sample Identifications		Analytical Fractions											
Ensafe ID	Matrix	VOA		SV		P/P		GRO		DRO		CN	
039EBO1102	WATER	X		X		X		X		X		X	
039DBO1102	WATER	X		X		X		X		X		X	
Total Billable Samples (Water/Soil)		2	0	2	0	2	0	2	0	2	0	2	0

- VOA= SW846 Volatiles
- SV= SW846 Semivolatiles
- P/P= SW846 Pesticide/PCB's
- GRO= SW846 Gasoline Range Organics
- DRO= SW846 Diesel Range Organics
- CN= SW846 Cyanide

DATA ASSESSMENT NARRATIVES

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DATA ASSESSMENT AND NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8260 Appendix IX; the National Functional Guidelines for Organic Data Review, June 1991, and DQO Level IV. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG # L5505

A validation was performed on the Volatile Data from SDG L5505. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- • Calibrations
- * • Internal Standard Performance
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 2

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, E2376, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

039DB01102	chloroethane
039EB01102	acetonitrile

The continuing calibration, E2376, contained compounds with RRFs less than 0.05. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and reject all non detects (R).

039DB01102	isobutanol
039EB01102	1,4-dioxane
	pentachloroethane

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

NJ = Presumptive evidence for the presence of the material at an estimated value

K = Result is biased high

L = Result is biased low

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
039DB01102	chloroethane	+/-	J/UJ
039EB01102	acetonitrile		
039DB01102	isobutanol	+/-	J/R
039EB01102	1,4-dioxane		
	pentachloroethane		

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8270 Appendix IX; National Functional Guidelines for Organic Data Review, and DQO Level IV. All comments made within this report should be considered when examining the analytical results (Form I's).

SDG # L5505

A validation was performed on the Volatile Data from SDG L5505. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- * • Internal Standard Performance
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ANALYSIS

PAGE - 2

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, S0201002/301003, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

039EB01102	methyl parathion
039DB01102	

System Performance and Overall Assessment

The overall system performance was fair. The data package exhibited a contractual non compliance. The laboratory reported in the case narrative that the 120 ng std for one of the initial calibration was outside of calibration criteria, therefore, only a four point calibration was used. Method 8270 requires a minimum of a five point calibration for all compounds page 8270-11, section 5.4. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

NJ = Presumptive evidence for the presence of the material at an estimated value

K = Result is biased high

L = Result is biased low

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
039EB01102 039DB01102	methyl parathion	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLORS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5505

A validation was performed on the Pesticide/Aroclor Data from SDG L5505. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Continuing Calibrations

Several continuing calibration standards associated with the reported samples exhibited %Ds above the QC limits.

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLOR ANALYSIS

PAGE - 2

Continuing Calibrations, Continued

Specific Findings

The continuing calibration of 10/17/95 (20:57) contained a compound with a %D greater than 50% but less than 90%. For the samples and the non-compliant compound listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

039EB01102	Isodrin
039DB01102	

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
039EB01102	Isodrin	+/-	J/UJ
039DB01102			

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE

TPH AS GASOLINE AND DIESEL

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8015 modified for Gasoline and Diesel analysis; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5505

A validation was performed on the TPH Data from SDG L5505. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data did not require qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
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NO QUALIFICATIONS WERE REQUIRED

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE
Metals

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, calibration standards, blank analysis results and MS/MSD results. A minimum of ten percent of all laboratory calculations are recalculated by the reviewer. The data validation was performed by the "Laboratory Data Validation Functional Guideline for Evaluating Inorganic Analysis" February, 1994. All comments made within this report should be considered when examining the analytical results (Form Is).

This data package consisted of results from Ensafe, SDG# L5505W, the analysis of two (2) field water samples and no Matrix Spike, Matrix Spike Duplicate and Duplicate pair for TAL Metals and Cyanide. Overall, the inorganic data quality was fair. All protocol requirements were followed with the exception of the following problems.

Specific QA/QC deficiency Findings are listed numerically in the following categories:

Holding Times

The holding times were met as specified in the "Laboratory Data Validation Functional Guideline for Evaluating Inorganic Analysis", February, 1994.

Calibration

No deficiencies in this section.

Preparation and Field Blank

The preparation blank exhibited contamination but had no impact on the data.

Interferences

No significant interferences were observed.

Spike Recovery

No deficiencies in this section.

Metals Data Assessment Narrative (continued - Page 2)

Duplicate

No deficiencies in this section.

LCS

No deficiencies in this section.

Serial Dilution

No deficiencies in this section.

MSA

No deficiencies in this section.

1. Ensafe requires that all data points with the "B" qualifier be changed to "J".

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE</u>	<u>DL</u>	<u>QL</u>	<u>SPECIFIC FINDING</u>
All water samples	all analytes	B	J	1

DL - denotes laboratory qualifier/reported value
+ denotes positive values
U denotes non-detect values

QL - denotes data validation qualifier



HEARTLAND

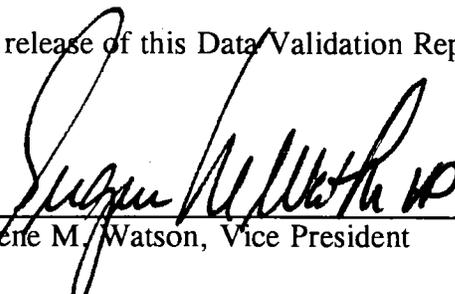
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: L5506
Date: January 23, 1996
Client Name: Ensafe
Project/Site Name: Charleston Zone A
Date Sampled: October 2, 1995
Number of Samples: 21 Non-aqueous Sample(s) with 4 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level III
Method(s) Utilized: SW846 Third Edition Appendix IX; CLP Multimedia SOW
Analytical Fractions: Volatiles, Semivolatiles, Pesticides/PCB's, Diesel Range Organics, Gasoline Range Organics, Metals

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:



Eugene M. Watson, Vice President



Date]

SDG# L5506

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

Ensafe ID	Matrix	VOA	SV	P/P	GRO	DRO	TAL		
039SB00101	SOIL	X	X	X	X	X	X		
039SB00102	SOIL	X	X	X	X	X	X		
039SB00201	SOIL	X	X	X	X	X	X		
039SB00202	SOIL	X	X	X	X	X	X		
039SB00401	SOIL	X	X	X	X	X	X		
039SB00402	SOIL	X	X	X	X	X	X		
039SB00501	SOIL	X	X	X	X	X	X		
039SB00502	SOIL	X	X	X	X	X	X		
039SB00601	SOIL	X	X	X	X	X	X		
039SB00602	SOIL	X	X	X	X	X	X		
039SB00701	SOIL	X	X	X	X	X	X		
039SB00702	SOIL	X	X	X	X	X	X		
039SB00801	SOIL	X	X	X	X	X	X		
039SB00802	SOIL	X	X	X	X	X	X		
039SB00901	SOIL	X	X	X	X	X	X		
039SB00902	SOIL	X	X	X	X	X	X		
039SB01001	SOIL	X	X	X	X	X	X		
039SB01002	SOIL	X	X	X	X	X	X		
039SB01101	SOIL	X	X	X	X	X	X		
039SB01102	SOIL	X	X	X	X	X	X		
039TB01102	SOIL	X							
Total Billable Samples (Water/Soil)		0	21	0	20	0	20	0	20

- VOA = SW846 Volatiles
- SV = SW846 Semivolatiles
- P/P = SW846 Pesticide/PCB's
- GRO = SW846 Gasoline Range Organics
- DRO = SW846 Diesel Range Organics
- TAL = CLP Metals

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT AND NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8260 Appendix IX; the National Functional Guidelines for Organic Data Review, June 1991, and DQO Level III. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG # L5506

A validation was performed on the Volatile Data from SDG L5506. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- * • Internal Standard Performance
- * • Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

**DATA ASSESSMENT AND NARRATIVE
VOLATILE ANALYSIS**

PAGE - 2

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, J3798, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

039SB00201	trichlorofluoromethane
039SB00202	vinyl acetate
039SB00101	

The continuing calibration, J3809, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

039SB00502MS	trichlorofluoromethane
039SB00102	
039SB00602	
039SB00501	
039SB00502	
039SB00502MSD	
039SB00801	

The continuing calibration, J3839, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

039SB00601	trichlorofluoromethane
039SB00401	vinyl acetate
039SB00402	
039SB00802	
039SB00702	
039SB01001	
039SB01002	
039SB00902	
039SB01101	
039SB01102	
039TB01102	

**DATA ASSESSMENT AND NARRATIVE
VOLATILE ANALYSIS**

PAGE - 3

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, J3839, contained compounds with %Ds greater than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and reject all non detects (R).

039SB00601	chloroethane
039SB00401	
039SB00402	
039SB00802	
039SB00702	
039SB01001	
039SB01002	
039SB00902	
039SB01101	
039SB01102	
039TB01102	

The continuing calibration, J3889, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

039SB00701	trichlorofluoromethane
039SB00901	vinyl acetate

The continuing calibration, J3889, contained compounds with %Ds greater than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and reject all non detects (R).

039SB00701	chloroethane
039SB00901	

**DATA ASSESSMENT AND NARRATIVE
VOLATILE ANALYSIS**

PAGE - 4

Internal Standards

All internal standard EICP areas did not meet the internal standard EICP area QA/QC criteria.

Specific Finding:

The Samples listed below, exhibited low internal standard areas. Qualify all associated positive results as estimated (J) and all non detects as estimated (UJ).

039SB00802 039SB01102	1,4-dichlorobenzene-d ₄
039SB00602	chlorobenzene-d ₅ 1,4-dichlorobenzene-d ₄

Method Blanks

<u>Associated blank</u>	<u>Compound</u>	<u>Concentration</u>
28588MB	ethylbenzene xylene (total)	1.7J ug/Kg 1.8J ug/Kg

<u>Samples</u>	<u>Compound</u>	<u>Qualification</u>
039SB00902	xylene (total)	CRQL

Field Blanks

<u>Associated blank</u>	<u>Compound</u>	<u>Concentration</u>
CNSFW00401	benzene chloroform	1.6J ug/L 4.7J ug/L

<u>Samples</u>	<u>Compound</u>	<u>Qualification</u>
039SB01101	benzene	CRQL

**DATA ASSESSMENT AND NARRATIVE
VOLATILE ANALYSIS**

PAGE - 5

Surrogates

All of the surrogate recoveries for the all blanks and samples were not within QA/QC limits.

Specific Finding:

The sample 039SB00602, exhibited low surrogate recoveries for toluene-d₈. Qualify all positive results as estimated (J) and all non detects as estimated (UJ).

The sample 039SB00802, exhibited surrogate recoveries that were less than 10%. Qualify all positive results as estimated (J) and reject all non detects (R).

Compound Identification/Quantitation

Specific Finding:

For samples 039SB00101, 039SB00602, 039SB00802 and 039SB01102, reject all E-flagged results in favor of the D-flagged results in the diluted sample. For the diluted samples 039SB00101DL, 039SB00602DL, 039SB00802DL and 039SB01102DL, reject all results (UR) except for the D-flagged results with corresponding E-flagged results.

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

NJ = Presumptive evidence for the presence of the material at an estimated value

K = Result is biased high

L = Result is biased low

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
039SB00201	trichlorofluoromethane	+/-	J/UJ
039SB00202	vinyl acetate		
039SB00101			
039SB00502MS	trichlorofluoromethane	+/-	J/UJ
039SB00102			
039SB00602			
039SB00501			
039SB00502			
039SB00502MSD			
039SB00801			
039SB00601	trichlorofluoromethane	+/-	J/UJ
039SB00401	vinyl acetate		
039SB00402			
039SB00802			
039SB00702			
039SB01001			
039SB01002			
039SB00902			
039SB01101			
039SB01102			
039TB01102			
039SB00601	chloroethane	+/-	J/R
039SB00401			
039SB00402			
039SB00802			
039SB00702			
039SB01001			
039SB01002			
039SB00902			
039SB01101			
039SB01102			
039TB01102			

* DL denotes the Form I qualifier supplied by the laboratory
 QL denotes the qualifier used by the data validation firm
 + in the DL column denotes a positive result
 - in the DL column denotes a non detect result

SUMMARY OF DATA QUALIFICATIONS

Page - 2

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
039SB00701 039SB00901	trichlorofluoromethane vinyl acetate	+/-	J/UJ
039SB00701 039SB00901	chloroethane	+/-	J/R
039SB00802 039SB01102	All associated analytes 1,4-dichlorobenzene-d ₄	+/-	J/UJ
039SB00602	chlorobenzene-d ₅ 1,4-dichlorobenzene-d ₄		
039SB00902	xylene (total)	+	CRQL
039SB01101	benzene	+	CRQL
039SB00602	All analytes	+/-	J/UJ
039SB00802	All analytes	+/-	J/R
039SB00101 039SB00602 039SB00802 039SB01102	All E-flagged results	+/-	UR
039SB00101DL 039SB00602DL 039SB00802DL 039SB01102DL	All results except D-flagged results	+/-	UR

* DL denotes the Form I qualifier supplied by the laboratory
 QL denotes the qualifier used by the data validation firm
 + in the DL column denotes a positive result
 - in the DL column denotes a non detect result

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8270 Appendix IX; National Functional Guidelines for Organic Data Review, and DQO Level III. All comments made within this report should be considered when examining the analytical results (Form I's).

SDG # L5506

A validation was performed on the Volatile Data from SDG L5506. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- * • Calibrations
- Internal Standard Performance
- * • Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

Internal Standards

All internal standard EICP areas did not meet the internal standard EICP area QA/QC criteria.

Specific Finding:

The Samples listed below, exhibited low internal standard areas. Qualify all associated positive results as estimated (J) and all non detects as estimated (UJ).

039SB00902

1,4-dichlorobenzene-d₄
naphthalene-d₈

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ANALYSIS

PAGE - 2

Surrogates

Surrogate recoveries for all samples and blanks did not meet QA/QC criteria. The SOW and the National Functional Guidelines allow one surrogate for each fraction to fall outside the QA/QC criteria as long as the recovery is greater than 10%.

Specific Finding:

Samples 039SB00902 and 039SB00902RE, exhibited low surrogate recoveries for two or more surrogates from each fraction. Qualify all positive results as estimated (J) and all non detects as estimated (UJ).

Compound Identification/Quantitation

Specific Finding:

Reject all results for 039SB00902, in favor of the re-analyzed due to non compliant internal standard areas and non compliant surrogate recoveries..

For samples 039SB00802, 039SB00501 and 039SB01102, reject all E-flagged results in favor of the D-flagged results in the diluted sample. For the diluted samples 039SB00802DL, 039SB00501DL and 039SB01102DL, reject all results (UR) except for the D-flagged results with corresponding E-flagged results.

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

NJ = Presumptive evidence for the presence of the material at an estimated value

K = Result is biased high

L = Result is biased low

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
039SB00902	All associated analytes 1,4-dichlorobenzene-d ₄ naphthalene-d ₈	+/-	J/UJ
039SB00902 039SB00902RE	All analytes	+/-	J/UJ
039SB00902	All analytes	+/-	R
039SB00802 039SB00501 039SB01102	All E-flagged results	+	R
039SB00802DL 039SB00501DL 039SB01102DL.	All results except D-flagged results	+/-	R

- * DL denotes the Form I qualifier supplied by the laboratory
 QL denotes the qualifier used by the data validation firm
 + in the DL column denotes a positive result
 - in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLORS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5506

A validation was performed on the Pesticide/Aroclor Data from SDG L5506. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- Calibration
- * • Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Continuing Calibrations

Several continuing calibration standards associated with the reported samples exhibited %Ds above the QC limits.

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLOR ANALYSIS

PAGE - 2

Continuing Calibrations, Continued

Specific Findings

The continuing calibration of 10/24/95 (3:20) contained compounds with %Ds greater than 15% but less than 50%. For the samples and the non-compliant compound listed below, the positive results are qualified as estimated, J.

039SB00401 4,4'-DDE
039SB01001

The continuing calibration of 10/24/95 (13:35) contained a compound with a %D greater than 15% but less than 50%. For the sample and the non-compliant compound listed below, the positive results are qualified as estimated, J.

039SB01101 4,4'-DDE

The continuing calibration of 10/27/95 (9:26) contained compounds with %Ds greater than 50% but less than 90%. For the samples and the non-compliant compound listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

039SB01102 Aroclor 1260

Surrogate Recoveries

Four (4) field samples exhibited non-compliant TCMX and/or DCB recoveries.

Specific Finding

The samples listed below exhibited low TCMX and/or DCB recoveries. The positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

039SB00601
039SB00501
039SB00802
039SB01102

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLOR ANALYSIS

PAGE - 3

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
039SB00401 039SB01001	4,4'-DDE	+	J
039SB01101	4,4'-DDE	+	J
039SB01102	Aroclor 1260	+/-	J/UJ
039SB00601 039SB00501 039SB00802 039SB01102	ALL	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE

TPH AS GASOLINE AND DIESEL

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8015 modified for Gasoline and Diesel analysis; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5506

A validation was performed on the TPH Data from SDG L5506. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • Calibration
- * • Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Surrogate Recoveries

One sample exhibited recovery below 10%.

Specific Finding

For the following sample, the positive results are qualified as estimated, J, and non-detect results are rejected, R, due to surrogate recovery less than 10%.

039SB00102

**DATA ASSESSMENT NARRATIVE
TPH AS GASOLINE AND DIESEL**

PAGE - 2

System Performance and Overall Assessment

Overall performance was acceptable. The recovery of the spike compound in the MS/MSD could not be calculated due to the high native level of diesel in the sample. The data reviewer estimates that less than 10% of the data required qualifications/rejections.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
039SB00102	all compounds	+/-	J/R

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE METALS

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5506

A validation was performed on the Metals Data from SDG L5506. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- * ● Matrix Spike Recovery
- Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- * ● Serial Dilutions
- MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited contamination for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Iron	3.23 mg/kg	No impact

The USEPA requires that all sample values below five times the preparation, field, DI or calibration blank contamination be qualified as estimated, "U". The field or DI water blanks exhibited contamination but had no impact on the data.

The preparation blank exhibited negative bias for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Potassium	-139.0 mg/kg	all samples
Vanadium	-0.61 mg/kg	039SB00102, 602, 802 and 1102.

The USEPA requires that the reviewer estimated the impact from negative bias. This reviewer requires that all positive and non-detect results below ten times the negative bias will be qualified as estimated, "J" or "UJ".

Duplicate Analysis

Specific Finding

The Duplicate analysis for Calcium was outside the control limits. All positive results for all water samples are qualified as estimated, "J". The RPDs for Lead and Zinc were not greater than 35% and will not be qualified.

MSAs

Specific Finding

The post digestion spike recovery for GFAA was above the upper control limits. All positive results for the listed samples below are qualified as estimated, "J".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Arsenic	039SB00101	127
Arsenic	039SB00102	120
Arsenic	039SB00201	124
Arsenic	039SB00202	125
Arsenic	039SB00401	120
Arsenic	039SB00502	122
Arsenic	039SB00602	122
Arsenic	039SB00702	124
Arsenic	039SB00801	123
Arsenic	039SB00802	117
Arsenic	039SB00902	126
Arsenic	039SB01002	124
Arsenic	039SB01102	118

Specific Finding

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B" per Ensafe's request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
all samples	K.	+/U	J/UJ
039SB00102, 602, 801 and 1102.	V.		
all samples	Ca.	+	J
039SB00101, 102, 201, 202, 401, 502, 602, 702, 801, 802, 902, 1002 and 1102.	As.	+	J
All "B" results	all analytes	B	J



HEARTLAND

ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: L5509
Date: January 16, 1996
Client Name: Ensafe
Project/Site Name: Charleston Zone A & Zone B
Date Sampled: October 13 - 28, 1995
Number of Samples: 12 Non-aqueous Sample(s) with 3 MS/MSD(s)
Laboratory: Lockheed Analytical
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level IV
Method(s) Utilized: SW846 Third Edition
Analytical Fractions: Volatiles, Semivolatiles, Pesticides/PCB's, Herbicides, Organophosphorus Pesticides, Petroleum Hydrocarbons, Hexavalent Chromium, Metals

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:


Eugene M. Watson, Vice President

1-16-96
Date

SDG# L5509

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

ENSAFE ID	MATR	VOA	SVOA	P/P	HERB	OPP	TPH	HCR	TAL								
038-C-B002-01	SOIL	X	X	X	X	X	X	X	X								
038-C-B006-01	SOIL	X	X	X	X	X	X	X	X								
038-C-B006-01MS	SOIL						X	X	X								
038-C-B006-01MSD	SOIL						X	X	X								
039-C-B003-01	SOIL	X	X	X	X	X	X	X	X								
039-C-B014-01	SOIL	X	X	X	X	X	X	X	X								
GDB-C-B001-99	SOIL	X															
GDB-C-B001-99MS	SOIL	X															
GDB-C-B001-99MSD	SOIL	X															
GDA-C-B011-01	SOIL	X	X														
GDA-C-B011-01MS	SOIL	X	X														
GDA-C-B011-01MSD	SOIL	X	X														
Total Billable Samples (Water/		0	10	0	7	0	4	0	4	0	4	0	6	0	6	0	6

- VOA = SW846 Volatiles
- SV = SW846 Semivolatiles
- P/P = SW846 Pesticide/PCB's
- HERB = SW846 Herbicides
- OPP = SW846 Organophosphorus Pesticides
- TPH = SW846 Petroleum Hydrocarbons
- HCR = SW846 Hexavalent Chromium
- TAL = SW846 Metals

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT AND NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8260 Appendix IX; the National Functional Guidelines for Organic Data Review, June 1991, and DQO Level IV. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG # L5509

A validation was performed on the Volatile Data from SDG L5509. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- Internal Standard Performance
- Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- Compound Identification /Quantitation

* - All criteria were met for this parameter

Initial Calibrations

The initial calibrations that were analyzed by the laboratory for these samples were not acceptable for all compound %RSDs. The average RRFs for all of the criteria compounds met the initial calibration criteria.

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 2

Initial calibrations (continued)

Specific Finding:

The initial calibration analyzed on, 10/13/95, contained compounds with %RSDs greater than 30%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J).

039CB00301	acetone
GDFCB00101	

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

Specific Finding:

The continuing calibration, I0571, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

039CB01401	acetonitrile
038CB00201	
038CB00601	
GDFCB00101MS	
GDFCB00101MSD	
GDFCB00101RE	

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 3

Internal Standards

All internal standard EICP areas did not meet the internal standard EICP area QA/QC criteria.

Specific Finding:

The Samples listed below, exhibited low internal standard areas. Qualify all associated positive results as estimated (J) and all non detects as estimated (UJ).

GDFCB00101 GDFCB00101RE	1,4-dichlorobenzene-d ₄
GDFCB00101MS GDFCB00101MSD	chlorobenzene-d ₅ 1,4-dichlorobenzene-d ₄

Method Blanks

<u>Associated blank</u>	<u>Compound</u>	<u>Concentration</u>
28618MB	bromomethane	2.3J ug/Kg
28651MB	2-butanone	1.1 ug/Kg
<u>Samples</u>	<u>Compound</u>	<u>Qualification</u>
039CB00301 GDFCB00101	bromomethane	CRQL
039CB01401 038CB00201	2-butanone	CRQL

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 4

Surrogates

All of the surrogate recoveries for the all blanks and samples were not within QA/QC limits.

Specific Finding:

The samples listed below, exhibited low surrogate recoveries for 1,2-dichloroethane-d₄ and bromofluorobenzene. Qualify all positive results as estimated (J) and all non detects as estimated (UJ).

039CB01401
GDBCB00101
GDBCB00101RE
GDBCB00101MS
GDBCB00101MSD

Compound Identification/Quantitation

Specific Finding:

Reject all results for the sample GDBCB00101RE, due to non compliant internal standard areas.

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

NJ = Presumptive evidence for the presence of the material at an estimated value

K = Result is biased high

L = Result is biased low

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
039CB00301 GDBCB00101	acetone	+	J
039CB01401 038CB00201 038CB00601 GDBCB00101MS GDBCB00101MSD GDBCB00101RE	acetonitrile	+/-	J/UJ
GDBCB00101 GDBCB00101RE	All associated analytes 1,4-dichlorobenzene-d ₄	+/-	J/UJ
GDBCB00101MS GDBCB00101MSD	chlorobenzene-d ₅ 1,4-dichlorobenzene-d ₄		
039CB00301 GDBCB00101	bromomethane	+	CRQL
039CB01401 038CB00201	2-butanone	+	CRQL
039CB01401 GDBCB00101 GDBCB00101RE GDBCB00101MS GDBCB00101MSD	All analytes	+/-	J/UJ
GDBCB00101RE	All analytes	+/-	R

- * DL denotes the Form I qualifier supplied by the laboratory
 QL denotes the qualifier used by the data validation firm
 + in the DL column denotes a positive result
 - in the DL column denotes a non detect result

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8270 Appendix IX; National Functional Guidelines for Organic Data Review, and DQO Level IV. All comments made within this report should be considered when examining the analytical results (Form I's).

SDG # L5509

A validation was performed on the Volatile Data from SDG L5509. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- * • Internal Standard Performance
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ANALYSIS

PAGE - 2

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, S0201002/301003, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

GDACB01101	methyl parathion
GDACB01101MS	parathion
GDACB01101MSD	
039CB01401	

The continuing calibration, S0201002/301003, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

039CB00301	1,3,5-trinitrobenzene
038CB00201	
038CB00601	

The continuing calibration, S0201002/301003, contained compounds with %Ds greater than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and reject all non detects (R).

039CB00301	methyl parathion
038CB00201	parathion
038CB00601	

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ANALYSIS

PAGE - 3

System Performance and Overall Assessment

The overall system performance was fair. The data package exhibited two contractual non compliances. The first, the laboratory reported in the case narrative that the 120 ng std for one of the initial calibration was outside of calibration criteria, therefore, only a four point calibration was used. Method 8270 requires a minimum of a five point calibration for all compounds page 8270-11, section 5.4. The second, the laboratory submitted a method blank with surrogate recoveries that were less than 5%. The laboratory re-analyzed the blank sample and obtained similar results. The method blank and all associated samples should have been re-extracted or an explanation should have been provided for the low surrogate recoveries. The surrogate problem appears to be isolated to the method blank, therefore, no qualifications are required. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

NJ = Presumptive evidence for the presence of the material at an estimated value

K = Result is biased high

L = Result is biased low

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDACB01101 GDACB01101MS GDACB01101MSD 039CB01401	methyl parathion parathion	+/-	J/UJ
039CB00301 038CB00201 038CB00601	1,3,5-trinitrobenzene	+/-	J/UJ
039CB00301 038CB00201 038CB00601	methyl parathion parathion	+/-	J/R

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLORS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5509

A validation was performed on the Pesticide/Aroclor Data from SDG L5509. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Continuing Calibrations

Several continuing calibration standards associated with the reported samples exhibited %Ds above the QC limits.

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLOR ANALYSIS

PAGE - 2

Continuing Calibrations, Continued

Specific Findings

The continuing calibration of 11/14/95 (2:41/3:24/4:07) contained compounds with %Ds greater than 50% but less than 90%. For the samples and the non-compliant compounds listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

038CB00601	Aldrin
039CB00301	Beta-BHC
	Delta-BHC
	Heptachlor Epoxide
	Gamma Chlordane
	Alpha Chlordane
	4,4'-DDE
	Endosulfan II
	Endrin Aldehyde
	Endosulfan Sulfate
	Endrin Ketone
	Kepone

The continuing calibration of 11/14/95 (2:41/3:24/4:07) contained compounds with %Ds greater than 15% but less than 50%. For the sample and the non-compliant compound listed below, the positive results are qualified as estimated, J.

038CB00601	4,4'-DDD
039CB00301	4,4'-DDT

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
038CB00601	Aldrin	+/-	J/UJ
039CB00301	Beta-BHC		
	Delta-BHC		
	Heptachlor Epoxide		
	Gamma Chlordane		
	Alpha Chlordane		
	4,4'-DDE		
	Endosulfan II		
	Endrin Aldehyde		
	Endosulfan Sulfate		
	Endrin Ketone		
	Kepone		
038CB00601	4,4'-DDD	+	J
039CB00301	4,4'-DDT		

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE

ORGANOPHOSPHORUS PESTICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8140; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5509

A validation was performed on the Herbicide Data from SDG L5509. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Initial Calibrations

Several initial calibration standards associated with the reported samples exhibited correlation coefficients below the QC limit of 0.995.

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLOR ANALYSIS

PAGE - 2

Initial Calibrations, Continued

Specific Findings

The initial calibration of 10/23/95 contained compounds with correlation coefficients less than 0.990 but greater than 0.850. For the samples and the non-compliant compounds listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

038CB00601	Thionazin
038CB00201	Phorate
039CB01401	Sulfotep
039CB00301	

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID	ANALYTE ID	DL	QL
038CB00601	Thionazin	+/-	J/UJ
038CB00201	Phorate		
039CB01401	Sulfotep		
039CB00301			

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE

CHLORINATED HERBICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8150; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5509

A validation was performed on the Herbicide Data from SDG L5509. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- * • Calibration
- * • Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Surrogate Recoveries

One (1) field sample exhibited non-compliant surrogate recovery.

Specific Finding

The sample listed below exhibited a low 2,4-dichlorophenylacetic acid recovery. The positive results are qualified as estimated, J, and all non-detect results are qualified as estimated, UJ.

039CB01401

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLOR ANALYSIS

PAGE - 2

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
039CB01401	ALL	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE

TPH AS GASOLINE AND DIESEL

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8015 modified for Gasoline and Diesel analysis; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5509

A validation was performed on the TPH Data from SDG L5509. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data did not require qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID

ANALYTE ID

DL QL

NO QUALIFICATIONS WERE REQUIRED

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE METALS

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5509S

A validation was performed on the Metals Data from SDG L5509S. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- * ● Matrix Spike Recovery
- Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- * ● Serial Dilutions
- * ● MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited contamination for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Silver	0.78 mg/kg	all soil samples

The USEPA requires that all sample values below five times the preparation, field, DI or calibration blank contamination be qualified as estimated, "U".

The preparation blank exhibited negative bias for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Potassium	-209. mg/kg	all soil samples
Vanadium	-1.97 mg/kg	038CB01401

The USEPA requires the reviewer all negative bias for impact on the samples. This reviewer requires that all positive and non-detect results be qualified as estimated, "J" or "UJ" .

Duplicate Analysis

Specific Finding

The Duplicate analysis for Copper was outside the control limits. All positive results for all soil samples are qualified as estimated, "J". The Duplicate analysis for Mercury was not greater than 2 times the CRDL and will not be qualified.

Specific Finding

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B" per Ensafe's request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
All soil samples	Ag.	+	U
All soil samples 038CB01401.	K.	+/U	J/UJ
All soil samples	V.		
All "B" results	Cu.	+	J
	all analytes	B	J



HEARTLAND

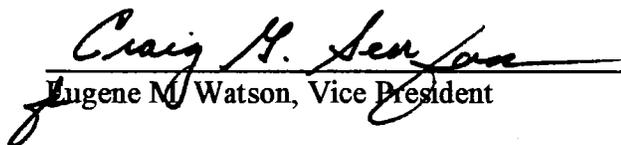
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: L5510
Date: January 16, 1996
Client Name: Ensafe
Project/Site Name: Charleston Zone B & Zone A
Date Sampled: October 3, 1995
Number of Samples: 37 Non-aqueous Sample(s) with 6 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level IV
Method(s) Utilized: SW846 Third Edition
Analytical Fractions: Volatiles, Semivolatiles, Pesticides/PCB's, Petroleum Hydrocarbons, Metals

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:


Eugene M. Watson, Vice President

1-16-96.
Date

SDG# L5510

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

ENSAFE ID	MATRIX	VOA	SVOA	P/P	TPH	TAL
038-S-B001-01	SOIL	X	X	X	X	X
038-S-B001-02	SOIL	X	X	X	X	X
038-S-B002-01	SOIL	X	X	X	X	X
038-S-B002-02	SOIL	X	X	X	X	X
038-S-B003-01	SOIL	X	X	X	X	X
038-S-B004-01	SOIL	X	X	X	X	X
038-S-B004-02	SOIL	X	X	X	X	X
038-S-B005-01	SOIL	X	X	X	X	X
038-S-B005-02	SOIL	X	X	X	X	X
038-S-B006-01	SOIL	X	X	X	X	X
038-S-B006-01MS	SOIL					X
038-S-B006-01MSD	SOIL					X
038-C-B006-01	SOIL				X	
038-C-B006-01MS	SOIL				X	
038-C-B006-01MSD	SOIL				X	
038-S-B006-02	SOIL	X	X	X	X	X
039-S-B003-01	SOIL	X	X	X	X	X
039-T-B003-01	SOIL	X				
039-S-B003-02	SOIL	X	X	X	X	X
039-S-B003-02MS	SOIL	X				
039-S-B003-02MSD	SOIL	X				
039-S-B012-01	SOIL	X	X	X	X	X
039-S-B012-01MS	SOIL		X	X	X	X
039-S-B012-01MSD	SOIL		X	X	X	X
039-S-B012-02	SOIL	X	X	X	X	X
039-S-B013-01	SOIL	X	X	X	X	X
039-S-B013-02	SOIL	X	X	X	X	X
039-S-B014-01	SOIL	X	X	X	X	X
039-S-B014-02	SOIL	X	X	X	X	X
039-S-B015-01	SOIL	X	X	X	X	X
039-S-B015-02	SOIL	X	X	X	X	X
114-S-B001-01	SOIL	X				
114-S-B001-01MS	SOIL	X				
114-S-B001-01MSD	SOIL	X				
GDB-S-B014-01	SOIL		X	X		
GDB-S-B014-01MS	SOIL		X	X		
GDB-S-B014-01MSD	SOIL		X	X		
Total Billable Samples (Water/Soil)		0 27	0 26	0 26	0 26	0 25

VOA = SW846 Volatiles
 SV = SW846 Semivolatiles
 P/P = SW846 Pesticide/PCB's
 TPH = SW846 Petroleum Hydrocarbons
 TAL = SW846 Metals

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT AND NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8260 Appendix IX; the National Functional Guidelines for Organic Data Review, June 1991, and DQO Level III. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG # L5510

A validation was performed on the Volatile Data from SDG L5510. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- Internal Standard Performance
- * • Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 2

Continuing Calibrations (continued)

Specific Finding:

The continuing calibration, J3889, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

038SB00601	trichlorofluoromethane
038SB00201	vinyl acetate
038SB00202	
039SB01401	
039SB01402	
039SB01501	
039SB01502	
039SB01301	

The continuing calibration, J3889, contained compounds with %Ds greater than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and reject all non detects (R).

038SB00601	chloroethane
038SB00201	
038SB00202	
039SB01401	
039SB01402	
039SB01501	
039SB01502	
039SB01301	

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 3

Continuing Calibrations (continued)

Specific Finding:

The continuing calibration, J3908, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

038SB00602	trichlorofluoromethane
038SB00501	vinyl acetate
038SB00502	
038SB00601RE	
039SB01302	
039SB00301	
039SB00302	
039SB01201	
039SB01202	

The continuing calibration, J3924, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

038SB00302MS	trichlorofluoromethane
038SB00302MSD	
038SB00401	
038SB00402	
038SB00101	
038SB00301	
038SB00501RE	
038SB00502RE	
039TB00301	

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 4

Internal Standards

All internal standard EICP areas did not meet the internal standard EICP area QA/QC criteria.

Specific Finding:

The Samples listed below, exhibited low internal standard areas. Qualify all associated positive results as estimated (J) and all non detects as estimated (UJ).

038SB00501	All internal standards
038SB00501RE	
038SB00601RE	1,4-difluorobenzene chlorobenzene-d ₅ 1,4-dichlorobenzene-d ₄
038SB00601	chlorobenzene-d ₅
038SB00502	1,4-dichlorobenzene-d ₄
038SB00502RE	

Surrogates

All of the surrogate recoveries for the all blanks and samples were not within QA/QC limits.

Specific Finding:

The samples listed below, exhibited low surrogate recoveries for bromofluorobenzene. Qualify all positive results as estimated (J) and all non detects as estimated (UJ).

038SB00502
038SB00502RE

The sample 038SB00501, exhibited high surrogate recoveries for 1,2-dichloroethane-d₄. Qualify all positive results as estimated (J).

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 5

Compound Identification/Quantitation

Specific Finding:

Reject all results for all re-analyzed samples, due to non compliant internal standard areas and /or non compliant surrogate recoveries.

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

NJ = Presumptive evidence for the presence of the material at an estimated value

K = Result is biased high

L = Result is biased low

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
038SB00601	trichlorofluoromethane	+/-	J/UJ
038SB00201	vinyl acetate		
038SB00202			
039SB01401			
039SB01402			
039SB01501			
039SB01502			
039SB01301			
038SB00601	chloroethane	+/-	J/R
038SB00201			
038SB00202			
039SB01401			
039SB01402			
039SB01501			
039SB01502			
039SB01301			
038SB00602	trichlorofluoromethane	+/-	J/UJ
038SB00501	vinyl acetate		
038SB00502			
038SB00601RE			
039SB01302			
039SB00301			
039SB00302			
039SB01201			
039SB01202			

- * DL denotes the Form I qualifier supplied by the laboratory
 QL denotes the qualifier used by the data validation firm
 + in the DL column denotes a positive result
 - in the DL column denotes a non detect result

SUMMARY OF DATA QUALIFICATIONS

Page - 2

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
038SB00302MS 038SB00302MSD 038SB00401 038SB00402 038SB00101 038SB00301 038SB00501RE 038SB00502RE 039TB00301	trichlorofluoromethane	+/-	J/UJ
038SB00501 038SB00501RE	All associated analytes All internal standards	+/-	J/UJ
038SB00601RE	1,4-difluorobenzene chlorobenzene-d ₅ 1,4-dichlorobenzene-d ₄		
038SB00601 038SB00502 038SB00502RE	chlorobenzene-d ₅ 1,4-dichlorobenzene-d ₄		
038SB00502 038SB00502RE	All analytes	+/-	J/UJ
038SB00501	All analytes	+	J
038SB00501RE 038SB00502RE 038SB00601RE	All analytes	+/-	R

* DL denotes the Form I qualifier supplied by the laboratory
 QL denotes the qualifier used by the data validation firm
 + in the DL column denotes a positive result
 - in the DL column denotes a non detect result

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8270 Appendix IX; National Functional Guidelines for Organic Data Review, and DQO Level III. All comments made within this report should be considered when examining the analytical results (Form I's).

SDG # L5510

A validation was performed on the Volatile Data from SDG L5510. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- * • Calibrations
- * • Internal Standard Performance
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

NJ = Presumptive evidence for the presence of the material at an estimated value

K = Result is biased high

L = Result is biased low

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
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No qualifications are required.

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLORS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5510

A validation was performed on the Pesticide/Aroclor Data from SDG L5510. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- * • Calibration
- Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- Compound Quantitation

* - All criteria were met for this parameter.

Method Blanks

The two (2) associated method blanks exhibited contamination for target compounds. The following qualifications are for both method blanks.

	BLK0551004	BLK0551005
4,4'-DDT	22 µg/Kg	6.9 µg/Kg
Methoxychlor	17 µg/Kg	

DATA ASSESSMENT NARRATIVE
PESTICIDE/AROCLOR ANALYSIS

PAGE - 2

Method Blanks, Continued

Specific Findings

<u>Samples</u>	<u>Compound</u>	<u>Qualification</u>
038SB00201	4,4'-DDT	U
038SB00401		
038SB00602		
039SB00301		
039SB01302		
039SB01401		
039SB01501		
038SB00202		

Surrogate Recoveries

Several field samples exhibited non-compliant TCMX and/or DCB recoveries.

Specific Finding

The samples listed below exhibited high TCMX and/or DCB recoveries. The positive results are qualified as estimated, J.

038SB00101
038SB00102
038SB00601DL
038SB00202

The sample listed below exhibited low TCMX and DCB recoveries. The positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

039SB01302

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLOR ANALYSIS

PAGE - 3

Analyte Identification/Quantitation

Four (4) samples required dilution to accurately quantitate target compounds. In three (3) dilution samples, 4,4'-DDT is reported above the calibration range. It is the professional opinion of the data reviewer that single component pesticides reported in the samples with high concentrations of aroclors should be considered suspect.

Specific Findings

For the following samples, the results for the E flagged compounds are replaced with the corresponding results from the dilution analysis. All other results from the dilution are rejected, UR, in favor of the results reported from the undiluted analysis.

038SB00101

038SB00102

038SB00301

038SB00601

For the following samples, the results for the E flagged compounds are qualified as estimated, J

038SB00101DL

038SB00102DL

038SB00301DL

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
038SB00201 038SB00401 038SB00602 039SB00301 039SB01302 039SB01401 039SB01501 038SB00202	4,4'-DDT	+	U
038SB00101 038SB00102 038SB00601DL 038SB00202	ALL	+	J
039SB01302	ALL	+/-	J/UJ
038SB00101 038SB00102 038SB00301 038SB00601	ALL E FLAGGED	+	D
038SB00101DL 038SB00102DL 038SB00301DL 038SB00601DL	ALL OTHERS	+/-	UR
038SB00101DL 038SB00102DL 038SB00301DL	ALL E FLAGGED	+	J

* DL denotes the Form I qualifier supplied by the laboratory
 QL denotes the qualifier used by the data validation firm
 + in the DL column denotes a positive result
 - in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE

TPH AS GASOLINE AND DIESEL

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8015 modified for Gasoline and Diesel analysis; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5510

A validation was performed on the TPH Data from SDG L5510. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- Compound Identification
- Compound Quantitation

* - All criteria were met for this parameter.

Compound Identification/Quantitation

According to the laboratory, sample 038SB00101 exhibited the possible presence of heavier hydrocarbons (as noted by the X flag on the result spreadsheet). The laboratory reported diesel quantitated using only three (3) peaks (which did meet the retention time criteria for diesel). It is the professional opinion of the reviewer that the diesel result could be inflated by the presence of heavier hydrocarbon compounds.

**DATA ASSESSMENT NARRATIVE
TPH AS GASOLINE AND DIESEL**

PAGE - 2

Compound Identification/Quantitation

Specific Finding

The positive result for diesel in the following sample is qualified as estimated, J, due to the lack of complete identification criteria and the potential for interference with heavier hydrocarbons.

038SB00101

System Performance and Overall Assessment

Overall performance was acceptable. The reviewer estimates that less than 5% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
038SB00101	diesel	+X	J

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE METALS

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5510

A validation was performed on the Metals Data from SDG L5510. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- Matrix Spike Recovery
- Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- * ● Serial Dilutions
- MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited contamination for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Aluminum	11.2 mg/kg	no impact
Calcium	7.38 mg/kg	no impact
Iron	4.44 mg/kg	no impact
Silver	0.78 mg/kg	038SB00101, 401, 502 and 601.
Chromium	1.00 mg/kg	038SB00602.

Potassium 212. mg/kg all samples but 038SB00102, 502 and 602.

The USEPA requires that all sample values below five times the preparation, field, DI or calibration blank contamination be qualified as estimated, "U". The field or DI water blanks exhibited contamination but had no impact on the data.

The preparation blank exhibited negative bias for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Vanadium	-19.7 mg/kg	038SB00602, 039SB00302, 1202, 1302, 1401, 1402, 1501 and 1502.

The USEPA requires that the reviewer estimated the impact from negative bias. This reviewer requires that all positive and non-detect results below ten times the negative bias will be qualified as estimated, "J" or "UJ".

Matrix Spike Analysis

Specific Finding

The Matrix Spike analysis for Antimony was below the lower control limits. All positive and non-detect results for all soil samples are qualified as estimated, "J" or "UJ".

Duplicate Analysis

Specific Finding

The Duplicate analysis for Copper was outside the control limits. All positive results for all soil samples are qualified as estimated, "J".

MSAs

Specific Finding

The post digestion spike recovery for GFAA was below the lower control limits. All positive and non-detect results for the listed samples below are qualified as estimated, "J" or "UJ".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Selenium	038SB00201	71
Selenium	038SB00202	76
Selenium	039SB00301	74
Selenium	039SB01201	70
Selenium	039SB01301	71
Selenium	039SB01402	79

Specific Finding

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B" per Ensafes's request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
038SB00101, 401, 501 and 601. 038SB00602.	Ag. Cr. K.	+	U
all samples but 038SB00102, 502 and 602.			
038SB00602, 039SB00302, 1202, 1302, 1401, 1402, 1501 and 1502.	V.	+/U	J/UJ
All samples	Sb.	+/U	J/UJ
All samples	Cu.	+	J
038SB00201, 202, 039SB00301, 1201, 1301 and 1402.	Se.	+/U	J/UJ
All "B" results	all analytes	B	J



HEARTLAND

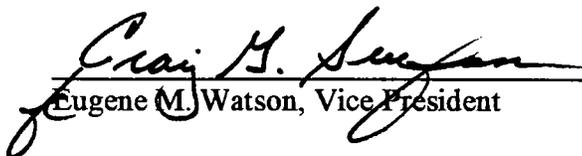
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: L5530
Date: January 15, 1996
Client Name: Ensafe
Project/Site Name: Charleston Zone A & ZONE B
Date Sampled: October 4 - 14, 1995
Number of Samples: 14 Non-aqueous Sample(s) with 5 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level IV
Method(s) Utilized: SW846 Third Edition
Analytical Fractions: Volatiles, Semivolatiles, Pesticides/Aroclors, Organophosphorus Pesticides, Herbicides, Hexavalent Chromium, Metals, Cyanide

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:


Eugene M. Watson, Vice President

1-16-96
Date

SDG# L5530

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

ENSAFE ID	MATRIX	VOA	SVOA	P/A	OPP	HERB	HCR	TAL	CN								
507-C-B004-01	SOIL	X	X	X	X	X	X	X	X								
507-C-B004-01MS	SOIL			X													
507-C-B004-01MSD	SOIL			X													
GDB-C-B001-01	SOIL	X	X	X	X	X	X	X									
GDB-C-B001-01MS	SOIL	X															
GDB-C-B001-01MSD	SOIL	X															
GDB-C-B008-01	SOIL	X	X	X	X	X	X	X	X								
GDB-C-B008-01MS	SOIL						X										
GDB-C-B008-01MSD	SOIL						X										
GDA-C-B011-01	SOIL		X														
GDA-C-B011-01MS	SOIL		X														
GDA-C-B011-01MSD	SOIL		X														
038-C-B006-01MS	SOIL							X									
038-C-B006-01MSD	SOIL							X									
Total Billable Samples (Water/Soil)		0	5	0	6	0	5	0	3	0	3	0	5	0	5	0	2

- VOA = SW846 Volatiles
- SV = SW846 Semivolatiles
- P/A = SW846 Pesticide/Aroclors
- OPP = SW846 Organophosphorus Pesticides
- HERB = SW846 Herbicides
- HCR = SW846 Hexavalent Chromium
- TAL = SW846 Metals
- CN = SW846 Cyanide

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT AND NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8260 Appendix IX; the National Functional Guidelines for Organic Data Review, June 1991, and DQO Level IV. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG # L5530

A validation was performed on the Volatile Data from SDG L5530. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- Internal Standard Performance
- Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- Compound Identification /Quantitation

* - All criteria were met for this parameter

Initial Calibrations

The initial calibrations that were analyzed by the laboratory for these samples were not acceptable for all compound %RSDs. The average RRFs for all of the criteria compounds met the initial calibration criteria.

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 2

Initial calibrations (continued)

Specific Finding:

The initial calibration analyzed on, 10/13/95, contained compounds with %RSDs greater than 30%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J).

GDFCB00801 acetone

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

Specific Finding:

The continuing calibration, I0571, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

507CB00401 acetonitrile
GDFCB00801RE

Internal Standards

All internal standard EICP areas did not meet the internal standard EICP area QA/QC criteria.

Specific Finding:

The Samples listed below, exhibited low internal standard areas. Qualify all associated positive results as estimated (J) and all non detects as estimated (UJ).

GDFCB00801 1,4-dichlorobenzene-d₄
GDFCB00801RE

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE -3

Method Blanks

<u>Associated blank</u>	<u>Compound</u>	<u>Concentration</u>
28618MB	bromomethane	2.3J ug/Kg

<u>Samples</u>	<u>Compound</u>	<u>Qualification</u>
GDBCB00801	bromomethane	CRQL

Surrogates

All of the surrogate recoveries for the all blanks and samples were not within QA/QC limits.

Specific Finding:

The samples listed below, exhibited low surrogate recoveries for 1,2-dichloroethane-d₄ and bromofluorobenzene. Qualify all positive results as estimated (J) and all non detects as estimated (UJ).

GDBCB00801
GDBCB00801RE

Compound Identification/Quantitation

Specific Finding:

Reject all results for the sample GDBCB00801RE, due to non compliant internal standard areas.

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5 % of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

NJ = Presumptive evidence for the presence of the material at an estimated value

K = Result is biased high

L = Result is biased low

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDFCB00801	acetone	+	J
507CB00401 GDFCB00801RE	acetonitrile	+/-	J/UJ
GDFCB00801 GDFCB00801RE	All associated analytes 1,4-dichlorobenzene-d ₄	+/-	J/UJ
GDFCB00801	bromomethane	+	CRQL
GDFCB00801 GDFCB00801RE	All analytes	+/-	J/UJ
GDFCB00801RE	All analytes	+/-	R

- * DL denotes the Form I qualifier supplied by the laboratory
 QL denotes the qualifier used by the data validation firm
 + in the DL column denotes a positive result
 - in the DL column denotes a non detect result

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8270 Appendix IX; National Functional Guidelines for Organic Data Review, and DQO Level IV. All comments made within this report should be considered when examining the analytical results (Form I's).

SDG # L5530

A validation was performed on the Volatile Data from SDG L5530. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- * • Internal Standard Performance
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ANALYSIS

PAGE - 2

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, S0201002/301003, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

507CB00401	1,3,5-trinitrobenzene
GDBC00801	

The continuing calibration, S0201002/301003, contained compounds with %Ds greater than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and reject all non detects (R).

507CB00401	methyl parathion
GDBC00801	parathion

System Performance and Overall Assessment

The overall system performance was fair. The data package exhibited two contractual non compliances. The first, the laboratory reported in the case narrative that the 120 ng std for one of the initial calibration was outside of calibration criteria, therefore, only a four point calibration was used. Method 8270 requires a minimum of a five point calibration for all compounds page 8270-11, section 5.4. The second, the laboratory submitted a method blank with surrogate recoveries that were less than 5%. The laboratory re-analyzed the blank sample and obtained similar results. The method blank and all associated samples should have been re-extracted or an explanation should have been provided for the low surrogate recoveries. The surrogate problem appears to be isolated to the method blank, therefore, no qualifications are required. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

NJ = Presumptive evidence for the presence of the material at an estimated value

K = Result is biased high

L = Result is biased low

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
507CB00401 GDBCB00801	1,3,5-trinitrobenzene	+/-	J/UJ
507CB00401 GDBCB00801	methyl parathion parathion	+/-	J/R

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLORS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5530

A validation was performed on the Pesticide/Aroclor Data from SDG L5530. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Continuing Calibrations

Several continuing calibration standards associated with the reported samples exhibited %Ds above the QC limits.

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLOR ANALYSIS

PAGE - 2

Continuing Calibrations, Continued

Specific Findings

The continuing calibration of 11/14/95 (2:41/3:24/4:07) contained compounds with %Ds greater than 50% but less than 90%. For the samples and the non-compliant compounds listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

GDFCB00101	Aldrin
GDFCB00801	Beta-BHC
	Delta-BHC
	Heptachlor Epoxide
	Gamma Chlordane
	Alpha Chlordane
	4,4'-DDE
	Endosulfan II
	Endrin Aldehyde
	Endosulfan Sulfate
	Kepone

The continuing calibration of 11/14/95 (2:41/3:24/4:07) contained compounds with %Ds greater than 15% but less than 50%. For the sample and the non-compliant compound listed below, the positive results are qualified as estimated, J.

GDFCB00801	4,4'-DDD
	4,4'-DDT

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDFCB00101	Aldrin	+/-	J/UJ
GDFCB00801	Beta-BHC		
	Delta-BHC		
	Heptachlor Epoxide		
	Gamma Chlordane		
	Alpha Chlordane		
	4,4'-DDE		
	Endosulfan II		
	Endrin Aldehyde		
	Endosulfan Sulfate		
	Kepone		
GDFCB00801	4,4'-DDD	+	J
	4,4'-DDT		

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE

CHLORINATED HERBICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8150; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5530

A validation was performed on the Herbicide Data from SDG L5530. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- * • Calibration
- * • Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Surrogate Recoveries

One (1) field sample exhibited non-compliant surrogate recovery.

Specific Finding

The sample listed below exhibited a low 2,4-dichlorophenylacetic acid recovery. The positive results are qualified as estimated, J, and all non-detect results are qualified as estimated, UJ.

GDFCB00101

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLOR ANALYSIS

PAGE - 2

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDFCB00101	ALL	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE

ORGANOPHOSPHORUS PESTICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8140; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5530

A validation was performed on the Herbicide Data from SDG L5530. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Initial Calibrations

Several initial calibration standards associated with the reported samples exhibited correlation coefficients below the QC limit of 0.995.

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLOR ANALYSIS

PAGE - 2

Initial Calibrations, Continued

Specific Findings

The initial calibration of 10/23/95 contained compounds with correlation coefficients less than 0.990 but greater than 0.850. For the samples and the non-compliant compounds listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

GDFCB00801	Thionazin
507CB00401	Phorate
GDFCB00101	Sulfotep

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDFCB00801	Thionazin	+/-	J/UJ
507CB00401	Phorate		
GDFCB00101	Sulfotep		

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE METALS

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5530S

A validation was performed on the Metals Data from SDG L5530S. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- * ● Matrix Spike Recovery
- Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- * ● Serial Dilutions
- * ● MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited contamination for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Silver	0.78 mg/kg	all soil samples

The USEPA requires that all sample values below five times the preparation, field, DI or calibration blank contamination be qualified as estimated, "U".

The preparation blank exhibited negative bias for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Potassium	-209. mg/kg	507CB00401
Vanadium	-1.97 mg/kg	507CB00401 and GDBCB00801

The USEPA requires the reviewer all negative bias for impact on the samples. This reviewer requires that all positive and non-detect results be qualified as estimated, "J" or "UJ" .

Duplicate Analysis

Specific Finding

The Duplicate analysis for Copper was outside the control limits. All positive results for all soil samples are qualified as estimated, "J". The Duplicate analysis for Mercury was not greater than 2 times the CRDL and will not be qualified.

Specific Finding

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B" per Ensafe's request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
All soil samples	Ag.	+	U
507CB00401.	K.	+/U	J/UJ
507CB00401 and GDBCB00801.	V.		
All soil samples	Cu.	+	J
All "B" results	all analytes	B	J



HEARTLAND

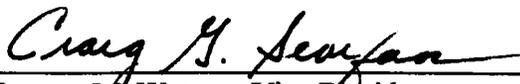
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: L5540
Date: January 15, 1996
Client Name: Ensafe
Project/Site Name: Charleston Zone B & Zone A
Date Sampled: October 4, 1995
Number of Samples: 49 Non-aqueous Sample(s) with 5 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level III and IV
Method(s) Utilized: SW846
Analytical Fractions: Volatiles, Semivolatiles, Pesticides/PCB's, Metals, Cyanide

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:


Eugene M. Watson, Vice President

1-16-96
Date

SDG# L5540

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

ENSAFE ID	MATRIX	VOA	SVOA	P/P	TAL	CN
507-S-B001-01	SOIL	X	X		X	
507-S-B001-02	SOIL	X	X		X	
507-S-B002-01	SOIL	X	X		X	
507-S-B002-02	SOIL	X	X		X	
507-S-B003-01	SOIL	X	X		X	
507-S-B003-02	SOIL	X	X		X	
507-S-B004-01	SOIL	X	X		X	
507-S-B004-02	SOIL	X	X		X	
507-S-B005-01	SOIL	X	X		X	
507-S-B005-01MS	SOIL	X	X		X	
507-S-B005-01MSD	SOIL	X	X		X	
507-S-B005-02	SOIL	X	X		X	
GDA-S-B003-01	SOIL	X				
GDA-S-B003-01MS	SOIL	X				
GDA-S-B003-01MSD	SOIL	X				
GDB-S-B001-01	SOIL	X	X	X	X	X
GDB-C-B001-01	SOIL	X				
GDB-C-B001-01MS	SOIL	X				
GDB-C-B001-01MSD	SOIL	X				
GDB-S-B001-02	SOIL	X	X	X	X	X
GDB-S-B002-01	SOIL	X	X	X	X	X
GDB-S-B002-02	SOIL	X	X	X	X	X
GDB-S-B003-01	SOIL	X	X	X	X	X
GDB-S-B004-01	SOIL	X	X	X	X	X
GDB-S-B004-01MS	SOIL			X		X
GDB-S-B004-01MSD	SOIL			X		X
GDB-S-B004-02	SOIL	X	X	X	X	X
GDB-S-B005-01	SOIL	X	X	X	X	X
GDB-S-B005-02	SOIL	X	X	X	X	X
GDB-S-B006-01	SOIL	X	X	X	X	X
GDB-S-B006-02	SOIL	X	X	X	X	X
GDB-S-B007-01	SOIL	X	X	X	X	X
GDB-S-B007-02	SOIL	X	X	X	X	X
GDB-S-B008-01	SOIL	X	X	X	X	X
GDB-S-B008-02	SOIL	X	X	X	X	X
GDB-S-B009-01	SOIL	X	X	X	X	X
GDB-S-B009-02	SOIL	X	X	X	X	X
GDB-S-B010-01	SOIL	X	X	X	X	X
GDB-S-B010-02	SOIL	X	X	X	X	X
GDB-S-B011-01	SOIL	X	X	X	X	X
GDB-S-B011-02	SOIL	X	X	X	X	X
GDB-S-B012-01	SOIL	X	X	X	X	X
GDB-S-B012-02	SOIL	X	X	X	X	X
GDB-S-B013-01	SOIL	X	X	X	X	X
GDB-S-B013-02	SOIL	X	X	X	X	X
GDB-S-B014-01	SOIL	X	X	X	X	X
GDB-S-B014-01MS	SOIL	X	X	X	X	X
GDB-S-B014-01MSD	SOIL	X	X	X	X	X
GDB-S-B014-02	SOIL	X	X	X	X	X
GDB-S-B015-01	SOIL	X	X	X	X	X
GDB-S-B015-02	SOIL	X	X	X	X	X
Total Billable Samples (Water/Soil)		0 49	0 43	0 33	0 43	0 33

VOA= SW846 Volatiles
SV= SW846 Semivolatiles
P/P= SW846 Pesticide/PCB's
TAL= SW846 Metals
CN= SW846 Cyanide

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT AND NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8260; the National Functional Guidelines for Organic Data Review, June 1991, and DQO Level III. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG # L5540

A validation was performed on the Volatile Data from SDG L5540. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- Internal Standard Performance
- Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 2

Continuing Calibrations (continued)

Specific Finding:

The continuing calibration, I0603, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

GDBSB00102	chloroethane
GDBSB00601	
GDBSB00602	
GDBSB00501	

The continuing calibration, J3924, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

507TB00401	trichlorofluoromethane
------------	------------------------

The continuing calibration, J3942, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

GDBSB00301	trichlorofluoromethane
GDBSB01401	
GDBSB01201	
GDBSB01202	
GDBSB01101	
GDBSB01102	
GDBSB00801	
GDBSB00802	
GDBSB00701	
GDBSB00702	
GDBSB00901	
GDBSB00902	

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 3

Continuing Calibrations (continued)

Specific Finding:

The continuing calibration, J3942, contained compounds with %Ds greater than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and reject all non detects (R).

GDBSB00301	chloroethane
GDBSB01401	
GDBSB01201	
GDBSB01202	
GDBSB01101	
GDBSB01102	
GDBSB00801	
GDBSB00802	
GDBSB00701	
GDBSB00702	
GDBSB00901	
GDBSB00902	

The continuing calibration, J3978, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

GDBSB01301	trichlorofluoromethane
GDASB00301	
GDASB00301MS	
GDASB00301MSD	

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 4

Internal Standards

All internal standard EICP areas did not meet the internal standard EICP area QA/QC criteria.

Specific Finding:

The Samples listed below, exhibited low internal standard areas. Qualify all associated positive results as estimated (J) and all non detects as estimated (UJ).

507SB00501MS	1,4-dichlorobenzene-d ₄
507SB00401	
GDBSB01501	
507SB00501MSDRE	
GDBSB00102	
GDBSB00601	
GDBSB00102RE	
GDBSB00601RE	
GDBSB00901	
GDBSB01401MSD	

GDBSB00201RE	chlorobenzene-d ₅
GDBSB01101	1,4-dichlorobenzene-d ₄
GDBSB00901RE	

GDBSB00201	All internal standards
GDBSB00202	
GDBSB00101	
507SB00401RE	
GDBSB01501RE	
GDBSB00202RE	
GDBSB00101RE	
GDBSB00502	
GDBSB01001	
GDBSB01002	
GDBSB01101RE	

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 5

Method Blanks

<u>Associated blank</u>	<u>Compound</u>	<u>Concentration</u>
28769MB	ethylbenzene	1.4J ug/Kg
	xylene (total)	1.3J ug/Kg

<u>Samples</u>	<u>Compound</u>	<u>Qualification</u>
GDBSB00901	ethylbenzene	CRQL
	xylene (total)	CRQL

Surrogates

All of the surrogate recoveries for the all blanks and samples were not within QA/QC limits.

Specific Finding:

The samples listed below, exhibited low surrogate recoveries for 1,2-dichloroethane-d₄ and/or bromofluorobenzene. Qualify all positive results as estimated (J) and all non detects as estimated (UJ).

GDBSB01501RE
GDBSB00201
GDBSB00201RE
GDBSB00202
GDBSB00101
GDBSB00101RE
GDBSB00201
GDBSB01002

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 6

Compound Identification/Quantitation

Specific Finding:

Reject all results for the samples listed below, due to non compliant internal standard areas and/or non compliant surrogate recoveries.

507SB00401RE
507SB00501MSRE
507SB00501MSDRE
GDBSB00201
GDBSB00202RE
GDBSB00101RE
GDBSB01501RE
GDBSB00102RE
GDBSB00601RE
GDBSB01101RE
GDBSB00901RE

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

NJ = Presumptive evidence for the presence of the material at an estimated value

K = Result is biased high

L = Result is biased low

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDBSB00102 GDBSB00601 GDBSB00602 GDBSB00501	chloroethane	+/-	J/UJ
507TB00401	trichlorofluoromethane	+/-	J/UJ
GDBSB00301 GDBSB01401 GDBSB01201 GDBSB01202 GDBSB01101 GDBSB01102 GDBSB00801 GDBSB00802 GDBSB00701 GDBSB00702 GDBSB00901 GDBSB00902	trichlorofluoromethane	+/-	J/UJ
GDBSB00301 GDBSB01401 GDBSB01201 GDBSB01202 GDBSB01101 GDBSB01102 GDBSB00801 GDBSB00802 GDBSB00701 GDBSB00702 GDBSB00901 GDBSB00902	chloroethane	+/-	J/R

- * DL denotes the Form I qualifier supplied by the laboratory
 QL denotes the qualifier used by the data validation firm
 + in the DL column denotes a positive result
 - in the DL column denotes a non detect result

SUMMARY OF DATA QUALIFICATIONS

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<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDBSB01301 GDASB00301 GDASB00301MS GDASB00301MSD	trichlorofluoromethane	+/-	J/UJ
507SB00501MS 507SB00401 GDBSB01501 507SB00501MSDRE GDBSB00102 GDBSB00601 GDBSB00102RE GDBSB00601RE GDBSB00901 GDBSB01401MSD	All associated analytes 1,4-dichlorobenzene-d ₄	+/-	J/UJ
GDBSB00201RE GDBSB01101 GDBSB00901RE	chlorobenzene-d ₅ 1,4-dichlorobenzene-d ₄		
GDBSB00201 GDBSB00202 GDBSB00101 507SB00401RE GDBSB01501RE GDBSB00202RE GDBSB00101RE GDBSB00502 GDBSB01001 GDBSB01002 GDBSB01101RE	All internal standards		

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 QL denotes the qualifier used by the data validation firm
 + in the DL column denotes a positive result
 - in the DL column denotes a non detect result

SUMMARY OF DATA QUALIFICATIONS

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<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDBSB00901	ethylbenzene	+	CRQL
	xylene (total)	+	CRQL
GDBSB01501RE GDBSB00201 GDBSB00201RE GDBSB00202 GDBSB00101 GDBSB00101RE GDBSB00201 GDBSB01002	All analytes	+/-	J/UJ
507SB00401RE 507SB00501MSRE 507SB00501MSDRE GDBSB00201 GDBSB00202RE GDBSB00101RE GDBSB01501RE GDBSB00102RE GDBSB00601RE GDBSB01101RE GDBSB00901RE	All analytes	+/-	R

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8270; National Functional Guidelines for Organic Data Review, and DQO Level IV. All comments made within this report should be considered when examining the analytical results (Form I's).

SDG # L5540

A validation was performed on the Volatile Data from SDG L5540. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- * • Internal Standard Performance
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ANALYSIS

PAGE - 2

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, S0201002, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

28556MB	benzoic acid
GDBSB00301	
GDBSB01401	
GDBSB01401MS	
GDBSB01401MSD	
GDBSB01301	
GDBSB01302	
GDBSB01102	
GDBSB00801	
GDBSB00701	
GDBSB00901	
GDBSB01502	
GDBSB00402	
GDBSB00502	
GDBSB00602	
507SB00101	
507SB00201	
507SB00301	
507SB00501	
507SB00501MS	
507SB00501MSD	
507SB00502	

The continuing calibration, S0201002, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

GDBSB01501	2,2'-oxybis(1-chloropropane)
GDBSB01001	

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ANALYSIS

PAGE - 3

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

NJ = Presumptive evidence for the presence of the material at an estimated value

K = Result is biased high

L = Result is biased low

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
28556MB GDBSB00301 GDBSB01401 GDBSB01401MS GDBSB01401MSD GDBSB01301 GDBSB01302 GDBSB01102 GDBSB00801 GDBSB00701 GDBSB00901 GDBSB01502 GDBSB00402 GDBSB00502 GDBSB00602 507SB00101 507SB00201 507SB00301 507SB00501 507SB00501MS 507SB00501MSD 507SB00502	benzoic acid	+/-	J/UJ
GDBSB01501 GDBSB01001	2,2'-oxybis- (1-chloropropane)	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
 QL denotes the qualifier used by the data validation firm
 + in the DL column denotes a positive result
 - in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLORS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5540

A validation was performed on the Pesticide/Aroclor Data from SDG L5540. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- * • Calibration
- Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- Compound Quantitation

* - All criteria were met for this parameter.

Method Blanks

The two (2) associated method blanks exhibit contamination for the target compound 4,4'-DDT.

	28535MB
4,4'-DDT	3.7 µg/Kg

DATA ASSESSMENT NARRATIVE
PESTICIDE/AROCLOR ANALYSIS

PAGE - 2

Method Blanks, Continued

Specific Findings

<u>Samples</u>	<u>Compound</u>	<u>Qualification</u>
GDSB00201 GDSB01101 GDSB01201 GDSB01501	4,4'-DDT	U
GDSB00301 GDSB00402 GDSB00702 GDSB00802 GDSB01202 GDSB01402	4,4'-DDT	CRQL

	28536MB
4,4'-DDT	6.9 µg/Kg

<u>Samples</u>	<u>Compound</u>	<u>Qualification</u>
GDSB00101 GDSB00401 GDSB00502	4,4'-DDT	U

Surrogate Recoveries

One (1) field sample exhibited non-compliant TCMX recovery.

Specific Finding

The sample listed below exhibited a high TCMX recovery. The positive results are qualified as estimated, J.

GDBSB01301

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLOR ANALYSIS

PAGE - 3

Analyte Identification/Quantitation

Three (3) samples required dilution to accurately quantitate target compounds.

Specific Findings

For the following samples, the results for the E flagged compounds are replaced with the corresponding results from the dilution analysis. All other results from the dilution are rejected, UR, in favor of the results reported from the undiluted analysis.

GDBSB00501

GDBSB01001

GDBSB01301

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDSB00201 GDSB01101 GDSB01201 GDSB01501	4,4'-DDT	+	U
GDSB00301 GDSB00402 GDSB00702 GDSB00802 GDSB01202 GDSB01402	4,4'-DDT	+	CRQL
GDSB00101 GDSB00401 GDSB00502	4,4'-DDT	+	U
GDBSB01301	ALL	+	J
GDBSB00501 GDBSB01001 GDBSB01301	ALL E FLAGGED	+	D
GDBSB00501DL GDBSB01001DL GDBSB01301DL	ALL OTHERS	+/-	UR

- * DL denotes the Form I qualifier supplied by the laboratory
 QL denotes the qualifier used by the data validation firm
 + in the DL column denotes a positive result
 - in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE METALS

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5540S

A validation was performed on the Metals Data from SDG L5540S. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- * ● Matrix Spike Recovery
- Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- * ● Serial Dilutions
- MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited negative bias for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Potassium	-132. mg/kg	all samples
Vanadium	-1.91 mg/kg	all samples

The USEPA requires the reviewer all negative bias for impact on the samples. This reviewer requires that all positive and non-detect results be qualified as estimated, "J" or "UJ" .

Duplicate Analysis

Specific Finding

The Duplicate analysis for Lead was outside the control limits. All positive results for all soil samples are qualified as estimated, "J".

MSAs

The following sample results are qualified as estimated, "J" due to high recovery during post digestion spiking at GFAA.

<u>Elements</u>	<u>sample ID.</u>	<u>% recovery</u>
Arsenic	507SB00102	118
Arsenic	507SB00101	116
Arsenic	GDBSB01402	117
Arsenic	GDBSB00801	115
Arsenic	GDBSB00802	117

Specific Finding

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B" per Ensafe's request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
all soil samples	K and V.	+/U	J/UJ
all soil samples	Pb.	+	J
507SB00102, 101, GDBSB01402, 00801 and 00802.	As.	+	J
All "B" results	all analytes	B	J



HEARTLAND

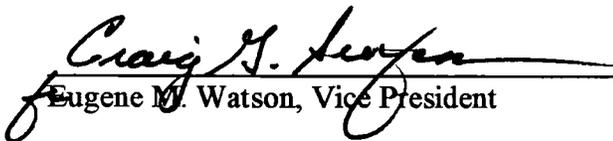
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: 5542
Date: January 18, 1996
Client Name: Ensafe/Allen & Hoshall
Project/Site Name: Charleston Zone A
Date Sampled: October 5, 1995
Number of Samples: 1 Non-aqueous Sample(s) with 1 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level III
Method(s) Utilized: SW846 Third Edition
Analytical Fractions: Volatiles, Semivolatiles, Pesticides/PCB's, Organophosphorus Pesticides, Herbicides, Hexavalent Chromium, Metals, Cyanide

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:


Eugene M. Watson, Vice President

1-19-96
Date

SDG# 5542

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

ENSAFE ID	MATRIX	VOA		SVOA		P/P		OPP		HERB		HCR		TAL		CN	
GDA-C-B003-02	SOIL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Total Billable Samples (Water/Soil)		0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1

- VOA = SW846 Volatiles
- SV = SW846 Semivolatiles
- P/P = SW846 Pesticide/PCB's
- OPP = SW846 Organophosphorus Pesticides
- HERB = SW846 Herbicides
- HCR = SW846 Hexavalent Chromium
- TAL = SW846 Metals
- CN = SW846 Cyanide

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8240; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5542

A validation was performed on the Volatile Data from SDG L5542. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibration
- Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Internal Standard Performance
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Continuing Calibrations

The continuing calibration analyzed exhibited non-compliant %Ds for compounds which required qualification of the data.

**DATA ASSESSMENT NARRATIVE
VOLATILE ANALYSIS**

PAGE - 2

Continuing Calibrations, continued

Specific Findings

The continuing calibration, I0571.D, contained compounds with %Ds greater than 25% but less than 50%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J.

GDACB00302 2-butanone

The continuing calibration, I0571.D, contained compounds with %Ds greater than 50% but less than 90%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J. and the non-detect results are qualified as estimated, UJ.

GDACB00302 acetonitrile

The continuing calibration, I0571.D, contained compounds with average RRFs less than 0.05. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J, and the non-detect results are rejected, R.

GDACB00302 1,4-dioxane
Isobutanol

Method Blanks

The method blank exhibited contamination for 2-butanone. One (1) sample required qualification.

	28651MB
2-butanone	1.1 µg/Kg

Specific Finding

<u>Samples</u>	<u>Compound</u>	<u>Qualification</u>
GDACB00302	2-butanone	CRQL

**DATA ASSESSMENT NARRATIVE
VOLATILE ANALYSIS**

PAGE - 3

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of data required qualifications/rejections.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDACB00302	2-butanone	+	J
GDACB00302	acetonitrile	+/-	J/UJ
GDACB00302	1,4-dioxane Isobutanol	+/-	J/R
GDACB00302	2-butanone	+B	CRQL

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8270; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5542

A validation was performed on the Semivolatile Data from SDG L5542. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibration
- Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Internal Standard Performance
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Continuing Calibrations

One (1) of the two (2) continuing calibrations standards analyzed exhibited non-compliant %Ds for two (2) compounds which required qualification of the data.

**DATA ASSESSMENT NARRATIVE
SEMIVOLATILE ANALYSIS**

PAGE - 2

Continuing Calibrations, continued

Specific Findings

The continuing calibration standard, S0301003.D and S0201002.D contained compounds with %Ds greater than 50% but less than 90%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

GDACB00302

methyl parathion
parathion

Method Blanks

The surrogate recoveries in the method blank and method blank RE were less than 10% for three (3) of the eight (8) compounds. However, all field samples exhibited acceptable recoveries. TICs were detected in the method blank. All B flagged TICs are rejected.

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 5% of data required qualifications

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDACB00302	methyl parathion parathion	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLORS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5542

A validation was performed on the Pesticide/Aroclor Data from SDG L5542. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
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NO QUALIFICATIONS ARE REQUIRED.

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE

ORGANOPHOSPHOROUS PESTICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8140; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5542

A validation was performed on the Organophosphorous Pesticide Data from SDG L5542. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- Calibration
- * • Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Initial Calibrations

The initial calibrations that were analyzed by the laboratory for these samples were not acceptable for all compound correlation coefficients.

**DATA ASSESSMENT NARRATIVE
ORGANOPHOSPHOROUS PESTICIDES**

PAGE - 2

Initial Calibrations, continued

Specific Findings

The initial calibration on 10/23-24/95, contained compounds with correlation coefficients less than 0.990 but greater than 0.850. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

GDACB00302	thionazin
	Phorate
	Sulfotepp

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates that 5% of data required qualifications/rejections.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDACB00302	thionazin Phorate Sulfotepp	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

CHLORINATED HERBICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8150; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5542

A validation was performed on the Chlorinated Herbicides from SDG L5542. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data did not require qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID

ANALYTE ID

DL QL

NO QUALIFICATIONS WERE REQUIRED

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE METALS

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5542

A validation was performed on the Metals Data from SDG L5542. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- * ● Matrix Spike Recovery
- * ● Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- * ● Serial Dilutions
- * ● MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited contamination for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Iron	2.60 mg/kg	No impact
Zinc	0.69 mg/kg	No impact

The USEPA requires that all sample values below five times the preparation, field, DI or calibration blank contamination be qualified as estimated, "U". The field or DI water blanks exhibited contamination but had no impact on the data.

The preparation blank exhibited negative bias for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Potassium	-147.0 mg/kg	all samples

The USEPA requires that the reviewer estimated the impact from negative bias. This reviewer requires that all positive and non-detect results below ten times the negative bias will be qualified as estimated, "J" or "UJ".

Duplicate Analysis

Specific Finding

The RPD for Calcium was not greater than 35% and will not be qualified. The field duplicate results were not greater than 50% and will not be qualified.

Specific Finding

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B" per Ensafe's request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
All samples	K.	+/U	J/UJ
All "B" results	all analytes	B	J



HEARTLAND

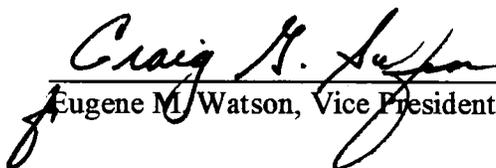
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: 5545
Date: January 18, 1996
Client Name: Ensafe/Allen & Hoshall
Project/Site Name: Charleston Zone A
Date Sampled: October 5, 1995
Number of Samples: 11 Non-aqueous Sample(s) with 3 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level III
Method(s) Utilized: SW846 Third Edition
Analytical Fractions: Volatiles, Semivolatiles, Pesticides/PCB's, Herbicides, Metals, Cyanide

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:


Eugene M. Watson, Vice President

1-19-96
Date

SDG# 5545

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

ENSAFE ID	MATRIX	VOA		SVOA		P/P		HERB		TAL		CN	
042-S-B001-01	SOIL	X		X		X		X		X		X	
042-S-B001-02	SOIL	X		X		X		X		X		X	
042-T-B001-02	SOIL	X											
GDA-S-B001-01	SOIL	X		X		X				X		X	
GDA-S-B001-02	SOIL	X		X		X				X		X	
GDA-S-B002-01	SOIL	X		X		X				X		X	
GDA-S-B002-02	SOIL	X		X		X				X		X	
GDA-S-B003-01	SOIL	X		X		X				X		X	
GDA-S-B003-02	SOIL	X		X		X				X		X	
001-S-B001-01	SOIL			X									
042-S-B010-01	SOIL							X					
Total Billable Samples (Water/Soil)		0	9	0	9	0	8	0	3	0	8	0	8

- VOA = SW846 Volatiles
- SV = SW846 Semivolatiles
- P/P = SW846 Pesticide/PCB's
- HERB = SW846 Herbicides
- TAL = SW846 Metals
- CN = SW846 Cyanide

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8260; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5545

A validation was performed on the Volatile Data from SDG L5545. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Internal Standard Performance
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Continuing Calibrations

The continuing calibration analyzed exhibited non-compliant %Ds for compounds which required qualification of the data.

**DATA ASSESSMENT NARRATIVE
VOLATILE ANALYSIS**

PAGE - 2

Continuing Calibrations, continued

Specific Findings

The continuing calibration, J3978, contained compounds with %Ds greater than 50% but less than 90%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J. and the non-detect results are qualified as estimated, UJ.

All Samples	trichlorofluoromethane
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System Performance and Overall Assessment

Overall performance was acceptable. The reviewer noted that the trip blank was analyzed as a soil. The data reviewer estimates less than 5% of data required qualifications/rejections.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
All Samples	trichlorofluoromethane	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8270; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5545

A validation was performed on the Semivolatile Data from SDG L5545. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibration
- Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Internal Standard Performance
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Continuing Calibrations

The continuing calibration standard analyzed exhibited a non-compliant %D for one (1) compound which required qualification of the data.

**DATA ASSESSMENT NARRATIVE
SEMIVOLATILE ANALYSIS**

PAGE - 2

Continuing Calibrations, continued

Specific Findings

The continuing calibration standard, S0201002.D contained compounds with %Ds greater than 50% but less than 90%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

GDASB00101	2,2'-oxybis(1-chloropropane)
GDASB00102	
GDASB00301	
GDASB00302	
GDASB00201	
GDASB00202	
042SB00101	
042SB00102	
GDASB00301MS	
GDASB00301MSD	

Method Blanks

The method blank that was analyzed exhibited contamination for di-n-butylphthalate. TICs were detected in the method blanks. All B flagged TICs are rejected.

	28905MB
di-n-butylphthalate	1000 µg/Kg

Specific Finding

<u>Samples</u>	<u>Compound</u>	<u>Qualification</u>
GDASB00302	di-n-butylphthalate	CRQL

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 5% of data required qualifications

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>			
GDASB00101	2,2'-oxybis(1-chloropro.)	+/-	J/UJ			
GDASB00102						
GDASB00301						
GDASB00302						
GDASB00201						
GDASB00202						
042SB00101						
042SB00102						
GDASB00301MS						
GDASB00301MSD						
GDASB00302				di-n-butylphthalate	+B	CRQL

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLORS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5545

A validation was performed on the Pesticide/Aroclor Data from SDG L5545. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- * • Calibration
- Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Method Blanks

The associated method blank exhibited contamination for the target compound 4,4'-DDT.

	28536MB
4,4'-DDT	6.9 µg/Kg

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLOR ANALYSIS

PAGE - 2

Method Blanks, Continued

Specific Findings

<u>Samples</u>	<u>Compound</u>	<u>Qualification</u>
042SB00101 042SB00102 GDASB00101 GDASB00202 GDASB00301	4,4'-DDT	U
GDASB00102	4,4'-DDT	CRQL

Surrogate Recoveries

Several field samples exhibited non-compliant TCMX or DCB recoveries. Qualifications are required for only one sample.

Specific Finding

The sample listed below exhibited a low DCB recovery. The positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

GDASB00201

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
042SB00101 042SB00102 GDASB00101 GDASB00202 GDASB00301	4,4'-DDT	+	U
GDASB00102	4,4'-DDT	+	CRQL
GDASB00201	ALL	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE

CHLORINATED HERBICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8150; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5545

A validation was performed on the Chlorinated Herbicides from SDG L5545. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- Calibration
- * • Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Initial Calibrations

The initial calibrations that were analyzed by the laboratory for these samples were not acceptable for all compound correlation coefficients.

**DATA ASSESSMENT NARRATIVE
CHLORINATED HERBICIDES**

PAGE - 2

Initial Calibrations, continued

Specific Findings

The initial calibration on 10/27/95, contained compounds with correlation coefficients less than 0.990 but greater than 0.850. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

All Samples	dalapon
-------------	---------

Surrogate Recoveries

One (1) sample required qualifications based on non-compliant surrogate recoveries.

Specific Findings

The following sample exhibited surrogate recovery below the QC limits. All positive and non-detect results in the following sample are qualified as estimated, J/UJ.

042SB00102

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates that 5% of data required qualifications/rejections.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
All Samples	dalapon	+/-	J/UJ
042SB00102	All compounds	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE METALS

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5545

A validation was performed on the Metals Data from SDG L5545. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- * ● Matrix Spike Recovery
- * ● Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- * ● Serial Dilutions
- MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited contamination for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Iron	2.60 mg/kg	No impact
Zinc	0.69 mg/kg	No impact

The USEPA requires that all sample values below five times the preparation, field, DI or calibration blank contamination be qualified as estimated, "U". The field or DI water blanks exhibited contamination but had no impact on the data.

The preparation blank exhibited negative bias for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Potassium	-139.0 mg/kg	all samples

The USEPA requires that the reviewer estimated the impact from negative bias. This reviewer requires that all positive and non-detect results below ten times the negative bias will be qualified as estimated, "J" or "UJ".

Duplicate Analysis

Specific Finding

The RPD for Calcium was not greater than 35% and will not be qualified.

MSAs

Specific Finding

The post digestion spike recovery for GFAA was below the lower control limits. All positive and non-detect results for the listed samples below are qualified as estimated, "J" or "UJ".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Thallium	042SB00102	74
Thallium	GDASB00301	79
Thallium	GDASB00101	81

The post digestion spike recovery for GFAA was above the upper control limits. All positive results for the listed samples below are qualified as estimated, "J".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Selenium	042SB00102	121
Selenium	GDASB00101	121
Selenium	GDASB00202	125
Selenium	GDASB00201	117
Selenium	GDASB00302	115

Specific Finding

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B" per Ensaf's request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
all samples	K.	+/U	J/UJ
042SB00102, GDASB00301 and 042SB00101.	TI.	+/U	J/UJ
042SB00102, GDASB00101, 202, 201 and 302.	Se.	+	J
All "B" results	all analytes	B	J



HEARTLAND

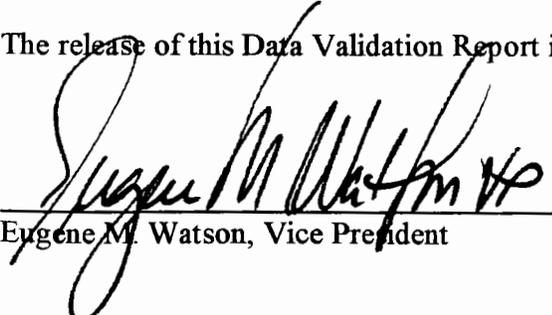
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: L5552
Date: January 25, 1996
Client Name: Ensafe
Project/Site Name: Charleston Zone A & ZONE B
Date Sampled: October 6, 1995
Number of Samples: 7 Non-aqueous Sample(s) with 7 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level IV
Method(s) Utilized: SW846 Third Edition
Analytical Fractions: Volatiles, Semivolatiles, Pesticides/PCB's, Herbicides, Organophosphorus, Hexavalent Chromium, Metals, Cyanide

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:



Eugene M. Watson, Vice President



Date

SDG# L5552

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

ENSAFE ID	MATRIX	VOA	SVOA	P/P	HERB	OPP	HCR	TAL	CN								
042CB00401	SOIL	X	X	X	X	X	X	X	X								
042CB00902	SOIL	X	X	X		X	X	X	X								
506CB00202	SOIL	X															
GDACB01101	SOIL		X														
507CB00401	SOIL			X													
002CB01301	SOIL				X												
002CB00701	SOIL					X											
Total Billable Samples (Water/Soil)		0	3	0	3	0	3	0	2	0	3	0	2	0	2	0	2

- VOA = SW846 Volatiles
- SV = SW846 Semivolatiles
- P/P = SW846 Pesticide/PCB's
- OPP = SW846 Organophosphorus Pesticides
- HERB = SW846 Herbicides
- HCR = SW846 Hexavalent Chromium
- TAL = SW846 Metals
- CN = SW846 Cyanide

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8260; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5552

A validation was performed on the Volatile Data from SDG L5552. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibration
- Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Internal Standard Performance
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Initial Calibrations

The initial calibration analyzed exhibited non-compliant %RSDs and RRFs for compounds which required qualification of the data.

**DATA ASSESSMENT NARRATIVE
VOLATILE ANALYSIS**

PAGE - 2

Continuing Calibrations, continued

Specific Findings

The initial calibration, 10/18/95 on GCMS-I, contained compounds with %Ds greater than 25% but less than 50%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J.

042CB00902 2-butanone

The initial calibration, 10/18/95 on GCMS-I, contained compounds with %Ds greater than 50% but less than 90%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J. and the non-detect results are qualified as estimated, UJ.

042CB00401 chloroethane
042CB00902 trichlorofluoromethane

The initial calibration, 10/18/95 on GCMS-I, contained compounds with RRFs less than 0.05. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J. and the non-detect results are rejected, R.

042CB00401 1,4-dioxane
042CB00902

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 5% of data required qualifications/rejections.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
042CB00902	2-butanone	+	J
042CB00401 042CB00902	chloroethane trichlorofluoromethane	+/-	J/UJ
042CB00401 042CB00902	1,4-dioxane	+/-	J/R

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8270; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5552

A validation was performed on the Semivolatile Data from SDG L5552. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibration
- Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Internal Standard Performance
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Continuing Calibrations

The continuing calibration standard analyzed exhibited non-compliant %Ds for two (2) compounds which required qualification of the data.

**DATA ASSESSMENT NARRATIVE
SEMIVOLATILE ANALYSIS**

PAGE - 2

Continuing Calibrations, continued

Specific Findings

The continuing calibration standard, S0201002.D contained compounds with %Ds greater than 50% but less than 90%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

042CB00402	methyl parathion
042CB00902	parathion

Method Blanks

TIC compounds were detected in the method blanks. All B flagged TICs are rejected, R.

System Performance and Overall Assessment

Overall performance was acceptable. The reviewer noted a contractual error. The laboratory analyzed an initial calibration curve using only four (4) calibration points for the part of the TCL instead of the method mandated five (5) points. The data reviewer estimates less than 5% of data required qualifications

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
042CB00402	methyl parathion	+/-	J/UJ
042CB00902	parathion		

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLORS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5552

A validation was performed on the Pesticide/Aroclor Data from SDG L5552. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Contractual Non-Compliance

The method requires that all target compounds, including the multi-component compounds, be analyzed with a five (5) point calibration curve. The laboratory analyzed a single point curve for the Aroclors 1221, 1232, 1242, 1248, and 1254, Toxaphene, and Chlordane. The data did not require qualification because no positive results were reported for the compounds analyzed with a single point calibration.

DATA ASSESSMENT NARRATIVE
PESTICIDE/AROCLOR ANALYSIS

PAGE - 2

Field Duplicates

The field duplicate pair of samples 042SB00401 and 042CB00401 exhibited positive results for one (1) compound.

Specific Finding

The field duplicate pair of samples 042SB00401 and 042CB00401 exhibited positive results for 4,4'-DDT. The calculated RPD was above the QC limit of 35%. The positive results for 4,4'-DDT are qualified as estimated, J.

042CB00401	4,4'-DDT
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System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
042CB00401	4,4'-DDT	+	J

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE

CHLORINATED HERBICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8150; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5552

A validation was performed on the Herbicide Data from SDG L5552. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID

ANALYTE ID

DL QL

NO QUALIFICATIONS ARE REQUIRED.

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE

ORGANOPHOSPHORUS PESTICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8140; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5552

A validation was performed on the Organophosphorus Pesticide Data from SDG L5552. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Initial Calibrations

Several initial calibration standards associated with the reported samples exhibited correlation coefficients below the QC limit of 0.995.

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLOR ANALYSIS

PAGE - 2

Initial Calibrations, Continued

Specific Findings

The initial calibration of 10/23/95 contained compounds with correlation coefficients less than 0.990 but greater than 0.850. For the samples and the non-compliant compounds listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

042CB00401	Thionazin
042CB00902	Phorate
	Sulfotep

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
042CB00401	Thionazin	+/-	J/UJ
042CB00902	Phorate		
	Sulfotep		

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE METALS

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5552

A validation was performed on the Metals Data from SDG L5552. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- * ● Matrix Spike Recovery
- * ● Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- Serial Dilutions
- MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited contamination for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Iron	2.60 mg/kg	no impact
Zinc	0.69 mg/kg	no impact

The preparation blank exhibited negative bias for the following element.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Potassium	-147. mg/kg	all samples

The USEPA requires that the reviewer qualify data for negative bias when there is impact on the data. This reviewer qualifies all results below ten times the contamination as estimated, "J" or "UJ". The field or DI water blanks exhibited contamination but had no impact on the data.

Duplicate Analysis

Specific Finding

The Duplicate analyses were in control for all elements. All field duplicate RPDs were below 50%.

MSAs

Specific Finding

The post digestion spike recovery for GFAA was below the lower control limits. All positive and non-detect results for the listed samples below are qualified as estimated, "J" or "UJ".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Thallium	042CB00902.	77.

The post digestion spike recovery for GFAA was above the upper control limits. All positive results for the listed samples below are qualified as estimated, "J".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Selenium	042CB00902.	121.

Specific Finding

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B" per Ensafe's request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
All samples	K.	+/U	J/UJ
042CB00902.	Se.	+/U	J/UJ
042CB00902.	Tl.	+	J
All "B" results	all analytes	B	J



HEARTLAND

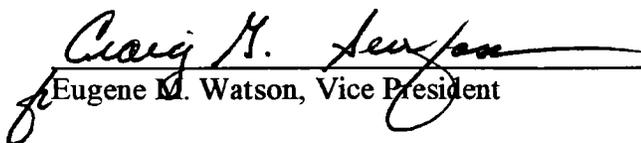
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: 5554
Date: January 18, 1996
Client Name: Ensafe/Allen & Hoshall
Project/Site Name: Charleston Zone A
Date Sampled: October 6, 1995
Number of Samples: 22 Non-aqueous Sample(s) with 3 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level III
Method(s) Utilized: SW846 Third Edition
Analytical Fractions: Volatiles, Semivolatiles, Pesticides/PCB's, Herbicides, Metals, Cyanide

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:


Eugene M. Watson, Vice President

1-19-96
Date

SDG# 5554

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

ENSAFE ID	MATRIX	VOA	SVOA	P/P	HERB	TAL	CN
042-S-B002-01	SOIL	X	X	X	X	X	X
042-S-B002-02	SOIL	X	X	X	X	X	X
042-S-B003-01	SOIL	X	X	X	X	X	X
042-S-B003-02	SOIL	X	X	X	X	X	X
042-T-B003-02	SOIL	X					
042-S-B004-01	SOIL	X	X	X	X	X	X
042-S-B004-02	SOIL	X	X	X	X	X	X
042-S-B005-01	SOIL	X	X	X	X	X	X
042-S-B005-02	SOIL	X	X	X	X	X	X
042-S-B006-01	SOIL	X	X	X	X	X	X
042-S-B006-02	SOIL	X	X	X	X	X	X
042-S-B007-01	SOIL	X	X	X	X	X	X
042-S-B007-02	SOIL	X	X	X	X	X	X
042-S-B008-01	SOIL	X	X	X	X	X	X
042-S-B008-02	SOIL	X	X	X	X	X	X
042-S-B009-01	SOIL	X	X	X	X	X	X
042-S-B009-02	SOIL	X	X	X	X	X	X
505-S-B001-01	SOIL	X	X	X	X	X	X
505-S-B001-02	SOIL	X	X	X	X	X	X
505-S-B004-01	SOIL	X	X	X	X	X	X
505-S-B004-02	SOIL	X	X	X	X	X	X
GDA-S-B003-01	SOIL	X					
Total Billable Samples (Water/Soil)		0 22	0 20	0 20	0 20	0 20	0 20

- VOA = SW846 Volatiles
- SV = SW846 Semivolatiles
- P/P = SW846 Pesticide/PCB's
- HERB = SW846 Herbicides
- TAL = SW846 Metals
- CN = SW846 Cyanide

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8260; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5554

A validation was performed on the Volatile Data from SDG L5554. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Internal Standard Performance
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Continuing Calibrations

The continuing calibrations analyzed exhibited non-compliant %Ds for compounds which required qualification of the data.

**DATA ASSESSMENT NARRATIVE
VOLATILE ANALYSIS**

PAGE - 2

Continuing Calibrations, continued

Specific Findings

The continuing calibration, J3978, contained compounds with %Ds greater than 50% but less than 90%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J. and the non-detect results are qualified as estimated, UJ.

042SB00201	trichlorofluoromethane
042SB00202	
042SB00601	

The continuing calibration, J4015, contained compounds with %Ds greater than 50% but less than 90%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J. and the non-detect results are qualified as estimated, UJ.

505SB00101	trichlorofluoromethane
505SB00102	
042SB00301	
042SB00302	

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 5% of data required qualifications/rejections.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID	ANALYTE ID	DL	QL
042SB00201 042SB00202 042SB00601	trichlorofluoromethane	+/-	J/UJ
505SB00101 505SB00102 042SB00301 042SB00302	trichlorofluoromethane	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8270; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5554

A validation was performed on the Semivolatile Data from SDG L5554. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibration
- Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Internal Standard Performance
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Continuing Calibrations

One (1) of the continuing calibration standards analyzed exhibited a non-compliant %D for one (1) compound which required qualification of the data.

**DATA ASSESSMENT NARRATIVE
SEMIVOLATILE ANALYSIS**

PAGE - 2

Continuing Calibrations, continued

Specific Findings

The continuing calibration standard, S0201002.D contained compounds with %Ds greater than 90%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J, and the non-detect results are rejected, R.

042SB00802	benzoic acid
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Method Blanks

TICs were detected in the method blanks. All B flagged TICs are rejected.

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 5% of data required qualifications

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

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UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
042SB00802	benzoic acid	+/-	J/R

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLORS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5554

A validation was performed on the Pesticide/Aroclor Data from SDG L5554. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- * • Calibration
- * • Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Surrogate Recoveries

Several field samples exhibited non-compliant DCB recoveries.

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLOR ANALYSIS

PAGE - 2

Surrogate Recoveries, Continued

Specific Finding

The sample listed below exhibited a high DCB recovery. The positive results are qualified as estimated, J.

505SB00401

The sample listed below exhibited a low DCB recovery. The positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

042SB00802

Field Duplicates

The field duplicate pair of samples 042SB00401 and 042CB00401 exhibited positive results for One (1) compound.

Specific Finding

The field duplicate pair of samples 042SB00401 and 042CB00401 exhibited positive results for 4,4'-DDT. The calculated RPD was above the QC limit of 35%. The positive results for 4,4'-DDT are qualified as estimated, J.

042SB00401

4,4'-DDT

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
505SB00401	ALL	+	J
042SB00802	ALL	+/-	J/UJ
042SB00401	4,4'-DDT	+	J

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE METALS

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5554

A validation was performed on the Metals Data from SDG L5554. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- Matrix Spike Recovery
- Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- Serial Dilutions
- MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited contamination for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Antimony	11.3 mg/kg	no impact
Iron	2.48 mg/kg	no impact

The USEPA requires that all sample values below five times the preparation, field, DI or calibration blank contamination be qualified as estimated, "U". The field or DI water blanks exhibited contamination but had no impact on the data.

Matrix Spike Analysis

Specific Finding

The Matrix Spike analysis for Cadmium was below the lower control limits. All positive and non-detect results for all soil samples are qualified as estimated, "J" or "UJ".

Duplicate Analysis

Specific Finding

The Duplicate analysis for Lead was outside the control limits. All positive results for all soil samples are qualified as estimated, "J".

Serial Dilution Analysis

Specific Finding

The Serial Dilution analysis for Calcium was outside the control limits. All positive results for all soil samples are qualified as estimated, "J".

MSAs

Specific Finding

The post digestion spike recovery for GFAA was above the upper control limits. All positive results for the listed samples below are qualified as estimated, "J".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Arsenic	042SB00202	119
Selenium	042SB00802	121
Selenium	042SB00902	123
Selenium	505SB00101	116
Selenium	042SB00602	118
Selenium	505SB00402	117
Selenium	042SB00301	116
Selenium	042SB00502	121

Specific Finding

All sample results left with a “B” qualifier after all other qualifications, will be qualified with a “J” qualifier in place of the “B” per Ensafe’s request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
All soil samples	Cd.	+/U	J/UJ
All soil samples	Pb.	+	J
All soil samples	Ca.	+	J
042SB00202.	As.	+	J
042SB00802, 902, 602, 301 and 502, 505SB00101 and 402.	Se.		
All "B" results	all analytes	B	J



HEARTLAND

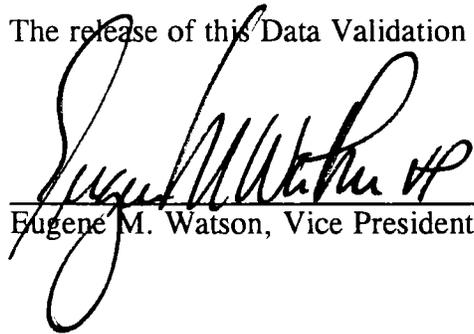
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: L5557
Date: January 26, 1996
Client Name: Ensafe
Project/Site Name: Charleston Zone A & ZONE B
Date Sampled: October 9, 1995
Number of Samples: 7 Non-aqueous Sample(s) with 5 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level III
Method(s) Utilized: CLP Multimedia SOW
Analytical Fractions: Volatiles, Semivolatiles, Pesticides/PCB's, Organophosphorus Pesticides, Herbicides, Hexavalent Chromium, Metals, Cyanide

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:



Eugene M. Watson, Vice President



Date

SDG# 15557

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

Ensafe ID	Matrix	VOA	SV	P/P	OPP	HERB	HCR	TAL	CN				
506CB00202	SOIL	X											
GDACB00501	SOIL	X	X	X	X	X	X	X	X				
GDACB00701	SOIL	X	X	X	X	X	X	X	X				
GDACB01101	SOIL	X	X	X	X	X	X	X	X				
507CB00499	SOIL			X									
002CB00701	SOIL				X								
002CB01301	SOIL					X							
Total Billable Samples (Water/Soil)		0	4	0	3	0	4	0	3	0	3	0	3

VOA= CLP Volatiles

P/P= CLP Pesticide/PCB's

OPP= CLP Organophosphorus Pesticides

HERB= CLP Herbicides

HCR= CLP Hexavalent Chromium

TAL= CLP Metals w/cyanide

CN= CLP Cyanide

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT AND NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8260 Appendix IX; the National Functional Guidelines for Organic Data Review, June 1991, and DQO Level IV. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG # L5557

A validation was performed on the Volatile Data from SDG L5557. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- Internal Standard Performance
- Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- Compound Identification /Quantitation

* - All criteria were met for this parameter

Initial Calibrations

The initial calibrations that were analyzed by the laboratory for these samples were not acceptable for all compound %RSDs and the average RRFs for all of the compounds did not meet the initial calibration criteria.

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 2

Initial calibrations (continued)

Specific Finding:

1. The initial calibration analyzed on, 10/18/95, contained compounds with RRFs less than 0.05. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and reject all non detects (R).

28878MB	1,4-dioxane
GDACB00701	
GDACB00501	
GDACB01101	

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

Specific Finding:

The continuing calibration, E2359, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

GDACB00701RE	acetone
	2-butanone

The continuing calibration, E2359, contained compounds with RRFs less than 0.05. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and reject all non detects (R).

GDACB00701RE	isobutanol
	1,4-dioxane

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 3

Internal Standards

All internal standard EICP areas did not meet the internal standard EICP area QA/QC criteria.

Specific Finding:

The Samples listed below, exhibited low internal standard areas. Qualify all associated positive results as estimated (J) and all non detects as estimated (UJ).

GDACB00701 1,4-dichlorobenzene-d₄
GDACB00501

GDACB00701RE pentafluorobenzene
 1,4-difluorobenzene
 chlorobenzene-d₅
 1,4-dichlorobenzene-d₄

Method Blanks

<u>Associated blank</u>	<u>Compound</u>	<u>Concentration</u>
28916MB	methylene chloride	1.2J

<u>Samples</u>	<u>Compound</u>	<u>Qualification</u>
GDACB00701RE	methylene chloride	CRQL

Surrogates

All of the surrogate recoveries for the all blanks and samples were not within QA/QC limits.

Specific Finding:

The samples listed below, exhibited low surrogate recoveries for bromofluorobenzene. Qualify all positive results as estimated (J) and all non detects as estimated (UJ).

GDACB00701
GDACB00701RE

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 4

Compound Identification/Quantitation

Specific Finding:

Reject all results for the sample GDACB00701RE, due to non compliant internal standard areas.

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

NJ = Presumptive evidence for the presence of the material at an estimated value

K = Result is biased high

L = Result is biased low

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
28878MB GDACB00701 GDACB00501 GDACB01101	1,4-dioxane	+/-	J/R
GDACB00701RE	acetone 2-butanone	+/-	J/UJ
GDACB00701RE	isobutanol 1,4-dioxane	+/-	J/R
GDACB00701 GDACB00501	All associated analytes 1,4-dichlorobenzene-d ₄	+/-	J/UJ
GDACB00701RE	pentafluorobenzene 1,4-difluorobenzene chlorobenzene-d ₅ 1,4-dichlorobenzene-d ₄		
GDACB00701RE	methylene chloride	+	CRQL
GDACB00701 GDACB00701RE	All analytes	+/-	J/UJ
GDACB00701RE	All analytes	+/-	R

* DL denotes the Form I qualifier supplied by the laboratory
 QL denotes the qualifier used by the data validation firm
 + in the DL column denotes a positive result
 - in the DL column denotes a non detect result

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8270 Appendix IX; National Functional Guidelines for Organic Data Review, and DQO Level IV. All comments made within this report should be considered when examining the analytical results (Form I's).

SDG # L5557

A validation was performed on the Semivolatile Data from SDG L5557. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- * • Internal Standard Performance
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

NJ = Presumptive evidence for the presence of the material at an estimated value

K = Result is biased high

L = Result is biased low

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDACB01101	methyl parathion parathion	+/-	J/UJ
GDACB00501 GDACB00701	1,3,5-trinitrobenzene	+/-	J/UJ
GDACB00501 GDACB00701	methyl parathion parathion	+/-	J/R

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

CHLORINATED PESTICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5557

A validation was performed on the Chlorinated Pesticide Data from SDG L5557. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Continuing Calibrations

The continuing calibrations that were analyzed by the laboratory for these samples were not acceptable for all compound %Ds.

**DATA ASSESSMENT NARRATIVE
CHLORINATED PESTICIDES**

PAGE - 2

Continuing Calibrations, continued

Specific Findings

The continuing calibrations on 11/04/95, at 0241/0324/0407, contained compounds with %Ds greater than 15% but less than 50%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J.

GDACB00501 4,4'-DDT
GDACB01101

The continuing calibrations on 11/04/95, at 0242/0324/0407, contained compounds with %Ds greater than 50% but less than 90%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

GDACB00501 aldrin
GDACB01101 β-BHC
 δ-BHC
 Heptachlor epoxide
 γ-chlordane
 α-chlordane
 4,4'-DDE
 Endosulfan II
 Endrin aldehyde
 Endosulfan sulfate
 Endrin ketone
 Kepone

Field Duplicates

Specific Findings

The following field duplicate pair exhibited poor precision for the reported positive results. The positive results for the noted compound are qualified as estimated, J.

GDACB01101 4,4'-DDT

**DATA ASSESSMENT NARRATIVE
CHLORINATED PESTICIDES**

PAGE - 3

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates that 5% of data required qualifications/rejections.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDACB00501 GDACB01101	4,4'-DDT	+	J
GDACB00501 GDACB01101	aldrin β-BHC δ-BHC Heptachlor epoxide γ-chlordane α-chlordane 4,4'-DDE Endosulfan II Endrin aldehyde Endosulfan sulfate Endrin ketone Kepone	+/-	J/UJ
GDACB01101	4,4'-DDT	+	J

- * DL denotes the Form I qualifier supplied by the laboratory
 QL denotes the qualifier used by the data validation firm
 + in the DL column denotes a positive result
 - in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

ORGANOPHOSPHORUS PESTICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8140; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5557

A validation was performed on the Organophosphorus Pesticide Data from SDG L5557. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID ANALYTE ID DL QL

NO QUALIFICATIONS ARE REQUIRED.

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE

CHLORINATED HERBICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8150; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5557

A validation was performed on the Herbicide Data from SDG L5557. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID

ANALYTE ID

DL QL

NO QUALIFICATIONS ARE REQUIRED.

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE METALS, CYANIDE AND HEX CR.

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5557

A validation was performed on the Metals and Cyanide Data from SDG L5557. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- Matrix Spike Recovery
- * ● Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- Serial Dilutions
- MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited contamination for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Iron	2.43 mg/kg	no impact
Zinc	0.90 mg/kg	no impact

The USEPA requires that all sample values below five times the preparation, field, DI or calibration blank contamination be qualified as non-detect, "U". The field or DI water blanks exhibited contamination but had no impact on the data.

Matrix Spike Analysis

Specific Finding

The Matrix Spike analysis for Antimony for soils was below the lower control limits. All positive and non-detect results for all soil samples are qualified as estimated, "J" or "UJ".

Duplicate Analysis

Specific Finding

The field duplicate and laboratory duplicate RPDs were within the 50% criteria.

MSAs

Specific Finding

The post digestion spike recovery for GFAA was below the lower control limits. All positive and non-detect results for the listed samples below are qualified as estimated, "J" or "UJ".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Arsenic	GDACB00501	84
Selenium	GDACB01101	78
Selenium	GDACB00701	83

Specific Finding

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B" per Ensafe's request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
All soil samples	Sb.	+/U	J/UJ
GDACB00501.	As.	+/U	J/UJ
GDACB01101 and 00701.	Se.		
All "B" results	all analytes	B	J



HEARTLAND

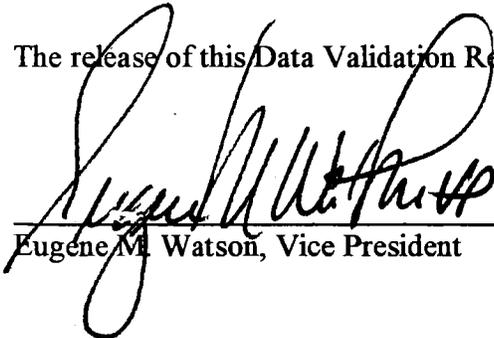
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: L5563
Date: January 26, 1996
Client Name: Ensafe, Inc.
Project/Site Name: Charleston Zone A & Zone B
Date Sampled: October 7-9, 1995
Number of Samples: 48 Non-aqueous Sample(s) with 4 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level III
Method(s) Utilized: SW846 Third Edition
Analytical Fractions: Volatiles, Semivolatiles, Pesticide/PCB's, Herbicides, pH, Metals, and Cyanide

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:


Eugene M. Watson, Vice President


Date

SDG# L5563

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

ENSAFE ID	MATRIX	VOA	SVOA	P/P	HERB	PH	TAL	CN							
001SB00101	SOIL	X	X												
042SB01001	SOIL	X	X	X	X		X	X							
043SB00101	SOIL	X	X			X	X								
043SB000102	SOIL	X	X			X	X								
043SB00201	SOIL	X	X			X	X								
043SB00301	SOIL	X	X			X	X								
043TB00301	SOIL	X	X												
043SB00401	SOIL	X	X			X	X								
043SB00402	SOIL	X	X			X	X								
043SB00501	SOIL	X	X			X	X								
043SB00502	SOIL	X	X			X	X								
043SB00601	SOIL	X	X			X	X								
043SB00602	SOIL	X	X			X	X								
505SB00201	SOIL	X	X	X	X		X	X							
505SB00301	SOIL	X	X	X	X		X	X							
505SB00302	SOIL	X	X	X	X		X	X							
505SB00501	SOIL	X	X	X	X		X	X							
505SB00502	SOIL	X	X	X	X		X	X							
505SB00601	SOIL	X	X	X	X		X	X							
505SB00701	SOIL	X	X	X	X		X	X							
505SB00702	SOIL	X	X	X	X		X	X							
505SB00801	SOIL	X	X	X	X		X	X							
505SB00802	SOIL	X	X	X	X		X	X							
505SB00901	SOIL	X	X	X	X		X	X							
505SB01001	SOIL	X	X	X	X		X	X							
505SB1002	SOIL	X	X	X	X		X	X							
505SB01101	SOIL	X	X	X	X		X	X							
505SB01102	SOIL	X	X	X	X		X	X							
GDASB00501	SOIL	X	X	X			X	X							
GDASB00502	SOIL	X	X	X			X	X							
GDASB00601	SOIL	X	X	X			X	X							
GDASB00602	SOIL	X	X	X			X	X							
GDASB00701	SOIL	X	X	X			X	X							
GDASB00702	SOIL	X	X	X			X	X							
GDASB00801	SOIL	X	X	X			X	X							
GDASB00802	SOIL	X	X	X			X	X							
GDASB00901	SOIL	X	X	X			X	X							
GDASB00902	SOIL	X	X	X			X	X							
GDASB01001	SOIL	X	X	X			X	X							
GDASB01101	SOIL	X	X	X			X	X							
GDASB01102	SOIL	X	X	X			X	X							
GDASB01201	SOIL	X	X	X			X	X							
GDASB01202	SOIL	X	X	X			X	X							
GDASB01301	SOIL	X	X	X			X	X							
GDASB01302	SOIL	X	X	X			X	X							
507CB00498	SOIL			X											
002SB02801	SOIL						X								
002SB02901	SOIL						X								
Total Billable Samples (Water/Soil)		0	45	0	45	0	34	0	16	0	10	0	45	0	33

VOA= SW846 Volatiles
 SV= SW846 Semivolatiles
 P/P SW846 Pesticide/PCB
 HERB= SW846 Herbicides
 TAL= SW846 Metals
 CN= SW846 Cyanide
 PH= pH

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT AND NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8260 Appendix IX; the National Functional Guidelines for Organic Data Review, June 1991, and DQO Level III. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG # L5563

A validation was performed on the Volatile Data from SDG L5563. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- Internal Standard Performance
- Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

**DATA ASSESSMENT AND NARRATIVE
VOLATILE ANALYSIS**

PAGE - 2

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, C0238, contained compounds with %Ds greater than 25% but less than 50%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J).

505SB00702 acetone
505SB00802

The continuing calibration, C0256, contained compounds with %Ds greater than 25% but less than 50%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J).

505SB00702RE 2-butanone

The continuing calibration, C0329, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

043SB00102DL1 chloroethane

The continuing calibration, J4085, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

GDASB01201 trichlorofluoromethane
043SB00402
043SB00502DL
GDASB01102

The continuing calibration, J4085, contained compounds with %Ds greater than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and reject all non detects (R).

GDASB01201 chloroethane
043SB00402
043SB00502DL
GDASB01102

**DATA ASSESSMENT AND NARRATIVE
VOLATILE ANALYSIS**

PAGE - 3

Internal Standards

All internal standard EICP areas did not meet the internal standard EICP area QA/QC criteria.

Specific Finding:

The Samples listed below, exhibited low internal standard areas. Qualify all associated positive results as estimated (J) and all non detects as estimated (UJ).

043SB00102	pentafluorobenzene
043SB00102DL	1,4-difluorobenzene
GDASB01102RE	chlorobenzene-d ₅
GDASB01102	1,4-dichlorobenzene-d ₄
043SB00301	1,4-dichlorobenzene-d ₄
043SB00601	
043SB00301MS	
043SB00301MSD	
505SB00501RE	
505SB00702RE	
043SB00102	chlorobenzene-d ₅
043SB00601	1,4-dichlorobenzene-d ₄
043SB00502	

Method Blanks

<u>Associated blank</u>	<u>Compound</u>	<u>Concentration</u>
29030MB	methylene chloride	1.3J
29044MB	acetone	8.1
	2-butanone	1.6
	2-hexanone	1.3
29228	2-hexanone	1.2

**DATA ASSESSMENT AND NARRATIVE
VOLATILE ANALYSIS**

PAGE - 4

Method Blanks (continued)

<u>Samples</u>	<u>Compound</u>	<u>Qualification</u>
GDASB01102	methylene chloride	CRQL
505SB01002 043SB00602 043SB00301	acetone	U
043SB00602	2-butanone	CRQL

Trip Blanks

<u>Associated blank</u>	<u>Compound</u>	<u>Concentration</u>
043TB00301	methylene chloride chloroform	1.1J ug/L 4.7J ug/L

<u>Samples</u>	<u>Compound</u>	<u>Qualification</u>
042SB01001 043SB00101 043SB00201 043SB00602 505SB00801 505SB00901 505SB01002 505SB01101 505SB01202 GDASB01102 GDASB01302	methylene chloride	CRQL
043SB00301 043SB00601RE	methylene chloride	U

**DATA ASSESSMENT AND NARRATIVE
VOLATILE ANALYSIS**

PAGE - 5

Surrogates

All of the surrogate recoveries for the all blanks and samples were not within QA/QC limits.

Specific Finding:

The samples listed below, exhibited low surrogate recoveries for bromofluorobenzene. Qualify all positive results as estimated (J) and all non detects as estimated (UJ).

GDASB01102
505SB00501
505SB00501RE
505SB00601
505SB00601RE
505SB00702
505SB00702RE
505SB00301
505SB00301RE
043SB00601
043SB00102
043SB00102DL
043SB00301

Compound Identification/Quantitation

Specific Finding:

For samples 043SB00102 and 043SB00502, reject all E-flagged results in favor of the D-flagged results in the diluted sample. For the diluted samples 043SB00102 and 043SB00502, reject all results (UR) except for the D-flagged results with corresponding E-flagged results.

Reject all results for the re-analyzed samples listed below, in favor of the original sample analysis due to non compliant internal standard areas and/or surrogate recoveries.

505SB00501RE
505SB00601RE
505SB00702RE
505SB00301RE
GDASB01102RE

**DATA ASSESSMENT AND NARRATIVE
VOLATILE ANALYSIS**

PAGE - 6

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

NJ = Presumptive evidence for the presence of the material at an estimated value

K = Result is biased high

L = Result is biased low

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
505SB00702 505SB00802	acetone	+	J
505SB00702RE	2-butanone	+	J
043SB00102DL1	chloroethane	+/-	J/UJ
GDASB01201 043SB00402 043SB00502DL GDASB01102	trichlorofluoromethane	+/-	J/UJ
GDASB01201 043SB00402 043SB00502DL GDASB01102	chloroethane	+/-	J/R
043SB00102 043SB00102DL GDASB01102RE GDASB01102	All associated analytes pentafluorobenzene 1,4-difluorobenzene chlorobenzene-d ₅ 1,4-dichlorobenzene-d ₄	+/-	J/UJ
043SB00301 043SB00601 043SB00301MS 043SB00301MSD 505SB00501RE 505SB00702RE	1,4-dichlorobenzene-d ₄		
043SB00102DL1 043SB00601RE 043SB00502	chlorobenzene-d ₅ 1,4-dichlorobenzene-d ₄		

- * DL denotes the Form I qualifier supplied by the laboratory
 QL denotes the qualifier used by the data validation firm
 + in the DL column denotes a positive result
 - in the DL column denotes a non detect result

SUMMARY OF DATA QUALIFICATIONS

Page - 2

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDASB01102	methylene chloride	+	CRQL
505SB01002 043SB00602 043SB00301	acetone	+	U
043SB00602	2-butanone	+	CRQL
042SB01001 043SB00101 043SB00201 043SB00602 505SB00801 505SB00901 505SB01002 505SB01101 505SB01202 GDASB01102 GDASB01302	methylene chloride	+	CRQL
043SB00301 043SB00601RE	methylene chloride	+	U

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

SUMMARY OF DATA QUALIFICATIONS

Page - 3

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDASB01102 505SB00501 505SB00501RE 505SB00601 505SB00601RE 505SB00702 505SB00702RE 505SB00301 505SB00301RE 043SB00601 043SB00102 043SB00102DL 043SB00301	All analytes	+/-	J/UJ
043SB00102 043SB00502	All E-flagged results	+	R
043SB00102DL 043SB00502DL	All results except D-flagged results	+/-	R
505SB00501RE 505SB00601RE 505SB00702RE 505SB00301RE GDASB01102RE	All analytes	+/-	R

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8270 Appendix IX; National Functional Guidelines for Organic Data Review, and DQO Level III. All comments made within this report should be considered when examining the analytical results (Form I's).

SDG # L5563

A validation was performed on the Semivolatile Data from SDG L5563. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- * • Internal Standard Performance
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ANALYSIS

PAGE - 2

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, S0201002, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

505SB00502	bis(2-chloroisopropyl)ether
505SB00501	
505SB00601	

The continuing calibration, S0201002, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

GDASB00702	benzoic acid
GDASB00602	
GDASB00802	
GDASB01202	
043SB00501	
043SB00401	
043SB00402	
043SB00502	
GDASB01302	

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

NJ = Presumptive evidence for the presence of the material at an estimated value

K = Result is biased high

L = Result is biased low

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
505SB00502 505SB00501 505SB00601	bis(2-chloroisopropyl)ether	+/-	J/UJ
GDASB00702 GDASB00602 GDASB00802 GDASB01202 043SB00501 043SB00401 043SB00402 043SB00502 GDASB01302	benzoic acid	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

CHLORINATED PESTICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5563

A validation was performed on the Chlorinated Pesticide Data from SDG L5563. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- Calibration
- * • Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- Compound Quantitation

* - All criteria were met for this parameter.

Continuing Calibrations

The continuing calibrations that were analyzed by the laboratory for these samples were not acceptable for all compound %Ds.

**DATA ASSESSMENT NARRATIVE
CHLORINATED PESTICIDES**

PAGE - 2

Continuing Calibrations, continued

Specific Findings

The continuing calibrations on 11/04/95, at 0242/0324/0407, contained compounds with %Ds greater than 15% but less than 50%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J.

GDASB00902 4,4'-DDT

GDASB00601 4,4'-DDE
GDASB01001

The continuing calibrations on 11/04/95, at 0242/0324/0407, contained compounds with %Ds greater than 50% but less than 90%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

GDASB00902 aldrin
GDASB00601 β -BHC
GDASB01001 δ -BHC
 Heptachlor epoxide
 γ -chlordane
 α -chlordane
 4,4'-DDE
 Endosulfan II
 Endrin aldehyde
 Endosulfan sulfate
 Endrin ketone
 Kepone

Surrogate Recoveries

Five (5) samples required qualifications based on non-compliant surrogate recoveries. See the specific findings on the following page.

**DATA ASSESSMENT NARRATIVE
CHLORINATED PESTICIDES**

PAGE - 3

Surrogate Recoveries, continued

Specific Findings

The following samples exhibited a surrogate recovery below the QC limits. All positive and non-detect results in the following samples are qualified as estimated, J/UJ.

GDASB00601
GDASB01001
505SB00201

The following samples exhibited a surrogate recovery above the QC limits. All positive results in the following samples are qualified as estimated, J.

GDASB00801
GDASB01301

Compound Quantitation

The following samples required dilutions to accurately quantitate some of the detected target compounds. For the following samples, the E flagged results are rejected, R, in favor of the results reported from the dilution analysis. All other results from the dilution analyses are rejected, UR.

GDASB00901
042SB01001
505SB00301
GDASB01201

The positive results for the noted compounds in the following samples are qualified as estimated, J, because the concentration is above the calibration range.

042SB01001

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates that 5% of data required qualifications/rejections.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDASB00902	4,4'-DDT	+	J
GDASB00601 GDASB01001	4,4'-DDE	+	J
GDASB00902 GDASB00601 GDASB01001	aldrin β -BHC δ -BHC Heptachlor epoxide γ -chlordane α -chlordane 4,4'-DDE Endosulfan II Endrin aldehyde Endosulfan sulfate Endrin ketone Kepone	+	J/UJ
GDASB00601 GDASB01001 505SB00201	All Compounds	+/-	J/UJ
GDASB00801 GDASB01301	All Compounds	+	J
GDASB00901 042SB01001 505SB00301 GDASB01201	All E Flagged	+	R
GDASB00901DL 042SB01001DL 505SB00301DL GDASB01201DL	All except D Flagged	+	R
042SB01001	All E flagged	+	J

SUMMARY OF DATA QUALIFICATIONS

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

CHLORINATED HERBICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8150; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5563

A validation was performed on the Herbicide Data from SDG L5563. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Initial Calibrations

One (1) initial calibration standard associated with the reported samples exhibited correlation coefficient below the QC limit of 0.995.

DATA ASSESSMENT NARRATIVE
PESTICIDE/AROCLOR ANALYSIS

PAGE - 2

Initial Calibrations, Continued

Specific Findings

The initial calibration of 10/27/95 contained a compound with a correlation coefficient less than 0.990 but greater than 0.850. For the samples and the non-compliant compound listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

All samples

Dalapon

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
All samples	Dalapon	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE METALS AND CYANIDE

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5563

A validation was performed on the Metals Data from SDG L5563. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- Matrix Spike Recovery
- Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- Serial Dilutions
- MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited contamination for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Iron	11.1 mg/kg	no impact
Zinc	1.34 mg/kg	no impact

The USEPA requires that all sample values below five times the preparation, field, DI or calibration blank contamination be qualified as non-detect, "U". The field or DI water blanks exhibited contamination but had no impact on the data.

Matrix Spike Recovery

Specific Finding

The Matrix Spike recoveries for soils for Mercury and Manganese were below the lower control limits. All positive and non-detect results are qualified as estimated, "J" or "UJ".

Duplicate Analysis

Specific Finding

The Duplicate analyses for soils for Calcium, Chromium and Iron were outside the control limits. All positive results are qualified as estimated, "J". The RPD for Lead was not greater than 35% and will not be qualified. The differences for Magnesium and Nickel were not greater than 2 times the CRDL and will not be qualified.

Serial Dilution

Specific Finding

The Serial Dilution for soils for Magnesium was outside the control limits. All positive results are qualified as estimated, "J".

MSAs

Specific Finding

The post digestion spike recovery for GFAA was below the lower control limits. All positive and non-detect results for the listed samples below are qualified as estimated, "J" or "UJ".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Selenium	002SB02801	84
Selenium	043SB00301	78
Selenium	043SB00401	81
Selenium	043SB00402	77
Selenium	043SB00601	84
Selenium	505SB00201	74

Selenium	505SB00301	84
Selenium	505SB00701	78
Selenium	505SB00702	76
Selenium	505SB00801	69
Selenium	505SB00901	80
Selenium	GDASB00601	82
Selenium	GDASB00602	76
Selenium	GDASB00701	77
Selenium	GDASB00702	75
Selenium	GDASB00901	84
Selenium	GDASB00801	67
Selenium	GDASB01001	76
Selenium	GDASB01102	70
Selenium	GDASB01202	71
Selenium	GDASB01301	81
Selenium	GDASB01302	84

Specific Finding

The post digestion spike recovery for GFAA was above the upper control limits. All positive results for the listed samples below are qualified as estimated, "J".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Arsenic	GDASB01302	120

Specific Finding

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B" per Ensafes request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
All samples	Hg and Mn.	+/U	J/UJ
All samples	Ca, Cr and Fe.	+	J
All samples	Mg.	+	J
002SB02801, 042SB01001, 043SB00301, 401, 402, 502, 601, 505SB00201, 301, 701, 702, 801, 802, 901, 1101, GDASB00502, 601, 602, 701, 702, 802, 901, 1001, 1102, 1202 and 1302. GDASB01302.	Se.	+/ U	J/ UJ
All "B" results	As. all analytes	+ B	J J



HEARTLAND

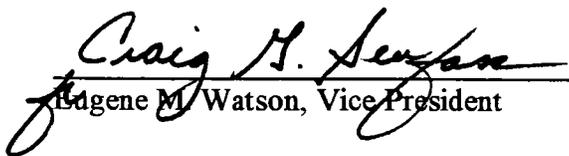
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: 5568
Date: January 18, 1996
Client Name: Ensafe/Allen & Hoshall
Project/Site Name: Charleston Zone A
Date Sampled: October 10, 1995
Number of Samples: 2 Aqueous Sample(s) with 1 MS/MSD(s)
7 Non-aqueous Sample(s) with 3 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level III
Method(s) Utilized: SW846 Third Edition
Analytical Fractions: Volatiles, Semivolatiles, Pesticides, Organophosphorus Pesticides, Herbicides, Hexavalent Chromium, Metals, Cyanide

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:


Eugene M. Watson, Vice President

1-19-96.
Date

SDG# 5568

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

ENSAFE ID	MATRIX	VOA		SVOA		P/P		OPP		HERB	HCR	TAL	CN				
GDA-E-B007-01	WATER	X		X		X		X		X	X	X	X	X			
GDA-D-B007-01	WATER	X		X		X		X		X	X	X	X	X			
002-C-B001-01	SOIL							X		X	X	X					
002-C-B002-01	SOIL							X		X	X	X					
002-C-B007-01	SOIL							X		X	X	X					
002-C-B011-02	SOIL							X		X	X	X					
002-C-B013-01	SOIL							X		X	X	X					
002-C-B024-02	SOIL							X		X	X	X					
001-S-B001-01	SOIL											X					
Total Billable Samples (Water/Soil)		2	0	2	0	2	0	2	6	0	8	0	8	0	9	0	2

- VOA = SW846 Volatiles
- SV = SW846 Semivolatiles
- P/P = SW846 Pesticide/PCB's
- OPP = SW846 Organophosphorus Pesticides
- HERB = SW846 Herbicides
- HCR = SW846 Hexavalent Chromium
- TAL = SW846 Metals
- CN = SW846 Cyanide

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8260; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5568

A validation was performed on the Volatile Data from SDG L5568. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibration
- Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Internal Standard Performance
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Continuing Calibrations

The continuing calibration analyzed exhibited non-compliant %Ds for compounds which required qualification of the data.

**DATA ASSESSMENT NARRATIVE
VOLATILE ANALYSIS**

PAGE - 2

Continuing Calibrations, continued

Specific Findings

The continuing calibration, E0095.D, contained compounds with %Ds greater than 50% but less than 90%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J. and the non-detect results are qualified as estimated, UJ.

GDAEB00701	chloroethane
GDADB00701	trichlorofluoromethane

Method Blanks

The method blank exhibited contamination for acetone. However, the compound was detected in the MS/MSD samples only so qualifications of the field samples were not required.

System Performance and Overall Assessment

Overall performance was acceptable. The reviewer noted that the wrong date was on the initial calibration data. Further, the laboratory did not submit internal standard area summaries. The reviewer used raw data to verify the internal standard area recoveries. The data reviewer estimates less than 5% of data required qualifications/rejections.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDAEB00701	chloroethane	+/-	J/UJ
GDADB00701	trichlorofluoromethane		

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8270; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5568

A validation was performed on the Semivolatile Data from SDG L5568. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Internal Standard Performance
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Continuing Calibrations

The continuing calibration standard analyzed exhibited non-compliant %Ds for three (3) compounds which required qualification of the data.

**DATA ASSESSMENT NARRATIVE
SEMIVOLATILE ANALYSIS**

PAGE - 2

Continuing Calibrations, continued

Specific Findings

The continuing calibration standard, S0301003.D and S0201002.D contained compounds with %Ds greater than 50% but less than 90%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

GDAEB00701
GDADB00701

methyl parathion
n-nitrosomethylethylamine
famfur

System Performance and Overall Assessment

Overall performance was acceptable. The reviewer noted a contractual error. The laboratory analyzed an initial calibration curve using only four (4) calibration points instead of the method mandated five (5) points. The data reviewer estimates less than 5% of data required qualifications

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDAEB00701	methyl parathion	+/-	J/UJ
GDADB00701	n-nitrosomethylethylamine famfur		

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLORS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5568

A validation was performed on the Pesticide/Aroclor Data from SDG L5568. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Initial Calibrations

One (1) initial calibration standard associated with the reported samples exhibited a correlation coefficient below the QC limit of 0.995.

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLOR ANALYSIS

PAGE - 2

Initial Calibrations, Continued

Specific Findings

The initial calibration of 10/25/95 on GC-A contained compounds with a correlation coefficient less than 0.990 but greater than 0.850. For the samples and the non-compliant compound listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

GDAEB00701
GDADB00701

Isodrin

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDAEB00701	Isodrin	+/-	J/UJ
GDADB00701			

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE

ORGANOPHOSPHOROUS PESTICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8140; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5568

A validation was performed on the Organophosphorous Pesticide Data from SDG L5568. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- Calibration
- * • Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Initial Calibrations

The initial calibrations that were analyzed by the laboratory for these samples were not acceptable for all compound correlation coefficients.

**DATA ASSESSMENT NARRATIVE
ORGANOPHOSPHOROUS PESTICIDES**

PAGE - 2

Initial Calibrations, continued

Specific Findings

The initial calibration on 11/03/95, contained compounds with correlation coefficients less than 0.990 but greater than 0.850. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

GDAEB00701	disulfoton
GDADB00701	

Surrogate Recoveries

One (1) sample required qualifications based on non-compliant surrogate recoveries.

Specific Findings

The following sample exhibited surrogate recovery below the QC limits. All positive and non-detect results in the following sample are qualified as estimated, J/UJ.

GDADB00701

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates that 5% of data required qualifications/rejections.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDAEB00701 GDADB00701	disulfoton	+/-	J/UJ
GDADB00701	all compounds	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

CHLORINATED HERBICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8150; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5568

A validation was performed on the Chlorinated Herbicides from SDG L5568. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data did not require qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
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NO QUALIFICATIONS WERE REQUIRED

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

METALS

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5568

A validation was performed on the Metals Data from SDG L5568. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- * ● Blanks
- * ● Interferences
- * ● Matrix Spike Recovery
- Matrix Duplicates
- Field Duplicates
- * ● Laboratory Control Samples
- Serial Dilutions
- MSAs

* - All criteria were met for this parameter.

Duplicate Analysis

Specific Finding

The Duplicate analyses for soils for Iron, Manganese and Zinc were outside the control limits. All positive results for all soil samples are qualified as estimated, "J". The RPD for Aluminum was below 35% and the RPD for Calcium was not greater than 2 times the CRDL and will not be qualified. The field duplicate for Calcium and Zinc were greater than 50% for soils. All positive results are qualified as estimated, "J".

Serial Dilution Analysis

Specific Finding

The Serial dilution for Sodium for water samples was outside the control limits. All positive results are qualified as estimated, "J".

MSAs

Specific Finding

The post digestion spike recovery for GFAA was below the lower control limits. All positive and non-detect results for the listed samples below are qualified as estimated, "J" or "UJ".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Selenium	002CB00701	76
Thallium	002CB02402	78

Specific Finding

The post digestion spike recovery for GFAA was above the upper control limits. All positive results for the listed samples below are qualified as estimated, "J".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Arsenic	001SB00101	122

Specific Finding

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B" per Ensafe's request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
All soil samples	Fe, Mn and Zn.	+	J
All soil samples	Ca and Zn.	+	J
All water samples	Na.	+	J
002CB00701	Se.	+/U	J/UJ
002CB02402	Tl.		
001SB00101	As.	+	J
All "B" results	all analytes	B	J



HEARTLAND

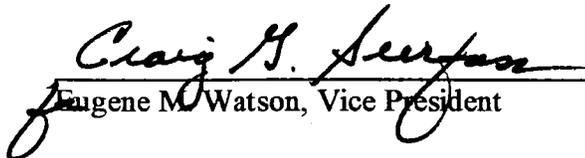
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: 5571
Date: January 18, 1996
Client Name: Ensafe/Allen & Hoshall
Project/Site Name: Charleston Zone A
Date Sampled: October 10, 1995
Number of Samples: 45 Non-aqueous Sample(s) with 6 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level III
Method(s) Utilized: SW846 Third Edition
Analytical Fractions: Volatiles, Semivolatiles, Pesticides, Metals, Cyanide

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:


Eugene M. Watson, Vice President

1-19-96
Date

SDG# 5571

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

ENSAFE ID	MATRIX	VOA	SVOA	P/P	TAL	CN					
001-S-B001-01	SOIL	X	X	X	X	X					
001-S-B001-02	SOIL	X	X	X	X	X					
GDA-T-B007-01	SOIL	X									
GDA-S-B013-02	SOIL			X							
002-S-B001-01	SOIL				X						
002-S-B001-02	SOIL				X						
002-S-B002-01	SOIL				X						
002-S-B002-02	SOIL				X						
002-S-B003-01	SOIL				X						
002-S-B003-02	SOIL				X						
002-S-B004-01	SOIL				X						
002-S-B004-02	SOIL				X						
002-S-B005-01	SOIL				X						
002-S-B005-02	SOIL				X						
002-S-B006-01	SOIL				X						
002-S-B006-02	SOIL				X						
002-S-B007-01	SOIL				X						
002-S-B007-02	SOIL				X						
002-S-B008-01	SOIL				X						
002-S-B008-02	SOIL				X						
002-S-B009-01	SOIL				X						
002-S-B009-02	SOIL				X						
002-S-B010-01	SOIL				X						
002-S-B010-02	SOIL				X						
002-S-B011-01	SOIL				X						
002-S-B011-02	SOIL				X						
002-S-B012-01	SOIL				X						
002-S-B012-02	SOIL				X						
002-S-B013-01	SOIL				X						
002-S-B013-02	SOIL				X						
002-S-B014-01	SOIL				X						
002-S-B014-02	SOIL				X						
002-S-B015-01	SOIL				X						
002-S-B015-02	SOIL				X						
002-S-B019-01	SOIL				X						
002-S-B019-02	SOIL				X						
002-S-B023-01	SOIL				X						
002-S-B023-02	SOIL				X						
002-S-B024-01	SOIL				X						
002-S-B024-02	SOIL				X						
002-S-B025-01	SOIL				X						
002-S-B025-02	SOIL				X						
002-S-B026-01	SOIL				X						
002-S-B026-02	SOIL				X						
002-S-B027-01	SOIL				X						
Total Billable Samples (Water/Soil)		0	3	0	2	0	3	0	43	0	2

VOA = SW846 Volatiles
 SV = SW846 Semivolatiles
 P/P = SW846 Pesticide/PCB's
 TAL = SW846 Metals
 CN = SW846 Cyanide

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8260; the National Functional Guidelines for Organic Data Review, June, 1991; DQO Level III requirements, and good professional judgement. All comments made within this report should be considered when examining the analytical results (Form I's).

SDG# L5571

A validation was performed on the Volatile Data from SDG L5571. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix spike Duplicates
- * • Field Duplicates
- * • Internal Standard Performance
- * • Compound Identification
- * • Compound Quantitation

*- All criteria were met for this parameter.

Continuing Calibration

The continuing calibration analyzed exhibited non-compliant %Ds for compounds which required qualification of the data.

DATA ASSESSMENT NARRATIVE VOLATILE ORGANICS

PAGE 2

Continuing Calibrations, continued

Specific Finding

The continuing calibration, J4034, contained compounds with %Ds greater the 50% but less than 90%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

001SB00101	trichlorofluoromethane
001SB00102	vinyl acetate
001SB00102MS	
001SB00102MSD	
GDATB00701	

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates that less than 5% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis.

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
001SB00101	trichlorofluoromethane	+/-	J/UJ
001SB00102	vinyl acetate		
001SB00102MS			
001SB00102MSD			
GDATE00701			

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8270; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5571

A validation was performed on the Semivolatile Data from SDG L5571. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Internal Standard Performance
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Continuing Calibrations

The continuing calibrations standard that was analyzed exhibited a non-compliant %D for one (1) compound which required qualification of the data.

**DATA ASSESSMENT NARRATIVE
SEMIVOLATILE ANALYSIS**

PAGE - 2

Continuing Calibrations, continued

Specific Findings

The continuing calibration standard, S0201002.D contained compounds with %Ds greater than 50% but less than 90%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

001SB00101	2,2'-oxybis(1-chloropropane)
001SB00101MS	
001SB00101MSD	
001SB00102	

Method Blanks

TICs were detected in the method blank. All B flagged TICs in all samples are rejected, R.

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 5% of data required qualifications

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID	ANALYTE ID	DL	QL
001SB00101 001SB00101MS 001SB00101MSD 001SB00102	2,2'-oxybis(1-chloropro.)	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLORS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5571

A validation was performed on the Pesticide/Aroclor Data from SDG L5571. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID ANALYTE ID DL QL

NO QUALIFICATIONS ARE REQUIRED.

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE METALS

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5571

A validation was performed on the Metals Data from SDG L5571. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- Matrix Spike Recovery
- Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- * ● Serial Dilutions
- MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited negative bias for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Magnesium	-8.80 mg/kg	No impact

The USEPA requires that the reviewer estimated the impact from negative bias. This reviewer requires that all positive and non-detect results below ten times the negative bias will be qualified as estimated, "J" or "UJ".

Matrix Spike Analysis

Specific Finding

The Matrix Spike analyses for Antimony, Lead and Selenium were below the lower control limits. All positive and non-detect results for all soil samples are qualified as estimated, "J" or "UJ".

Duplicate Analysis

Specific Finding

The Duplicate analyses for Iron, Manganese and Zinc outside the control limits. All positive results for all soil samples are qualified as estimated, "J".. The RPDs for Aluminum, Calcium and Lead were not greater than 35% and will not be qualified.

MSAs

Specific Finding

The post digestion spike recovery for GFAA was below the lower control limits. All positive and non-detect results for the listed samples below are qualified as estimated, "J" or "UJ".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Selenium	002SB00601	83
Thallium	002SB01201	44

The post digestion spike recovery for GFAA was above the upper control limits. All positive results for the listed samples below are qualified as estimated, "J".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Arsenic	001SB00101	122
Arsenic	002SB00702	125
Arsenic	002SB00102	117
Arsenic	002SB00701	118
Arsenic	002SB01202	118

Specific Finding

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B" per Ensafe's request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
All samples	Sb, Pb and Se.	+/U	J/UJ
All samples	Fe, Mn and Zn.	+	J
002SB00601.	Tl.	+/U	J/UJ
002SB01201.	Se.		
001SB00101, 002SB00702, 102, 701 and 1202.	As.	+	J
All "B" results	all analytes	B	J



HEARTLAND

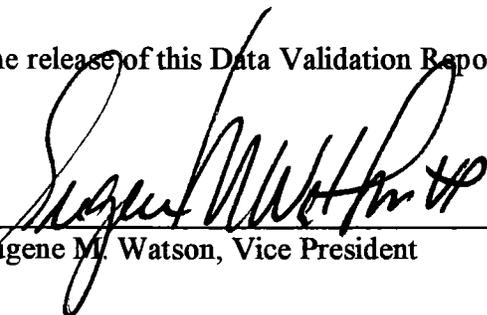
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: L5583
Date: January 25, 1996
Client Name: Ensafe
Project/Site Name: Charleston Zone A
Date Sampled: October 11, 1995
Number of Samples: 3 Aqueous Sample(s) with 3 MS/MSD(s)
4 Non-aqueous Sample(s) with 4 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level IV
Method(s) Utilized: SW846 Third Edition
Analytical Fractions: Volatiles, Semivolatiles, Pesticides/PCB's, Herbicides, Organophosphorus Pesticides, Dioxin, Hexavalent Chromium, Metals, Cyanide

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:



Eugene M. Watson, Vice President



Date

SDG# L5583

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

ENSAFE ID	MATRIX	VOA	SVOA	P/P	HERB	OPP	DIOX	HCR	TAL	CN							
506CB00202	SOIL	X	X		X	X		X	X								
GDA7000101	WATER	X	X	X	X	X	X	X	X	X							
GDAE000101	WATER	X	X	X	X	X	X	X	X	X							
GDACB01101	SOIL		X														
002CB00701	SOIL					X											
002CB01301	SOIL				X												
GDAEB00701	WATER								X								
Total Billable Samples (Water/Soil)		2	1	2	2	0	2	2	2	2	0	2	1	3	1	2	0

- VOA= SW846 Volatiles
- SV= SW846 Semivolatiles
- P/P= SW846 Pesticide/PCB's
- OPP= SW846 Organophosphorus Pesticides
- HERB= SW846 Herbicides
- DIOX= SW846 Dioxin
- HCR= SW846 Hexavalent Chromium
- TAL= SW846 Metals
- CN= SW846 Cyanide

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8260; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5583

A validation was performed on the Volatile Data from SDG L5583. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- GC/MS Tuning
- Calibration
- Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- Internal Standard Performance
- * • Compound Identification
- Compound Quantitation

* - All criteria were met for this parameter.

GC/MS Tuning

The tunes found in the data package for this SDG did not meet criteria. However, tunes which were processed correctly were found in the data package for SDG 5552 and were used to validate this SDG.

Continuing Calibrations

The continuing calibration analyzed exhibited non-compliant %Ds and RRFs for compounds which required qualification of the data.

DATA ASSESSMENT NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8260; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5583

A validation was performed on the Volatile Data from SDG L5583. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- GC/MS Tuning
- Calibration
- Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- Internal Standard Performance
- * • Compound Identification
- Compound Quantitation

* - All criteria were met for this parameter.

GC/MS Tuning

The tunes found in the data package for this SDG did not meet criteria. However, tunes which were processed correctly were found in the data package for SDG 5552 and were used to validate this SDG.

Continuing Calibrations

The continuing calibration analyzed exhibited non-compliant %Ds and RRFs for compounds which required qualification of the data.

**DATA ASSESSMENT NARRATIVE
VOLATILE ANALYSIS**

PAGE - 2

Continuing Calibrations, continued

Specific Findings

The continuing calibration, E0095.D, contained compounds with %Ds greater than 50% but less than 90%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J. and the non-detect results are qualified as estimated, UJ.

506CB00202	acetone
506CB00202MS	2-butanone
506CB00202MSD	

The continuing calibration, E0095.D, contained compounds with RRFs less than 0.05. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J. and the non-detect results are rejected, R.

506CB00202	isobutanol
506CB00202MS	1,4-dioxane
506CB00202MSD	

The continuing calibration, E0114.D, contained compounds with %Ds greater than 50% but less than 90%. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J. and the non-detect results are qualified as estimated, UJ.

GDA7000101	chloroethane
GDAE000101	
GDAE000101MS	
GDAE000101MSD	

The continuing calibration, E0095.D, contained compounds with RRFs less than 0.05. For the samples and non-compliant compounds listed below, the positive results are qualified as estimated, J. and the non-detect results are rejected, R.

GDA7000101	1,4-dioxane
GDAE000101	
GDAE000101MS	
GDAE000101MSD	

**DATA ASSESSMENT NARRATIVE
VOLATILE ANALYSIS**

PAGE - 3

Internal Standards

One (1) sample, the MS and MSD of the sample, and the RE of the sample exhibited similar non-compliant internal standard areas.

Specific Finding

The samples listed below exhibited low internal standard areas. All associated positive and non-detect results are qualified as estimated, J/UJ.

506CB00202	dichlorobenzene-d ₂
506CB00202RE	
506CB00202MS	
506CB00202MSD	all internal standards

Surrogate Recoveries

One (1) sample and the MS/MSD pair exhibited recoveries below the QC limits for bromofluorobenzene.

Specific Finding

The following samples exhibited non-compliant recoveries for one (1) surrogate compound. All positive and non-detect results in the samples are qualified as estimated, J/UJ.

506CB00202
506CB00202MS
506CB00202MSD

Compound Identification

Specific Finding

The following sample was reanalyzed due to poor response for one (1) internal standard. The original analysis of the sample is rejected, R, in favor of the results reported from the RE sample.

506CB00202

**DATA ASSESSMENT NARRATIVE
VOLATILE ANALYSIS**

PAGE - 4

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 5% of data required qualifications/rejections.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
506CB00202	acetone	+/-	J/UJ
506CB00202MS	2-butanone		
506CB00202MSD			
506CB00202	isobutanol	+/-	J/R
506CB00202MS	1,4-dioxane		
506CB00202MSD			
GDA7000101	chloroethane	+/-	J/UJ
GDAE000101			
GDAE000101MS			
GDAE000101MSD			
GDA7000101	1,4-dioxane	+/-	J/R
GDAE000101			
GDAE000101MS			
GDAE000101MSD			
506CB00202	All associated with dichlorobenzene-d ₂	+/-	J/UJ
506CB00202RE			
506CB00202MS			
506CB00202MSD	All associated with all internal standards	+/-	J/UJ
506CB00202	All Compounds	+/-	J/UJ
506CB00202MS			
506CB00202MSD			
506CB00202	All Compounds	+/-	R

* DL denotes the Form I qualifier supplied by the laboratory
 QL denotes the qualifier used by the data validation firm
 + in the DL column denotes a positive result
 - in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLORS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5583

A validation was performed on the Pesticide/Aroclor Data from SDG L5583. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Contractual Non-Compliance

The method requires that all target compounds, including the multi-component compounds, be analyzed with a five (5) point calibration curve. The laboratory analyzed a single point curve for the Aroclors 1221, 1232, 1242, 1248, and 1254, Toxaphene, and Chlordane. The data did not require qualification because no positive results were reported for the compounds analyzed with a single point calibration.

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLOR ANALYSIS

PAGE - 2

Initial Calibrations

One (1) initial calibration standard associated with the reported samples exhibited a correlation coefficient below the QC limit of 0.995.

Specific Findings

The initial calibration of 10/25/95 on GC-A contained compounds with a correlation coefficient less than 0.990 but greater than 0.850. For the samples and the non-compliant compound listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

GDA7000101
GDAE000101

Isodrin

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDA7000101	Isodrin	+/-	J/UJ
GDAE000101			

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE

CHLORINATED HERBICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8150; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5583

A validation was performed on the Herbicide Data from SDG L5583. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID

ANALYTE ID

DL QL

NO QUALIFICATIONS ARE REQUIRED.

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE

ORGANOPHOSPHORUS PESTICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8140; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5583

A validation was performed on the Organophosphorus Pesticide Data from SDG L5583. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- Calibration
- * • Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Initial Calibrations

Several initial calibration standards associated with the reported samples exhibited correlation coefficients below the QC limit of 0.995.

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLOR ANALYSIS

PAGE - 2

Initial Calibrations, Continued

Specific Findings

The initial calibration of 11/03/95 contained compounds with correlation coefficients less than 0.990 but greater than 0.850. For the samples and the non-compliant compounds listed below, the positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

GDA7000101	Disulfoton
GDAE000101	

Surrogate Recoveries

One (1) field sample exhibited a non-compliant Tributyl Phosphate recovery.

Specific Finding

The sample listed below exhibited a low DCB recovery. The positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

GDAE000101

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDA7000101 GDAE000101	Disulfoton	+/-	J/UJ
GDAE000101	ALL	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE

DIOXIN/FURANS - 8290

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, internal standard recoveries, clean-up standard recoveries, matrix spike recoveries, GC/MS high resolution performance, tuning results, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. SW-846 Method 8290; the National Functional Guidelines for Organic Data Review, where applicable; and EPA DQO Level IV requirements. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG# L5583

A validation was performed on the Dioxin/Furan Data from SDG 23560. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • Mass Resolution Checks
- * • Column Performance
- * • Calibrations
- * • Internal Standard Recovery
- Blanks
- * • Laboratory Control Samples
- N/A • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Congener Identification/Quantitation

* - All criteria were met for this parameter.

Blanks

The method blank exhibited positive results for OCDD and 2,3,4,6,7,8-HxCDF at concentration of 53.1 pg/L and 1.8 pg/L, respectively (see Table 1). The associated samples exhibited positive results 2,3,4,6,7,8-HxCDF at concentrations very similar to the method blank (2.3-2.4 pg/L).

Data Assessment Narrative

Page - 2

Table 1

Congener ID	MB Conc. (pg/L)	GDA7000101	Q	GDAE000101	Q
OCDD	53.1				
2,3,4,6,7,8-HxCDF	1.8	2.3	U	2.4	U

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

- U** = Not detected
- J** = Estimated value
- UJ** = Reported Quantitation limit is qualified as estimated
- R** = Result is rejected and unusable
- D** = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

- CRQL =** The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.
- U =** The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.
- No Action =** The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>CONGENER ID</u>	<u>DL</u>	<u>QL</u>
All samples	2,3,4,6,7,8-HxCDF	+B	U

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE METALS, CYANIDE and HEX CR

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5583

A validation was performed on the Metals Data from SDG L5583. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- Matrix Spike Recovery
- * ● Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- Serial Dilutions
- * ● MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited contamination for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Calcium	17.8 mg/kg	No impact
Iron	3.99 mg/kg	No impact
Magnesium	8.76 mg/kg	No impact
Sodium	20.7 mg/kg	No impact
Zinc	1.07 mg/kg	No impact

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Antimony	78.0 ug/l	No impact
Iron	32.2 ug/l	No impact
Sodium	77.6 ug/l	No impact
Zinc	3.76 ug/l	No impact

The USEPA requires that all sample values below five times the preparation, field, DI or calibration blank contamination be qualified as estimated, "U". The field or DI water blanks exhibited contamination but had no impact on the data.

Duplicate Analysis

Specific Finding

The Duplicate analysis for soils for Iron was outside the control limits. All positive results are qualified as estimated, "J".

Serial Dilution Analysis

Specific Findings

The Serial Dilution for waters for Sodium was outside the control limits. All positive results are qualified as estimated, "J".

Specific Finding

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B" per Ensafe's request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
All soil samples	Fe.	+	J
All water samples	Na.	+	J
All "B" results	all analytes	B	J



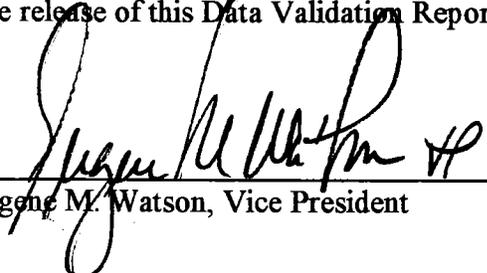
HEARTLAND
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: L5586
Date: January 26, 1996
Client Name: Ensafe, Inc.
Project/Site Name: Charleston Zone A
Date Sampled: October 11, 1995
Number of Samples: 17 Non-aqueous Sample(s) with 1 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level IV
Method(s) Utilized: SW846 Third Edition
Analytical Fractions: Volatiles, Semivolatiles, Pesticide/PCB's, Metals, and Cyanide

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:



Eugene M. Watson, Vice President



Date

SDG# L5586

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

Ensafe ID	Matrix	VOA	SV	P/P	TAL	CN
506SB00101	SOIL	X	X		X	
506SB00102	SOIL	X	X		X	
506SB00201	SOIL	X	X		X	
506SB00202	SOIL	X	X		X	
506SB00301	SOIL	X	X		X	
506SB00302	SOIL	X	X		X	
506SB00401	SOIL	X	X		X	
506SB00402	SOIL	X	X		X	
506SB00501	SOIL	X	X		X	
506SB00502	SOIL	X	X		X	
506SB00601	SOIL	X	X		X	
506SB00602	SOIL	X	X		X	
GDASB01401	SOIL	X	X	X	X	X
GDASB01402	SOIL	X	X	X	X	X
GDASB01302	SOIL			X		
002M000101	SOIL				X	
002M000201	SOIL				X	
Total Billable Samples (Water/Soil)		0 14	0 14	0 3	0 16	0 2

VOA= SW846 Volatiles

SV= SW846 Semivolatiles

P/P= SW846 Pesticide/PCB's

GRO= SW846 Gasoline Range Organics

DRO= SW846 Diesel Range Organics

TAL= CLP Metals

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT AND NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8260 Appendix IX; the National Functional Guidelines for Organic Data Review, June 1991, and DQO Level III. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG # L5586

A validation was performed on the Volatile Data from SDG L5586, The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- Internal Standard Performance
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

**DATA ASSESSMENT AND NARRATIVE
VOLATILE ANALYSIS**

PAGE - 2

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, J4086, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

506SB00601	trichlorofluoromethane
506SB00602	
506SB00302	
506SB00201	
506SB00101	
506SB00401	
GDASB01401	
GDASB01402	

The continuing calibration, J4086, contained compounds with %Ds greater than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and reject all non detects (R).

506SB00601	chloroethane
506SB00602	
506SB00302	
506SB00201	
506SB00101	
506SB00401	
GDASB01401	
GDASB01402	

The continuing calibration, J4105, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

506SB00301	trichlorofluoromethane
506SB00202	
506SB00102	
506SB00501	
506SB00502	

**DATA ASSESSMENT AND NARRATIVE
VOLATILE ANALYSIS**

PAGE - 3

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, J4124, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

506SB00402 trichlorofluoromethane

Internal Standards

All internal standard EICP areas did not meet the internal standard EICP area QA/QC criteria.

Specific Finding:

The Samples listed below, exhibited low internal standard areas. Qualify all associated positive results as estimated (J) and all non detects as estimated (UJ).

506SB00201 1,4-dichlorobenzene-d₄

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on the dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
506SB00601 506SB00602 506SB00302 506SB00201 506SB00101 506SB00401 GDASB01401 GDASB01402	trichlorofluoromethane	+/-	J/UJ
506SB00601 506SB00602 506SB00302 506SB00201 506SB00101 506SB00401 GDASB01401 GDASB01402	chloroethane	+/-	J/R
506SB00301 506SB00202 506SB00102 506SB00501 506SB00502	trichlorofluoromethane	+/-	J/UJ
506SB00402	trichlorofluoromethane	+/-	J/UJ
506SB00201	All associated analytes 1,4-dichlorobenzene-d ₄	+/-	J/R

- * DL denotes the Form I qualifier supplied by the laboratory
 QL denotes the qualifier used by the data validation firm
 + in the DL column denotes a positive result
 - in the DL column denotes a non detect result

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8270 Appendix IX; National Functional Guidelines for Organic Data Review, and DQO Level III. All comments made within this report should be considered when examining the analytical results (Form I's).

SDG # L5586

A validation was performed on the Semivolatile Data from SDG L5586. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- * • Calibrations
- Internal Standard Performance
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

Internal Standards

All internal standard EICP areas did not meet the internal standard EICP area QA/QC criteria.

Specific Finding:

The samples listed below, exhibited low internal standard areas. Qualify all associated positive results as estimated (J) and all non detects as estimated (UJ).

506SB000102

acenaphthene-d₁₀

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ANALYSIS

PAGE - 2

Compound Identification/Quantitation

Specific Finding:

For sample 506SB00102, reject all E-flagged results in favor of the D-flagged results in the diluted sample. For the diluted samples 506SB00102DL and 506SB00102DL2, reject all results (UR) except for the D-flagged results with corresponding E-flagged results.

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D= Result value is based on the dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
506SB000102	All associated analytes acenaphthene-d ₁₀	+/-	J/UJ
506SB00102	All E-flagged results	+	R
506SB00102DL 506SB00102DL2	All results except D-flagged results	+/-	R

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

CHLORINATED PESTICIDES/PCBs

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5586

A validation was performed on the Chlorinated Pesticide/PCB Data from SDG L5586. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Initial Calibration

The 4,4'-DDT breakdown was above the 20% QC limit on both columns. The reported result for 4,4'-DDE in sample GDASB01401 is qualified as estimated, J. However, the result should be considered as present based on presumptive evidence due to the non-compliant breakdown of the 4,4'-DDT in the breakdown standard.

Specific Finding

The breakdown for 4,4'-DDT was above the QC limit in the breakdown standard analyzed on both columns. The reported non-detect result for 4,4'-DDT is rejected, R, and the reported 4,4'-DDE result is qualified as estimated, J, in sample GDASB01401.

**DATA ASSESSMENT NARRATIVE
CHLORINATED PESTICIDES/PCBs**

PAGE - 2

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates that 5% of data required qualifications/rejections.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID	ANALYTE ID	DL	QL
GDASB01401	4,4'-DDT	-	R
	4,4'-DDE	+	J

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE METALS

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5586

A validation was performed on the Metals Data from SDG L5506. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- * ● Matrix Spike Recovery
- Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- * ● Serial Dilutions
- MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited contamination for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Calcium	17.8 mg/kg	no impact
Iron	3.99 mg/kg	no impact
Magnesium	8.76 mg/kg	no impact
Sodium	20.7 mg/kg	no impact
Zinc	1.07 mg/kg	no impact

The USEPA requires that all sample values below five times the preparation, field, DI or calibration blank contamination be qualified as estimated, "U". The field or DI water blanks exhibited contamination but had no impact on the data.

Duplicate Analysis

Specific Finding

The Duplicate analysis for Iron was outside the control limits. All positive results for all water samples are qualified as estimated, "J".

MSAs

Specific Finding

The post digestion spike recovery for GFAA was below the lower control limits. All positive and non-detect results for the listed samples below are qualified as estimated, "J" or "UJ".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Selenium	002M000101	75
Selenium	GDASB01402	80
Selenium	506SB00402	84

The post digestion spike recovery for GFAA was above the upper control limits. All positive results for the listed samples below are qualified as estimated, "J".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Arsenic	506SB00302	125
Thallium	506SB00601	117
Thallium	GDASB01041	116
Thallium	GDASB01402	117
Thallium	506SB00301	117
Thallium	506SB00302	117
Thallium	506SB00201	116
Thallium	506SB00101	115
Thallium	506SB00102	116
Thallium	506SB00301	116

Specific Finding

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B" per Ensafe's request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
All soil samples	Fe.	+	J
002M000101 and GDASB01402	Se.	+/U	J/UJ
506SB00302	As.	+	J
506SB00601, 301, 302, 201, 101, 102 and 301, GDASB010401 and 1402.	Tl.		
All "B" results	all analytes	B	J

ANNOTATED FORM Is



HEARTLAND

ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: L6024
Date: February 2, 1996
Client Name: Ensafe/Allen & Hoshall
Project/Site Name: Charleston; Zone ~~A~~ B
Date Sampled: December 9 - 11, 1995
Number of Samples: 6 Aqueous Sample(s) with 1 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level III
Method(s) Utilized: CLP Multimedia SOW
Analytical Fractions: Volatiles, Semivolatiles, Pesticides/PCB's, Petroleum Hydrocarbons, Organophosphorous Pesticides

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:

for *Kimberly S. Hoop*
Eugene M. Watson, Vice President

2/2/96
Date

SDG# L6024

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

ENSAFE ID	MATRIX	VOA		SVOA		P/P		TPH		HERB		OPP	
GDBEW00401	WATER	X		X		X							
GDBGW01D01	WATER	X		X		X							
GDBGW00101	WATER	X		X		X							
GDBGW00201	WATER	X		X		X							
GDBGW00301	WATER	X		X		X		X		X		X	
GDBGW04D01	WATER	X		X		X							
Total Billable Samples (Water/Soil)		6	0	6	0	6	0	1	0	1	0	1	0

VOA= CLP Volatiles

SV= CLP Semivolatiles

P/P= CLP Pesticide/PCB's

HERB= CLP Herbicides

OPP= CLP Organophosphorous Pesticides

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT AND NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA 8260; the National Functional Guidelines for Organic Data Review, June 1991, and DQO Level III. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG # L6024

A validation was performed on the Volatile Data from SDG L6024. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- * • Internal Standard Performance
- Blanks
- * • Surrogate Recoveries
- * • Laboratory Control Samples
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds and RRFs that were not within continuing calibration criteria.

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 2

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, I1258.D, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

GDBGW00401	bromomethane
GDBGW00401MS	
GDBGW00401MSD	

Method Blank

<u>Associated blank</u>	<u>Compound</u>	<u>Concentration</u>
31572MB	acetone	6.6J

<u>Samples</u>	<u>Compound</u>	<u>Qualification</u>
GDBGW01D01	acetone	U
GDBGW00101		CRQL
GDBGW00201		
GDBGW04D01		
GDAGW00201		

Reject all TICs flagged with laboratory "B" qualifier, due to method blank contamination.

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDBGW00401 GDBGW00401MS GDBGW00401MSD	bromomethane	+/-	J/UJ
GDBGW01D01 GDBGW00101 GDBGW00201 GDBGW04D01 GDAGW00201	acetone	+ +	U CRQL
All samples	"B" flagged TICs	+	R

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA 8270; National Functional Guidelines for Organic Data Review, and DQO Level III. All comments made within this report should be considered when examining the analytical results (Form I's).

SDG # L6024

A validation was performed on the Semivolatile Data from SDG L6024. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- * • Internal Standard Performance
- Blanks
- * • Surrogate Recoveries
- * • Laboratory Control Sample
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ANALYSIS

PAGE - 2

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, S0501005.D, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

31457MB	4-nitroaniline
GDAGW03D01	benzoic acid
GDAGW03D01MS	
GDAGW03D01MSD	
GDBGW01D01	
GDBGW00101	
GDBGW00201	

The continuing calibration, S0201002.D, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

GDBGW00101	benzoic acid
GDBGW00201	

Method Blank

<u>Associated blank</u>	<u>Compound</u>	<u>Concentration</u>
31457MB	bis(2ethylhexyl)phthalate	4.6J
<u>Samples</u>	<u>Compound</u>	<u>Qualification</u>
GDBGW01D01	bis(2ethylhexyl)phthalate	CRQL

Reject all TICs flagged with the laboratory qualifier "B", due to method blank contamination.

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
31457MB GDAGW03D01 GDAGW03D01MS GDAGW03D01MSD GDBGW01D01 GDBGW00101 GDBGW00201	4-nitroaniline benzoic acid	+/-	J/UJ
GDBGW00101 GDBGW00201	benzoic acid	+/-	J/UJ
GDBGW01D01	bis(2ethylhexyl)phthalate	+	CRQL
All samples	"B" flagged TICs	+	R

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLORS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991; and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L6024

A validation was performed on the Pesticide/Aroclor Data from SDG L6024. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • GC Performance
- * • Calibration
- * • Blanks
- Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Surrogate Recoveries

One (1) field sample exhibited a non-compliant DCB recovery.

Specific Finding

The sample listed below exhibited a low DCB recovery. The positive results are qualified as estimated, J, and the non-detect results are qualified as estimated, UJ.

GDBGW00101

DATA ASSESSMENT NARRATIVE

PESTICIDE/AROCLOR ANALYSIS

PAGE - 2

System Performance and Overall Assessment

Overall performance was acceptable. The data reviewer estimates less than 10% of the data required qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDBGW00101	ALL	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non-detect result

DATA ASSESSMENT NARRATIVE

CHLORINATED HERBICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8150; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L6024

A validation was performed on the Herbicides Data from SDG L6024. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data did not require qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID

ANALYTE ID

DL QL

NO QUALIFICATIONS WERE REQUIRED

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

ORGANOPHOSPHOROUS PESTICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8140; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L6024

A validation was performed on the Organophosphorous Pesticides from SDG L6024. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Initial Calibration

Specific Finding

The initial calibration analyzed exhibited one (1) compound with correlation coefficients below 0.990. All positive and non-detect results are qualified as estimated, J/UJ.

Dimethoate

System Performance and Overall Assessment

Overall performance was acceptable.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
All	Dimethoate	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

TPH AS GASOLINE AND DIESEL

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8015 modified for Gasoline and Diesel analysis; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L6024

A validation was performed on the TPH Data from SDG L6024. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data did not require qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID

ANALYTE ID

DL QL

NO QUALIFICATIONS WERE REQUIRED

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result



HEARTLAND

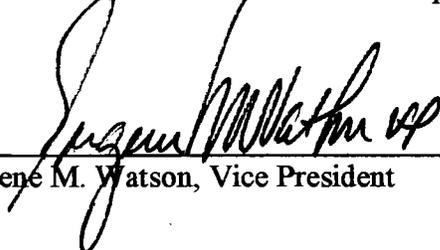
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: L5848
Date: January 26, 1996
Client Name: Ensafe, Inc.
Project/Site Name: Charleston Zone A
Date Sampled: November 14, 1995
Number of Samples: 4 Aqueous Sample(s) with 1 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level III
Method(s) Utilized: SW846 Third Edition
Analytical Fractions: Volatiles, Semivolatiles, Pesticide/PCB's, Metals, and Cyanide

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:



Eugene M. Watson, Vice President



Date

SDG# L5848

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

Ensafe ID	Matrix	VOA		SV		P/P		TAL		CN	
GDA7003D01	WATER	X		X		X		X		X	
GDAT003D01	WATER	X									
GDA3003D01	WATER	X		X		X		X		X	
GDAEB03D01	WATER	X		X		X		X		X	
Total Billable Samples (Water/Soil)		4	0	3	0	3	0	3	0	3	0

VOA= SW846 Volatiles
SV= SW846 Semivolatiles
P/P= SW846 Pesticide/PCB's
TAL= CLP Metals
CN= Cyanide

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT AND NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8260 Appendix IX; the National Functional Guidelines for Organic Data Review, June 1991, and DQO Level III. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG # L5848

A validation was performed on the Volatile Data from SDG L5848, The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- * • Internal Standard Performance
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds that were not within %D continuing calibration criteria. All RRFs were within calibration criteria.

**DATA ASSESSMENT AND NARRATIVE
VOLATILE ANALYSIS**

PAGE - 2

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, J4086, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

GDAT003D01	trichlorofluoromethane
GDAEB03D01	
GDA7003D01	
GDA3003D01	

Rinseate Blanks

<u>Associated blank</u>	<u>Compound</u>	<u>Concentration</u>
GDAEB03D01	chloroform	5.1J ug/L

<u>Samples</u>	<u>Compound</u>	<u>Qualification</u>
GDA7003D01	chloroform	U

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on the dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDAT003D01 GDAEB03D01 GDA7003D01 GDA3003D01	trichlorofluoromethane	+/-	J/UJ
GDA7003D01	chloroform	+	U

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8270 Appendix IX; National Functional Guidelines for Organic Data Review, and DQO Level III. All comments made within this report should be considered when examining the analytical results (Form I's).

SDG # L5848

A validation was performed on the Semivolatile Data from SDG L5848. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- * • Calibrations
- * • Internal Standard Performance
- Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- Compound Identification /Quantitation

* - All criteria were met for this parameter

Rinseate Blanks

<u>Associated blank</u>	<u>Compound</u>	<u>Concentration</u>
GDAEB03D01	benzoic acid	39J ug/L
<u>Samples</u>	<u>Compound</u>	<u>Qualification</u>
GDA7003D01	benzoic acid	U

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ANALYSIS

PAGE - 2

Compound Identification/Quantitation

Specific Finding:

Reject all results for the re-analyzed samples GDA30003D01RE and GDAEB03D01RE, in favor of the original sample analysis because the re-analysis was not required..

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D= Result value is based on the dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
GDA7003D01	benzoic acid	+	U
GDA30003D01RE GDAEB03D01RE	All analytes	+/-	R

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

CHLORINATED PESTICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5848

A validation was performed on the Chlorinated Pesticide Data from SDG L5848. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data did not require qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
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NO QUALIFICATIONS WERE REQUIRED

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE METALS AND CYANIDE

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5848W

A validation was performed on the Metals Data from SDG L5848W. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- * ● Matrix Spike Recovery
- * ● Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- Serial Dilutions
- MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited contamination for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Aluminum	80.6 ug/l	GDA3003D01.
Calcium	214. ug/l	GDA7003D01.
Iron	12.7 ug/l	GDA7003D01.
Magnesium	47.6 ug/l	no impact
Sodium	430. ug/l	no impact

The USEPA requires that all sample values below five times the preparation, field, DI or calibration blank contamination be qualified as non-detect, "U". The field or DI water blanks exhibited contamination but had no impact on the data.

Serial Dilution

Specific Finding

The Serial Dilutions for waters for Iron and Sodium were outside the control limits. All positive results are qualified as estimated, "J".

MSAs

Specific Finding

The post digestion spike recovery for GFAA was above the upper control limits. All positive results for the listed samples below are qualified as estimated, "J".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Selenium	GDAEB03D01	116

Specific Finding

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B" per Ensafes's request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
GDA3003D01.	Al.	+	U
GDA7003D01.	Ca and Fe.		
all samples	Fe and Na.	+	J
GDAEB03D01.	Se.	+	J
All "B" results	all analytes	B	J



HEARTLAND

ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: L5991W & L6024W
Date: February 2, 1996
Client Name: Ensafe/Allen & Hoshall
Project/Site Name: Charleston; Zone A & ZONE B
Date Sampled: December 6 - 12, 1995
Number of Samples: 16 Aqueous Sample(s) with 1 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level III
Method(s) Utilized: CLP Multimedia SOW
Analytical Fractions: Metals

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:

for Kimberly S. Stopp
Eugene M. Watson, Vice President

2/2/96
Date

SDG# L5991W & L6024W

Samples and Fractions Reviewed

Sample Identifications Analytical Fractions

ENSAFE ID	MATRIX	TAL	
GDBEW00301	WATER	X	
GDBGW00101	WATER	X	
GDBGW00201	WATER	X	
GDBGW00301	WATER	X	
GDBGW00401	WATER	X	
GDBGW01D01	WATER	X	
GDBGW04D01	WATER	X	
039GW00101	WATER	X	
039GW00301	WATER	X	
039GW00401	WATER	X	
039GW00501	WATER	X	
039GW04D01	WATER	X	
042EW00201MS	WATER	X	
042EW00201MSD	WATER	X	
Total Billable Samples (Water/Soil)			14 0

TAL = CLP Metals

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT NARRATIVE METALS, CYANIDE AND WET CHEMISTRY

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L5991W

A validation was performed on the Metals and wet chemistry Data from SDG L5991W. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- Matrix Spike Recovery
- * ● Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- Serial Dilutions
- MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited contamination for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Iron	21.9 ug/l	no impact
Sodium	133. ug/l	no impact
Zinc	6.33 ug/l	all samples below 31.7 ug/l

The USEPA requires that all sample values below five times the preparation, field, DI or calibration blank contamination be qualified as non-detect, "U". The field or DI water blanks exhibited contamination but had no impact on the data.

Matrix Spike Recovery

Specific Finding

The Matrix Spike recovery for waters for Iron was below the lower control limits. All positive and non-detect results are qualified as estimated, "J" or "UJ".

Serial Dilution

Specific Finding

The Serial Dilutions for waters for Iron and Sodium were outside the control limits. All positive results are qualified as estimated, "J".

MSAs

Specific Finding

The post digestion spike recovery for GFAA was below the lower control limits. All positive and non-detect results for the listed samples below are qualified as estimated, "J" or "UJ".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Thallium	039GW00301	74
Thallium	039GW00501	84
Thallium	039GW00401	84
Thallium	039GW04D01	84

Specific Finding

The post digestion spike recovery for GFAA was above the upper control limits. All positive results for the listed samples below are qualified as estimated, "J".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Arsenic	039GW00301	116
Arsenic	039GW00501	118

Specific Finding

All sample results left with a “B” qualifier after all other qualifications, will be qualified with a “J” qualifier in place of the “B” per Ensafe’s request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
All water samples	Zn.	+	J
All water samples	Fe.	+/U	J/UJ
All water samples	Fe and Na.	+	J
039GW00301 and 501.	As.	+	J
039GW00301, 501, 401 and 04D01.	Tl.		
All "B" results	all analytes	B	J

DATA ASSESSMENT NARRATIVE METALS, CYANIDE AND WET CHEMISTRY

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L6024W

A validation was performed on the Metals and wet chemistry Data from SDG L6024. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- Matrix Spike Recovery
- * ● Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- Serial Dilutions
- MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited contamination for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Calcium	29.4 ug/l	all samples below 147. ug/l
Iron	16.1 ug/l	all samples below 80.5 ug/l
Sodium	162. ug/l	no impact

The USEPA requires that all sample values below five times the preparation, field, DI or calibration blank contamination be qualified as non-detect, "U". The field or DI water blanks exhibited contamination but had no impact on the data.

Matrix Spike Recovery

Specific Finding

The Matrix Spike recovery for waters for Selenium was above the upper control limits. All positive results are qualified as estimated, "J".

Serial Dilution

Specific Finding

The Serial Dilutions for waters for Calcium, Magnesium and Sodium were outside the control limits. All positive results are qualified as estimated, "J".

MSAs

Specific Finding

The post digestion spike recovery for GFAA was below the lower control limits. All positive and non-detect results for the listed samples below are qualified as estimated, "J" or "UJ".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Lead	GDBGW00101	67
Lead	GDBGW01D01	60
Selenium	GDBGW00101	64
Selenium	GDBGW00201	61
Selenium	GDBGW00301	78
Selenium	GDBGW01D01	63
Thallium	GDBGW00101	53
Thallium	GDBGW00201	56
Thallium	GDBGW00301	66
Thallium	GDBGW01D01	55
Thallium	GDBEW00301	36

Specific Finding

The post digestion spike recovery for GFAA was above the upper control limits. All positive results for the listed samples below are qualified as estimated, "J".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Arsenic	GDBGW00101	118
Arsenic	GDBGW00301	120
Arsenic	GDBGW01D01	123

Specific Finding

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B" per Ensafe's request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
all samples below 80.5 ug/l	Fe.	+	U
all samples below 147. ug/l	Ca.		
all samples	Se.	+	J
all samples	Ca, Mg and Na.	+	J
GDBGW00101, 301 and 01D01.	As.	+	J
GDBGW00101 and 01D01.	Pb.	+/U	J/UJ
GDBGW00101, 201, 301 and 01D01.	Se.		
GDBGW00101, 201, 301, 01D01 and GDBEW00301.	Tl.		
All "B" results	all analytes	B	J



HEARTLAND

ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: L6022
Date: February 13, 1996
Client Name: Ensafe/Allen & Hoshall
Project/Site Name: Charleston; Zone B
Date Sampled: December 12 - 28, 1995
Number of Samples: 4 Aqueous Sample(s) with 2 MS/MSD(s)
Laboratory: Lockheed Analytical Services
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level IV
Method(s) Utilized: SW846 Third Edition
Analytical Fractions: Volatiles, Semivolatiles, Pesticides w/PCb's, Organophosphorus Pesticides, Herbicides, Dioxins, Petroleum Hydrocarbons, Metals, Chlorides, Sulfates, Hexavalent Chromium, Dissolved Solids, Cyanide

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:


Eugene M. Watson, Vice President

2-16-96
Date

SDG# L6022

Samples and Fractions Reviewed

Sample Identifications

Analytical Fractions

ENSAFE ID	MATRIX	VOA	SV	P/P	OPP	HB	DIO	TPH	TAL	CH	SUL	HCR	TDS	CN	
GDBHW04D01	WATER	X	X	X	X	X	X	X	X	X	X	X	X	X	
GDBGW00401	WATER														
042EW00201	WATER						X								
039HW00301	WATER						X								
GDBEW00301	WATER						X								
Total Billable Samples (Water/Soil)		1	0	1	0	1	0	1	0	1	0	1	0	1	0

- VOA = SW846 Volatiles
- SV = SW846 Semivolatiles
- P/P = SW846 Pesticide/PCB's
- OPP = SW846 Organophosphorus Pesticides
- HB = SW846 Herbicides
- DIO = SW846 Dioxins
- TPH = SW846 Petroleum Hydrocarbons
- TAL = SW846 Metals
- CH = SW846 Chloride
- SUL = SW846 Sulfides
- HCR = SW846 Hexavalent Chromium
- TDS = SW846 Total Dissolved Solids
- CN = SW846 Cyanide

DATA ASSESSMENT NARRATIVES

DATA ASSESSMENT AND NARRATIVE

VOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA 8260 Appendix IX; the National Functional Guidelines for Organic Data Review, June 1991, and DQO Level IV. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG # L6022

A validation was performed on the Volatile Data from SDG L6022. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- Calibrations
- * • Internal Standard Performance
- * • Blanks
- * • Surrogate Recoveries
- * • Laboratory Control Samples
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

Continuing calibrations

The continuing calibrations that were analyzed with this data package exhibited %Ds and RRFs that were not within continuing calibration criteria.

DATA ASSESSMENT AND NARRATIVE

VOLATILE ANALYSIS

PAGE - 2

Continuing calibrations (continued)

Specific Finding:

The continuing calibration, E0951.D, contained compounds with %Ds greater than 50%, but less than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as estimated (UJ).

31822MB	acetone
GDBHW04D01	trifluoromethane
GDBHW04D01MS	
GDBHW04D01MSD	

The continuing calibration, E0951.D, contained compounds with %Ds greater than 90%. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as rejected (R).

31822MB	bromomethane
GDBHW04D01	acetonitrile
GDBHW04D01MS	
GDBHW04D01MSD	

The continuing calibration, E0951.D, contained compounds with average RRF less than 0.050. For the samples and non-compliant compounds listed below, qualify all positive results as estimated (J) and all non detects as rejected (R).

31822MB	1,4-dioxane
GDBHW04D01	
GDBHW04D01MS	
GDBHW04D01MSD	

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
31822MB GDBHW04D01 GDBHW04D01MS GDBHW04D01MSD	acetone trifluoromethane	+/-	J/UJ
31822MB GDBHW04D01 GDBHW04D01MS GDBHW04D01MSD	bromomethane acetonitrile	+/-	J/R
31822MB GDBHW04D01 GDBHW04D01MS GDBHW04D01MSD	1,4-dioxane	+/-	J/R

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA 8270 Appendix IX; National Functional Guidelines for Organic Data Review, and DQO Level IV. All comments made within this report should be considered when examining the analytical results (Form I's).

SDG # L6022

A validation was performed on the Semivolatile Data from SDG L6022. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- * • Calibrations
- * • Internal Standard Performance
- * • Blanks
- * • Surrogate Recoveries
- * • Laboratory Control Sample
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

System Performance and Overall Assessment

The overall system performance was fair. The data reviewer estimates that none of the data requires qualification

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

DATA ASSESSMENT NARRATIVE

CHLORINATED PESTICIDES/PCBs

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8080; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L6022

A validation was performed on the Chlorinated Pesticide Data from SDG L6022. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data did not require qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID

ANALYTE ID

DL QL

NO QUALIFICATIONS WERE REQUIRED

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

ORGANOPHOSPHOROUS PESTICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8140; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L6022

A validation was performed on the Organophosphorous Pesticides from SDG L6022. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

Initial Calibration

Specific Finding

The initial calibration analyzed exhibited one (1) compound with correlation coefficients below 0.990. All positive and non-detect results are qualified as estimated, J/UJ.

Dimethoate

System Performance and Overall Assessment

Overall performance was acceptable.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
All	Dimethoate	+/-	J/UJ

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

CHLORINATED HERBICIDES

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8150; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L6022

A validation was performed on the Herbicides Data from SDG L6022. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data did not require qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID

ANALYTE ID

DL QL

NO QUALIFICATIONS WERE REQUIRED

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE

TPH AS GASOLINE AND DIESEL

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW-846 Method 8015 modified for Gasoline and Diesel analysis; the National Functional Guidelines for Organic Data Validation, June 1991, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L6022

A validation was performed on the TPH Data from SDG L6022. The data was evaluated based on the following parameters:

- * • Data Completeness
- * • Holding Times
- * • Calibration
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicates
- * • Field Duplicates
- * • Compound Identification
- * • Compound Quantitation

* - All criteria were met for this parameter.

System Performance and Overall Assessment

Overall performance was acceptable. The data did not require qualifications.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported Quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
------------------	-------------------	-----------	-----------

NO QUALIFICATIONS WERE REQUIRED

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

DATA ASSESSMENT NARRATIVE METALS, CYANIDE AND WET CHEMISTRY

General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the CLP ILM03.0 Method; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level IV requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

SDG # L6022W

A validation was performed on the Metals and wet chemistry Data from SDG L6024. The data was evaluated based on the following parameters.

- * ● Data Completeness
- * ● Holding Times
- * ● Calibrations
- Blanks
- * ● Interferences
- Matrix Spike Recovery
- Matrix Duplicates
- * ● Field Duplicates
- * ● Laboratory Control Samples
- Serial Dilutions
- MSAs

* - All criteria were met for this parameter.

Preparation and Field Blanks

Specific Finding

The preparation blank exhibited contamination for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Calcium	29.4 ug/l	no impact
Iron	16.1 ug/l	no impact
Sodium	162. ug/l	no impact

The USEPA requires that all sample values below five times the preparation, field, DI or calibration blank contamination be qualified as non-detect, "U". The field or DI water blanks exhibited contamination but had no impact on the data.

Matrix Spike Recovery

Specific Finding

The Matrix Spike recoveries for waters for Lead, Selenium and Thallium were below 30%. All non-detect results are rejected and all positive results are qualified as estimated, "J".

The Matrix Spike recoveries for waters for Barium, Beryllium, Chromium, Cobalt, Iron and Nickel were below the lower control limits. All positive and non-detect results are qualified as estimated, "J" or "UJ".

Duplicate Analysis

Specific Finding

The Duplicate analysis for Thallium was outside the control limits. All positive results are qualified as estimated, "J".

Serial Dilution

Specific Finding

The Serial Dilutions for waters for Calcium, Manganese, Magnesium and Sodium were outside the control limits. All positive results are qualified as estimated, "J".

MSAs

Specific Finding

The post digestion spike recovery for GFAA was below the lower control limits. All positive and non-detect results for the listed samples below are qualified as estimated, "J" or "UJ".

<u>Element</u>	<u>Sample IDs</u>	<u>% recoveries</u>
Thallium	GDBHW04D01	63

Specific Finding

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B" per Ensafe's request.

SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
All water samples	Pb, Se and Tl.	+	J
All water samples	Ba, Be, Cr, Co, Fe and Ni.	+/U	J/Uj
All water samples	Tl.	+	J
All water samples	Ca, Mg, Mn and Na.	+	J
All "B" results	all analytes	B	J

DATA ASSESSMENT NARRATIVE

DIOXIN/FURANS - 8290

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, internal standard recoveries, clean-up standard recoveries, matrix spike recoveries, GC/MS high resolution performance, tuning results, and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. SW-846 Method 8290; the National Functional Guidelines for Organic Data Review, where applicable; and EPA DQO Level IV requirements. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

SDG# L5958, L5992, L6022, L6024

A validation was performed on the Dioxin/Furan Data from SDGs L5958, L5992, L6022, and L6024. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • Mass Resolution Checks
- * • Column Performance
- * • Calibrations
- * • Internal Standard Recovery
- * • Blanks
- N/A • Laboratory Control Samples
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Congener Identification/Quantitation

* - All criteria were met for this parameter.

Blanks

The method blank exhibited positive results for 1,2,3,4,6,7,8-HpCDD, OCDD, and 2,3,4,6,7,8-HxCDF at concentrations of 10.5 pg/L, 88.6 pg/L, and 4.8 pg/L, respectively (see Table 1). One (1) congener also exhibited a EMPC that was above the detection limit, yet very low in concentration (6.5 pg/L). Positive congener results that were reported for true values (not EMPCs) that were less than Method Blank EMPCS were considered "real" since all identification criteria were met in the sample result.

Data Assessment Narrative

Page - 2

Table 1

Sample IDs	1,2,3,4,6,7,8- HpCDD	OCDD	2,3,4,6,7,8- HxCDF	OCDF
Method Blank	10.5	88.6	4.8	6.5 *
042EW00201		U		
039HW00301		U **		
GDBHW04D01		U	U	
GDBEW00301	U	NA		U

Concentrations are in pg/L

* Denotes EMPC due to poor ion ratios

** Qualified non detect due to rinseate blank contamination - see GDEW00301

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

- U** = Not detected
- J** = Estimated value
- UJ** = Reported Quantitation limit is qualified as estimated
- R** = Result is rejected and unusable
- D** = Result value is based on dilution analysis

METHOD BLANK QUALIFICATION CODES

- CRQL =** The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.
- U =** The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.
- No Action =** The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>CONGENER ID</u>	<u>DL</u>	<u>QL</u>
All samples	See Table 1		

- * DL denotes the Form I qualifier supplied by the laboratory
QL denotes the qualifier used by the data validation firm
+ in the DL column denotes a positive result
- in the DL column denotes a non detect result



HEARTLAND

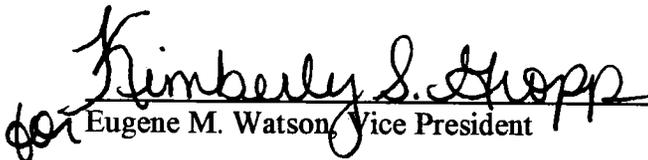
ENVIRONMENTAL SERVICES, INC.

Data Validation Report

SDG#: 25046
Date: April 19, 1996
Client Name: Ensafe/ Allen & Hoshall
Project/Site Name: Charleston; Zone B
Date Sampled: March 25, 1996
Number of Samples: 5 Non-aqueous Sample(s) with 0 MS/MSD(s)
Laboratory: Southwest Laboratory of Oklahoma
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data, June 1991 and February, 1994, respectively
QA/QC Level: EPA DQO Level III
Method(s) Utilized: SW846 Third Edition
Analytical Fractions: Semivolatiles

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:


Eugene M. Watson, Vice President

19 April 1996
Date

SDG# 25046

Samples and Fractions Reviewed

Sample Identifications Analytical Fractions

ENSAFE ID	MATRIX	SV
507SB00601	SOIL	X
507SB00701	SOIL	X
507SB00801	SOIL	X
507SB00901	SOIL	X
507SB01001	SOIL	X
Total Billable Samples (Water/Soil)		0 5

SV = SW846 Semivolatil

DATA ASSESSMENT AND NARRATIVE

SEMIVOLATILE ORGANICS

General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC/MS performance, tuning results, calibration results and internal standard areas. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8270; National Functional Guidelines for Organic Data Review, and DQO Level III. All comments made within this report should be considered when examining the analytical results (Form I's).

SDG # 25046

A validation was performed on the Semivolatile Data from SDG 25046. The data was evaluated based on the following parameters.

- * • Data Completeness
- * • Holding Times
- * • GC/MS Tuning
- * • Calibrations
- * • Internal Standard Performance
- * • Blanks
- * • Surrogate Recoveries
- * • Matrix Spike/Matrix Spike Duplicate
- * • Field Duplicates
- * • Compound Identification /Quantitation

* - All criteria were met for this parameter

System Performance and Overall Assessment

The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimates that less than 5% of the data is qualified.

GLOSSARY OF DATA QUALIFIERS

QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

SUMMARY OF DATA QUALIFICATIONS

SAMPLE ID

ANALYTE ID

DL

QL

No qualifications are required.

- * DL denotes the Form I qualifier supplied by the laboratory
- QL denotes the qualifier used by the data validation firm
- + in the DL column denotes a positive result
- in the DL column denotes a non detect result

VALIDATA

Chemical Services, Inc.

P. O. Box 930422, Norcross, GA 30093

(770) 923-3890

(770) 923-8769 (Fax)

DATA VALIDATION SUMMARY REPORT

COMPANY: Ensafe/Allen & Hoshall
SITE NAME: Charleston Navel Base, Zone B
PROJECT NUMBER: 8500.14
CONTRACTED LAB: Lockheed Analytical Services
QA/QC LEVEL: EPA Level IV
EPA METHOD: EPA SOW 3/90
VALIDATION GUIDELINES: *USEPA CLP National Functional Guidelines for Organic Data Review, 1994*
SAMPLE MATRIX: Soil
TYPE OF ANALYSIS: Semivolatile Organics
SDG NUMBER: L7280 (Level IV)

SAMPLE:

Client	Lab	Matrix	Semivolatile Organics
<u>Sample #</u> 507CB01301	<u>Sample #</u> L7280-1	Soil	X

DATA REVIEWER(S): Marvin L. Smith, Jean M. Delashmit

RELEASE SIGNATURE: 

Data Qualifier Definitions

- J - The associated numerical value is an estimated quantity.
- R - The data are unusable (the compound/analyte may or may not be present). Resampling and reanalysis are necessary for verification.
- U - The compound/analyte was analyzed for, but not detected. The associated numerical value is the sample quantitation limit.
- UJ - The compound/analyte was analyzed for, but not detected. The sample quantitation limit is an estimated quantity.

DATA QUALIFICATION SUMMARY

Lockheed Analytical Services - L7280 Level IV, CLP Organics

SAMPLE: 507CB01301

SEMIVOLATILE ORGANICS

I.) Holding Times:

All Holding Time criteria were met. No action was necessary.

II.) GC / MS Tuning:

All GC / MS Tuning criteria were met, so no action was taken.

III.) Calibration:

Initial Calibration:

The Percent Relative Standard Deviations (%RSD's) exceeded the 30% QC limit for the standards analyzed on 5/9/96 for the following compounds:

n-nitrosomethylethylamine	36.6%
2-methylphenol	37.7%
4-nitroquinoline-1-oxide	35.1%
famphur	32.8%

These compounds were not detected in the associated sample. No action was necessary.

Continuing Calibration:

The Percent Difference (%D) exceeded the 25% QC limit for the standard analyzed on 7/11/96 at 09:38 for the following compounds:

famphur	51.1%
n-nitrosomethylethylamine	36.7%

The non-detect results for these compounds in associated sample 507CB01301 were flagged as estimated (UJ).

IV.) Blanks:

Method Blank:

There were no positive detections in the method blank. No action was required.

V.) Surrogate Recoveries:

All Surrogate Recovery criteria were met. No action was necessary.

VI.) Laboratory Control Samples (LCS):

One LCS was analyzed with this SDG. All Percent Recovery criteria were met. No action was taken.

VII.) Matrix Spike / Matrix Spike Duplicate (MS / MSD):

No MS / MSD samples were analyzed in this SDG. No action was necessary.

VIII.) Field Duplicates:

Field duplicate sample 057CB01301 was analyzed in this SDG. Corresponding sample 057SB01301 was analyzed in SDG L7281. There were no calculable RPD's for this duplicate set. No action was taken.

IX.) Internal Standards Performance (ISTD's):

All Internal Standard Performance criteria were met, so no action was taken.

X.) TCL Compound Identification:

All TCL Compound Identification criteria were met, so no action was required.

XI.) Compound Quantitation and Reported Contract Required Quantitation Limits (CRQL's):

All CRQL criteria were met, so no action was taken.

XII.) Tentatively Identified Compounds (TIC's):

All TIC criteria were met, so no action was necessary.

XIII.) System Performance:

All System Performance criteria were met, so no action was taken.

XIV.) Overall Assessment of Data/General:

All laboratory data were acceptable with qualifications.

VALIDATA

Chemical Services, Inc.

P. O. Box 930422, Norcross, GA 30093

(770) 923-3890

(770) 923-8769 (Fax)

DATA VALIDATION SUMMARY REPORT

COMPANY: Ensafe/Allen & Hoshall
SITE NAME: Charleston Navel Base, Zone B
PROJECT NUMBER: 8500.14
CONTRACTED LAB: Lockheed Analytical Services
QA/QC LEVEL: EPA Level III
EPA METHOD: EPA SOW 3/90
VALIDATION GUIDELINES: USEPA CLP National Functional Guidelines for Organic Data Review, 1994
SAMPLE MATRIX: Soil
TYPE OF ANALYSIS: Semivolatile Organics
SDG NUMBER: L7281 (Level III)

SAMPLE:

Client	Lab		Semivolatile
<u>Sample #</u>	<u>Sample #</u>	<u>Matrix</u>	<u>Organics</u>
507SB01101	L7281-2	Soil	X
507SB01201	L7281-3	Soil	X
507SB01301	L7281-1	Soil	X

DATA REVIEWER(S): Marvin L. Smith, Jean M. Delashmit

RELEASE SIGNATURE: 

Data Qualifier Definitions

- J - The associated numerical value is an estimated quantity.
- R - The data are unusable (the compound/analyte may or may not be present). Resampling and reanalysis are necessary for verification.
- U - The compound/analyte was analyzed for, but not detected. The associated numerical value is the sample quantitation limit.
- UJ - The compound/analyte was analyzed for, but not detected. The sample quantitation limit is an estimated quantity.

DATA QUALIFICATION SUMMARY

Lockheed Analytical Services - L7281 Level III, CLP Organics

SAMPLE: 507SB01101, 507SB01201, 507SB01301

SEMIVOLATILE ORGANICS

I.) Holding Times:

All Holding Time criteria were met. No action was necessary.

II.) GC / MS Tuning:

All GC / MS Tuning criteria were met, so no action was taken.

III.) Calibration:

Initial Calibration:

All Initial Calibration criteria were met. No action was required.

Continuing Calibration:

All Continuing Calibration criteria were met. No action was taken.

IV.) Blanks:

Method Blank:

There were no positive detections in the method blank. No action was required.

V.) Surrogate Recoveries:

All Surrogate Recovery criteria were met. No action was necessary.

VI.) Laboratory Control Samples (LCS):

One LCS was analyzed with this SDG. All Percent Recovery criteria were met. No action was taken.

VII.) Matrix Spike / Matrix Spike Duplicate (MS / MSD):

MS / MSD samples were not analyzed in this SDG. No action was necessary.

VIII.) Field Duplicates:

Field duplicate sample 507CB01301 (corresponding to sample 507SB01301) was analyzed in SDG L7280. There were no calculable RPD's for this field duplicate set. No action was taken.

IX.) Internal Standards Performance (ISTD's):

All Internal Standard Performance criteria were met, so no action was taken.

X.) TCL Compound Identification:

All TCL Compound Identification criteria were met, so no action was required.

XI.) Compound Quantitation and Reported Contract Required Quantitation Limits (CRQL's):

All CRQL criteria were met, so no action was taken.

XII.) Tentatively Identified Compounds (TIC's):

All TIC criteria were met, so no action was necessary.

XIII.) System Performance:

All System Performance criteria were met, so no action was taken.

XIV.) Overall Assessment of Data/General:

All laboratory data were acceptable without qualifications.

Appendix F

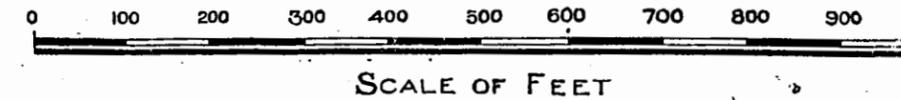
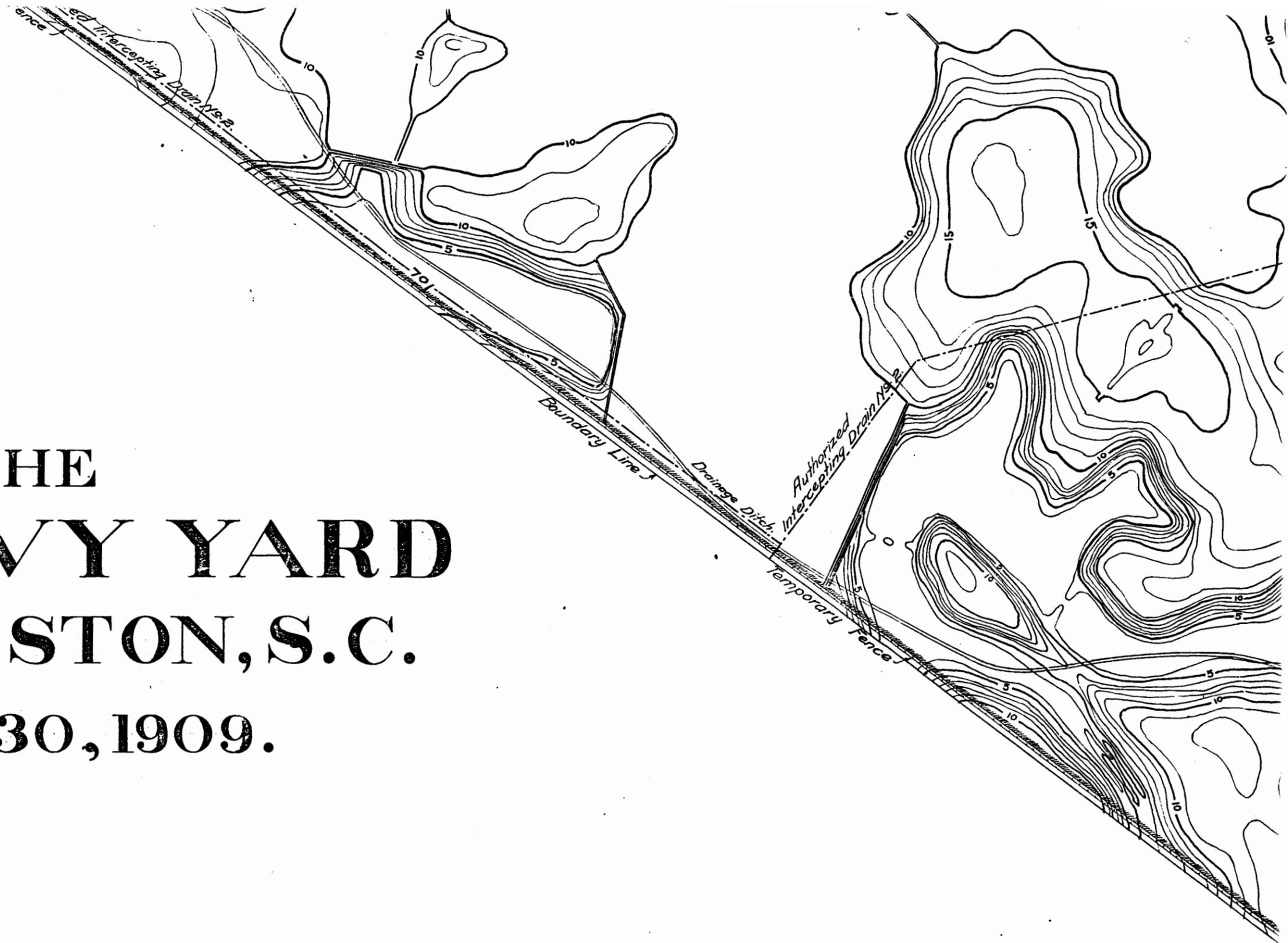
Documentation of Location of Building 1010

THE
U. S. NAVY YARD
CHARLESTON, S. C.
JUNE 30, 1909.

Accompanying Annual Report.

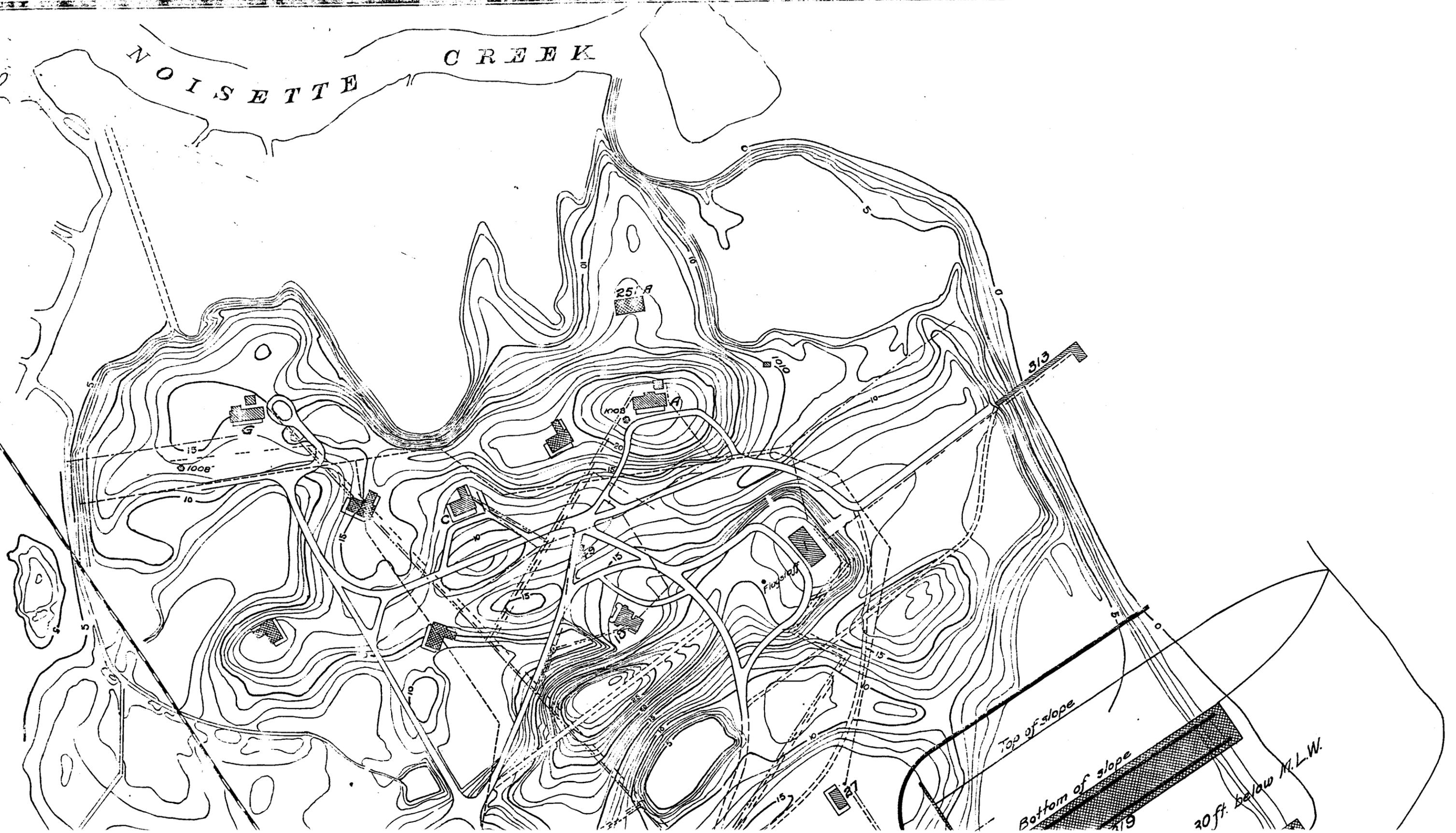
Respectfully submitted.

E. R. Gayler
Civil Engineer, U. S. N.



000675P1

NOISSETTE CREEK



- Steam Pipe.....
- Conduits.....
- Temporary Paving.....
- Pneumatic Pipe.....

YARD STRUCTURES.

- A Quarters for Commandant.
- G " " Civil Engineer.
- C " " Naval Constructor
- 1 Office building for Commandant.
- 2 C. & R. Shipfitters' Shop, with moldloft & c.
- 3 C. & R. Machine Shop.
- 5 C. & R. Joiner Shop.
- 6 C. & R. Foundry and Blacksmithshop.
- 7 Storehouse and Storekeeper's Office.
- 8 Y. & D. Workshop.
- 9 S. E. Machine Shop.
- 13 Equipment Building.
- 15 Watch house and Street Ry. Station.
- 16 Quarters for Paymaster.
- 18 " " Medical Officer.
- 19 Dispensary.
- 27 Latrine.
- 32 Central Power Station.
- 38 C. & R. Oil Storehouse.
- 49 Pump house for Artesian Well.
- 301 Dry Dock No. 1.
- 301-B Pumpwell and house.
- 311 Temporary Wharf.
- 313 " "
- 314 Pier.
- 318 Piers and slips for Torpedo Boats.
- 351 Quay Wall.
- 462 Quarters Wireless Telegraph Operators.
- 1002 Temporary Lumber Shed.
- 1003 " Locomotive Shed.
- 1004 " Marine Sick Quarters.
- 1005 " Inspectors' Office.
- 1006 " Coalbin.
- 1008 " Sentry Boxes (5).
- 109 " Marine Barracks.
- 1010 " Oil Storehouse.
- 1011 " Quarters for Off. comm. Marines.

- 1012 Temporary Icehouse and Paintshop.
- 1013 " Railroad Toolhouse.
- 1014 " Powerhouse.
- 1015 " Stable.
- 1017 " Gatehouse.
- 1018 " Ordnance Wrecking Magazine.
- 1019 " Telephone Exchange.
- 1020 " Dry Dock Latrine.
- 1021 " Storage for Docking Keel Blocks.
- 1022 " Gen. Toolhouse.
- 1023 " Cement Shed.

PROPOSED IMPROVEMENTS.

- 10 Cement Storage Shed.
- 25 Locomotive and Carhouse.
- 28 General Paintshop.
- 29 Gatehouse.
- 33 Laundry, Lavatory and Latrine.
- 34 Yard Stable.
- 37 Oil Storehouse.
- 39 Oil and Gasolene Storage.
- 47 Steel Storage Shed.
- 48 Crematory.
- 251-A Commandant's Stable.
- 4 Officers' Quarters.
- 316)
- 318) Additional Piers.
- 319)
- 317 Coaling Plant.
- 351 Quay Walls.
- 485 Cranetrack Extension.
- 490 Marine Railway.
- 625 Dredging.
- 701 Yard Wall.

THE
U. S. NAVY
CHARLES
JUNE 30

Accompanying Annual Report.

Respectfully submitted

E. R. G.
Civil Engineer

