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FINAL PHASE 2 CONFIRMATION/QUANTIFICATION STAGE 2 REPORT VOLUME 2 OF 2 APPENDICES KANSAS CITY MO

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ECOLOGY AND ENVIRONMENT

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INSTALLATION RESTORATION PROGRAM

PHASE II
CONFIRMATION/QUANTIFICATION

STAGE 2

RICHARDS-GEBAUR AIR FORCE BASE
MISSOURI

Prepared by:

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July 1988

ADMINISTRATIVE
RECORD COPY

FINAL REPORT
(September 1986 to November 1987)

VOLUME 2: APPENDICES

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UNITED STATES AIR FORCE
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(Volume 2)

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APPENDIX A

GLOSSARY OF TERMS

AAF: Army Air Field.

ABG: Air Base Group.

ACFT MAINT: Aircraft Maintenance.

AF: Air Force.

AFB: Air Force Base.

AFESC: Air Force Engineering and Services Center.

AFFF: Aqueous Film Forming Foam.

AFR: Air Force Regulation.

AFSC: Air Force Systems Command.

ALLUVIUM: Materials eroded, transported, and deposited by streams.

ALLUVIAL FAN: A fan-shaped deposit formed by a stream either where it issues from a narrow mountain valley into a plain or broad valley, or where a tributary stream joins a main stream.

ANTICLINE: A fold in which layered strata are inclined down and away from the axes.

AQUAZENE: An algicide.

ARTESIAN: Groundwater contained under hydrostatic pressure.

AQUIFER: A geologic formation, group of formations, or part of a formation that is capable of yielding water to a well or spring.

AROMATIC: Description of organic chemical compounds in which the carbon atoms are arranged into a ring with special electron stability associated. Aromatic compounds are often more reactive than non-aromatics.

ATC: Air Training Command.

AVGAS: Aviation Gasoline.

BEE: Bioenvironmental Engineer.

BES: Bioenvironmental Engineering Services

BIOACCUMULATE: Tendency of elements or compounds to accumulate or build up in the tissues of living organisms when they are exposed to these elements in their environments, e.g., heavy metals.

BIODEGRADABLE: The characteristics of a substance to be broken down from complex to simple compounds by microorganisms.

BX: Base Exchange.

CAMS: Consolidated Aircraft Maintenance Squadron.

CE: Civil Engineering.

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act.

CES: Civil Engineering Squadron.

CIRCA: About; used to indicate an approximate date.

CLOSURE: The completion of a set of rigidly defined functions for a hazardous waste facility no longer in operation.

COD: Chemical Oxygen Demand, a measure of the amount of oxygen required to oxidize organic and oxidizable inorganic compounds in water.

COE: Corps of Engineers.

CONFINED AQUIFER: An aquifer bounded above and below by impermeable strata or by geologic units of distinctly lower permeability than that of the aquifer itself.

CONFINING UNIT: A geologic unit with low permeability which restricts the movement of groundwater.

CONTAMINATION: The degradation of natural water quality to the extent that its usefulness is impaired; there is no implication of any specific limits since the degree of permissible contamination depends upon the intended end use or uses of the water.

Cr: Chemical symbol for chromium.

CS: Communications Squadron.

CSG: Combat Support Group.

DAVA: Defense Audiovisual Agency.

DCB: Dichlorobenzene.

DCM: Deputy Commander for Maintenance.

DCO: Deputy Commander for Operations.

DCRM: Deputy Commander for Resource Management.

DEQPPM: Defense Environmental Quality Program Policy Memorandum.

DET: Detachment.

DIP: The angle at which a stratum is inclined from the horizontal.

DISPOSAL FACILITY: A facility or part of a facility at which hazardous waste is intentionally placed into or on land or water, and at which waste will remain after closure.

DISPOSAL OF HAZARDOUS WASTE: The discharge, deposit, injection, dumping, spilling, or placing of any hazardous waste into or on land or water so that such waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including groundwater.

DOD: Department of Defense.

DOT: Department of Transportation.

DOWNGRADIENT: In the direction of decreasing hydraulic static head; the direction in which groundwater flows.

DPDO: Defense Property Disposal Office, previously included Redistribution and Marketing (R & M) and Salvage.

DUMP: An uncovered land disposal site where solid and/or liquid wastes are deposited with little or no regard for pollution control or aesthetics; dumps are susceptible to open burning and are exposed to the elements, disease vectors, and scavengers.

E & E: Ecology and Environment, Inc.

EFFLUENT: A liquid waste discharge from a manufacturing or treatment process, in its natural state, or partially or completely treated, that discharges into the environment.

EM: Electromagnetic.

EOD: Explosive Ordnance Disposal.

EP: Extraction Procedure, the EPA's standard laboratory procedure for leachate generation.

EPA: United States Environmental Protection Agency.

EPHEMERAL AQUIFER: A water-bearing zone typically located near the surface which normally contains water seasonally.

EROSION: The wearing away of land surface by wind, water, or chemical processes.

ETHYLENE GLYCOL: A liquid used for de-icing aircraft; it bioaccumulates and can exhibit toxic properties.

FAA: Federal Aviation Administration.

FACILITY: Any land and appurtenances thereon and thereto used for the treatment, storage, and/or disposal of hazardous wastes.

FAULT: A fracture in rock along which the adjacent rock surfaces are differentially displaced.

FLOODPLAIN: The lowland and relatively flat areas adjoining inland and coastal areas of the mainland and off-shore islands, including, at a minimum, areas subject to a one percent or greater chance of flooding in any given year.

FLOW PATH: The direction or movement of groundwater as governed principally by the hydraulic gradient.

FM: Formation (Geologic).

FPTA: Fire Protection Training Area.

FTW: Flying Training Wing.

FY: Fiscal Year.

GC/MS: Gas chromatograph/mass spectrophotometer, a laboratory procedure for identifying unknown organic compounds.

GPR: Ground Penetrating Radar.

GROUNDWATER: Water beneath the land surface in the saturated zone that is under atmospheric or artesian pressure.

GROUNDWATER RESERVOIR: The earth materials and the interstitial open spaces that contain groundwater.

HA: Health advisory, federal or state criteria for drinking water.

HALF-LIFE: The time required for half the atoms present in a radioactive substance to disintegrate.

HALON: A fluorocarbon fire extinguishing compound.

HALOGEN: The class of chemical elements including fluorine, chlorine, bromine, and iodine.

HARDFILL: Disposal sites receiving construction debris, wood, miscellaneous spoil material.

HARM: Hazard Assessment Rating Methodology.

HAZARDOUS SUBSTANCE: Under CERCLA, the definition of hazardous substance includes:

1. All substances regulated under Paragraphs 311 and 307 of the Clean Water Act (except oil);

2. All substances regulated under Paragraph 3001 of the Solid Waste Disposal Act;

3. All substances regulated under Paragraph 112 of the Clean Air Act;

4. All substances which the Administrator of EPA has acted against under Paragraph 7 of the Toxic Substance Control Act;

5. Additional substances designated under Paragraph 102 of the Superfund bill.

HAZARDOUS WASTE: As defined in RCRA, a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

HAZARDOUS WASTE GENERATION: The act or process of producing a hazardous waste.

HEAVY METALS: Metallic elements, including the transition series, which include many elements required for plant and animal nutrition in trace concentrations but which become toxic at higher concentrations.

HNU PHOTOIONIZER: Field instrument used to determine the total concentration of organic and inorganic vapors and gases with an ionization potential of less than 11.7 ev. The instrument does not respond to methane or hydrogen cyanide.

HQ: Headquarters.

HWAP: Hazardous Waste Accumulation Point.

HWMF: Hazardous Waste Management Facility.

HYDROCARBONS: Organic chemical compounds composed of hydrogen and carbon atoms chemically bonded. Hydrocarbons may be straight chain, cyclic, branched chain, aromatic, or polycyclic, depending upon arrangement of carbon atoms. Halogenated hydrocarbons are hydrocarbons in which one or more hydrogen atoms has been replaced by a halogen atom.

INCOMPATIBLE WASTE: A waste unsuitable for commingling with another waste or material because the commingling might result in generation of extreme heat or pressure, explosion or violent reaction, fire, formation of substances which are shock sensitive, friction sensitive, or otherwise have the potential for reacting violently, formation of toxic chemicals due to heat generation in such a manner that the likelihood of contamination of groundwater or escape of the substance into the environment is increased; any other reaction which might result in not meeting the air, human health, and environmental standards.

ICBM: Intercontinental Ballistic Missile.

ILS: Instrument Landing System.

INFILTRATION: The movement of water throught the soil surface into the ground.

IRP: Installation Restoration Program.

ISOPACH: Graphic presentation of geologic data, including lines of equal unit thickness that may be based on confirmed (drill hole) data or indirect geophysical measurement.

ISOPROPYL ALCOHOL: Flammable liquid used for cleaning small parts.

JP-4: Jet Propulsion Fuel No. 4, military jet fuel.

LCF: Launch Control Facility.

LEACHATE: A solution resulting from the separation or dissolving of soluble or particulate constituents from solid waste or other man-placed medium by percolation of water.

LEACHING: The process by which soluble materials in the soil, such as nutrients, pesticide chemicals, or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water.

LENTICULAR: A bed or rock stratum or body that is lens-shaped.

LF: Launch Facility.

LINER: A continuous layer of natural or man-made materials beneath or on the sides of a surface impoundment, landfill, or landfill cell which restricts the downward or lateral escape of hazardous waste, hazardous waste constituents, or leachate.

LITHOLOGY: The description of the physical character of a rock.

LOESS: An essentially unconsolidated unstratified calcareous silt; commonly homogeneous, permeable, and buff to gray in color.

LYSIMETER: A vacuum operated sampling device used for extracting pore water samples at various depths within the unsaturated zone.

MAC: Military Airlift Command.

MEK: Methyl ethyl ketone.

MERCURY AMALGAM: A solid used in dental work; contains the toxic metal mercury.

METALS: See "Heavy Metals."

MGD: Million gallons per day.

MOA: Military Operating Area.

MIK: Methyl isobutyl ketone.

MOGAS: Motor gasoline.

MONITORING WELL: A well used to measure groundwater levels and to obtain samples.

Mr/hr: Millirems/hour; a measure of radioactivity.

MSL: Mean Sea Level.

MSS: Missile Security Squadron.

MW: Monitoring well.

MWR: Morale Welfare and Recreation.

NCO: Non-commissioned Officer.

NCOIC: Non-commissioned Officer In-Charge.

NDI: Non-destructive inspection.

NET PRECIPITATION: The amount of annual precipitation minus annual evaporation.

NGVD: National Geodetic Vertical Datum of 1929.

NOAA: National Oceanic and Atmospheric Administration.

NPDES: National Pollutant Discharge Elimination System.

OEHL: Occupational and Environmental Health Laboratory.

OIC: Officer-In-Charge.

OMMS: Organization Missile Maintenance Squadron.

ORGANIC: Being, containing or relating to carbon compounds, especially in which hydrogen is attached to carbon.

Pb: Chemical symbol for lead.

PCB: Polychlorinated biphenyl; liquids used as a dielectrics in electrical equipment.

PCE: Perchloroethene, also called tetrachloroethene.

PERCOLATION: Movement of moisture by gravity or hydrostatic pressure through interstices of unsaturated rock or soil.

PERMEABILITY: The capacity of a porous rock, soil or sediment for transmitting a fluid without damage to the structure of the medium.

PERSISTENCE: As applied to chemicals, those which are very stable and remain in the environment in their original form for an extended period of time.

pCi/L: PicoCuries per liter, concentration unit for radiometric parameters.

PD-680: Cleaning solvent.

pH: Negative logarithm of hydrogen ion concentration.

PL: Public Law.

POL: Petroleum, oils and lubricants.

POLLUTANT: Any introduced gas, liquid, or solid that makes a resource unfit for a specific purpose.

POLYCYCLIC COMPOUND: All compounds in which carbon atoms are arranged into two or more rings, usually aromatic in nature.

POTASSIUM HYDROXIDE: Corrosive material, usually liquid, used for cleaning purposes.

POTENTIOMETRIC SURFACE: The surface to which water in an aquifer would rise in tightly cased wells open only to the aquifer.

PPB: Parts per billion by weight.

PPM: Parts per million by weight.

PRAMITOL: Herbicide.

PRECIPITATION: Rainfall.

PURPLE K: A bicarbonate-based fire extinguishing agent.

QUATERNARY MATERIALS: The second period of the Cenozoic geologic era, following the Tertiary, and including the last 2 to 3 million years.

RCRA: Resource Conservation and Recovery Act.

RECEPTORS: The potential impact group or resource for a waste contamination source.

RECHARGE AREA: A surface area in which surface water or precipitation percolates through the unsaturated zone and eventually reaches the zone of saturation. Recharge areas may be natural or man-made.

RECHARGE: The addition of water to the groundwater system by natural or artificial processes.

SAC: Strategic Air Command.

SANITARY LANDFILL: A land disposal site using an engineered method of disposing solid wastes on land in a way that minimizes environmental hazards.

SATURATED ZONE: That part of the earth's crust in which all voids are filled with water.

SATAF: Site Activation Task Force.

SAX'S TOXICITY: A rating method for evaluating the toxicity of chemical materials.

SCS: United States Department of Agriculture Soil Conservation Service.

SEISMICITY: Pertaining to earthquakes or earth vibrations.

SMS: Strategic Missile Squadron.

SMW: Strategic Missile Wing.

SODIUM CHROMATE: Liquid used in refrigeration/air conditioning machines; contains toxic chromium.

SOLID WASTE: Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations and from community activities, but does not include solid or dissolved materials in domestic sewage; solid or dissolved materials in irrigation return flows; industrial discharges which are point source subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended (86 USC 880); or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (68 USC 923).

SPG: Security Police Group.

SPILL: Any unplanned release or discharge of a hazardous waste onto or into the air, land, or water.

SPS: Security Police Squadron.

STORAGE OF HAZARDOUS WASTE: Containment, either on a temporary basis or for a longer period, in such a manner as not to constitute disposal of such hazardous waste.

STP: Sewage Treatment Plant.

SUPS: Supply Squadron.

SVS: Services Squadron.

TCE: Trichloroethene.

TCHTW: Technical Training Wing.

TDS: Total Dissolved Solids, a water quality parameter.

TOC: Total Organic Carbon.

TOXICITY: The ability of a material to produce injury of disease upon exposure, ingestion, inhalation, or assimilation by a living organism.

TRANSMISSIVITY: The rate at which water is transmitted through a unit width of aquifer under a unit hydraulic gradient.

TREATMENT OF HAZARDOUS WASTE: Any method, technique, or process including neutralization designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize the waste or so as to render the waste nonhazardous.

TRNS: Transportation Squadron.

TSD: Treatment, storage, or disposal.

TSDF: Treatment, storage, or disposal facility.

TTG: Technical Training Group.

TVOR: Tactical Very-high-frequency Omnidirectional Range, a ground-based radio transmitter for aircraft navigation.

UPGRADIENT: In the direction of increasing hydraulic static head; the direction opposite to the prevailing flow of groundwater.

UREA: Solid, toxic in high doses, used as a combination ground de-icer and fertilizer.

USAF: United States Air Force.

USAFSS: United States Air Force Security Service.

USDA: United States Department of Agriculture.

USFWS: United States Fish and Wildlife Service.

USGS: United States Geological Survey.

WATER TABLE: Surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere.

WWTP: Wastewater Treatment Plant.

APPENDIX B

CONTRACT DESCRIPTION OF WORK

CONTRACTOR COPY 55X

ORDER FOR SUPPLIES OR SERVICES

2. PROC INSTRUMENT ID NO. (PIIN): F33615-83-D-4003 — all packages & papers with this number.
3. CALL/ORDER NO.: 0013
4. DATE OF ORDER*: 86SEP05
5. REQUISITION/PURCHASE REQUEST PROJECT NO.: FY7624-86-01823
6. CERTIFIED FOR NATIONAL DEFENSE UNDER: DO-S1 — DOC REG 2/DMS REG 1 RATING

7. ISSUED BY — CODE F08419
DEPARTMENT OF THE AIR FORCE
AIR FORCE SYSTEMS COMMAND
AERONAUTICAL SYSTEMS DIV/PMRSC
WRIGHT-PATTERSON AFB OH 45433-6503
CONTRACT NEGOTIATOR:
GLENNITH C. JOHNSON, CAPT, USAF
PHONE: (513)-255-3042

8. ADMINISTERED BY — CODE S3305A
DCASMA BUFFALO
1103 FEDERAL BLDG.
111 WEST HURON ST.
BUFFALO NY 14202-2392

15 015

9. CONTRACTOR NAME AND ADDRESS — CODE 8R642 — FACILITY CODE (IF "9" FOR MULTIPLE FACILITIES SEE SECT "G")
ECOLOGY AND ENVIRONMENT, INC.
195 SUGG ROAD
BUFFALO NY 14225

PHONE: (716)-632-4491
COUNTY: ERIE

MAILING DATE
SEP 30 1986

DUPLICATE ORIGINAL

10. MAIL INVOICES TO

11. DISCOUNT FOR PROMPT PAYMENT
1ST N % ___ DAYS ___ NET DAYS
2ND ___ % ___ DAYS ___ OTHER (IF "9" SEE SECT "B")
3RD ___ % ___ DAYS

12A. PURCHASE OFFICE POINT OF CONTACT
LRX/L72/LRX

12B. RESERVED FOR SERVICE/AGENCY USE

13. PAYMENT WILL BE MADE BY — CODE S2202A (IF "9" SEE SECT "G")
DCASR BOSTON
495 SUMMER ST.
BOSTON MA 02210-2184

14. TYPE CONTRACTOR: J
15. SECURITY A. CLAS: U
B. DATE OF DD 254

CONTRACT ADMINISTRATION DATA

A. FAST PAY	B. CONTRACT (1) KIND	(2) TYPE	C. ABSTRACT RECIP ADP POINT	D. SPL CONT PROVISIONS	E. CONT ADMIN FUNC LMT
0		Y			

17. (RESERVED)
18. SVC/AGENCY USE
19. SURV CRIT: C
20. TOTAL AMOUNT: NOT-TO-EXCEED $ 183,468.00

21. APPROPRIATION AND ACCOUNTING DATA
A. SECTY CLAS: U
B. ACRN: AA
C. APPROPRIATION: 5763400
D. LIMIT SUBHEAD:
E. SUPPLEMENTAL ACCOUNTING CLASSIFICATION: 306 4740 5H4499 D00807 59200 000000 528500
F. CPN RECIPIENT DODAAC: F28500
G. OBLIGATION AMOUNT: $183,468.00
H. NON-CLIN/ELIN PAYMENT PROV
I. SVC AGENCY USE: FY7624-86-01823

22A. TYPE OF ORDER: DELIVERY [X] PURCHASE [ ]

B. NON-DOD CONTRACT NO.
This delivery order is subject to instructions contained on this side of form only and is issued in accordance with and subject to terms and conditions of above numbered contract, or Non-DOD Contract No.

Reference your _____
Furnish the following on terms specified herein, including, for U.S. purchases, General Provisions of Purchase Order on DD Form 1155* (EXCEPT CLAUSE NO 13 APPLIES ONLY IF THIS BOX [ ] IS CHECKED, AND NO 15 IF THIS BOX [ ] IS CHECKED), special provisions _____ and delivery as indicated. This purchase is negotiated under authority of 10 USC 2304(a)( ) or as specified in the schedule if within the U.S., its possessions or Puerto Rico; if otherwise, under 2304(a)(6).
[ ] If checked Additional General Provisions apply, supplier shall sign "Acceptance" on DD Form 1155 and return copies.

*If quantity accepted by the Government is same as quantity ordered, indicated by ✓ mark. If different enter actual quantity accepted below quantity ordered and encircle.

23. UNITED STATES OF AMERICA
HOWARD E. MARKS JR. 9/26/86 (YYMMMDD)
BY: NAME OF CONTRACTING/ORDERING OFFICER AND DATE

24. TOTAL
28. DIFFERENCES

25. QUANTITY ORDERED HAS BEEN
[ ] INSPECTED [ ] RECEIVED [ ] ACCEPTED, AND CONFORMS TO THE CONTRACT EXCEPT AS STATED

26. SHIP NO.
27. D.O. VOUCHER NO.
29. INITIALS

[ ] PARTIAL [ ] FINAL

31. PAID BY
32. Amount Verified Correct For

DATE SIGNATURE OF AUTHORIZED GOVERNMENT REPRESENTATIVE

30. PAYMENT [ ] COMPLETE [ ] PARTIAL [ ] FINAL

32. CHECK NUMBER

I CERTIFY THIS AMOUNT IS CORRECT AND PROPER FOR PAYMENT

34. BILL OF LADING NO.

SIGNATURE AND TITLE OF CERTIFYING OFFICER

36. RECEIVED AT
37. RECEIVED BY
38. DATE RECEIVED
39. TOTAL CONTAINERS
40. S/R ACCOUNT NUMBER
41. S/R VOUCHER NO.

PREVIOUS EDITION IS OBSOLETE.

AFSC FORM AUG 80 700

*When used as a formal contract this will be the effective date.

AFSC—Andrews AFB Md 1980

PART I SECTION B OF THE SCHEDULE
SUPPLIES LINE ITEM DATA

1. PROC INSTRUMENT ID NO. (PIIN)	2. SPIIN	3.
F33615-83-D-4003	0013	PAGE 2 OF 26

4. ITEM NO.	5. QUANTITY*	6. PURCH UNIT	7. UNIT PRICE	8. TOTAL ITEM AMOUNT*
0001	1	LO	$N	$N

9. CTY AS	10. ACRN	11. NSN	12. FSCM AND PART NUMBER	13. CIRR
	AA	N		

14. SITE CODES A.PQA B.ACP C.FOB	15. NOUN	16. SVC/AGENCY USE
D D	SAMPLING ANALYSIS AND DATA	15 016

17. R/MIPR DATA	18. AUTHORIZED RATE A.PROGRESS PAY B.RECOUP	19. CONTRACT PERCENT FEE	20. SVC ID NO.	21. ITEM/PROJ MGR
FY7624-86-01823	% %	%		FY7624

22. 1ST DISCOUNT A. B.DAYS	23. 2ND DISCOUNT A. B.DAYS	24. 3RD DISCOUNT A. B.DAYS	25. NET DAYS	26. QUANTITY VARIANCE A. OVER B. UNDER	27. TYPE CONTRACT	28. OPR
%	%	%		% %		

9. DESCRIPTIVE DATA

CONDUCT WORK IAW THE TASK DESCRIPTION OF THIS ORDER AND SECTION C, THE DESCRIPTION/SPECIFICATIONS OF THE BASIC CONTRACT. SUBMIT DATA IAW ATTACHMENT# 1 , THE CONTRACT DATA REQUIREMENTS LIST OF THE BASIC CONTRACT, AS IMPLEMENTED BY PARAGRAPH VI OF THE TASK DESCRIPTION.

4. ITEM NO.	5. QUANTITY*	6. PURCH UNIT	7. UNIT PRICE	8. TOTAL ITEM AMOUNT*
0002	1	LO	$N	$N

9. CTY AS	10. ACRN	11. NSN	12. FSCM AND PART NUMBER	13. CIRR
	AA	N		

14. SITE CODES A.PQA B.ACP C.FOB	15. NOUN	16. SVC/AGENCY USE
D D	SUPPORT	

17. R/MIPR DATA	18. AUTHORIZED RATE A.PROGRESS PAY B.RECOUP	19. CONTRACT PERCENT FEE	20. SVC ID NO.	21. ITEM/PROJ MGR
FY7624-86-01823	% %	%		FY7624

22. 1ST DISCOUNT A. B.DAYS	23. 2ND DISCOUNT A. B.DAYS	24. 3RD DISCOUNT A. B.DAYS	25. NET DAYS	26. QUANTITY VARIANCE A. OVER B. UNDER	27. TYPE CONTRACT	28. OPR
%	%	%		% %		

9. DESCRIPTIVE DATA

PROVIDE SUPPORT IN ACCORDANCE WITH THE TASK DESCRIPTION OF THIS ORDER AND SECTION C, THE DESCRIPTION/SPECIFICATIONS OF THE BASIC CONTRACT.

* PRESENTS NET AMOUNT OF INCREASE/DECREASE WHEN MODIFYING EXISTING ITEM NO.
N = NOT APPLICABLE
U = UNDEFINITIZED
NSP = NOT SEPARATELY PRICED
E = ESTIMATED
− (IN QTY AND $) = DECREASE
+ OR − (IN ITEM NO.) = ADDITION OR DELETION
CIRR: CONTROLLED ITEM RPT RQMT

SITE CODES: S = SOURCE, D = DESTINATION, O = INTERMEDIATE

FS FORM JAN 80 705 PREVIOUS EDITION WILL BE USED. AFB Md 1980

PART I SECTION B OF THE SCHEDULE
SUPPLIES LINE ITEM DATA

1. PROC INSTRUMENT ID NO. (PIIN)	2. SPIIN	3.
F33615-83-D-4003	0013	PAGE 3 OF 26

4. ITEM NO.	5. QUANTITY*	6. PURCH UNIT	7. UNIT PRICE	8. TOTAL ITEM AMOUNT*
0004	1	LO	$ N	$ N

SCTY CLAS | 10. ACRN | 11. NSN | 12. FSCM AND PART NUMBER | 13. CIRR

U AA N 15 017

14. SITE CODES A.PGA B.ACP C.FOB | 15. NOUN | 16. SVC/AGENCY USE

D D D CHEM ANALYSIS AND DATA

17. PR/MIPR DATA | 18. AUTHORIZED RATE A.PROGRESS PAY % B.RECOUP % | 19. CONTRACT PERCENT FEE % | 20. SVC ID NO. | 21. ITEM/PROJ MGR

FY7624-86-01823 FY7624

22. 1ST DISCOUNT A. % B.DAYS | 23. 2ND DISCOUNT A. % B.DAYS | 24. 3RD DISCOUNT A. % B.DAYS | 25. NET DAYS | 26. QUANTITY VARIANCE A. OVER % B. UNDER % | 27. TYPE CONTRACT | 28. OPR

29. DESCRIPTIVE DATA

PERFORM CHEMICAL TESTS IAW THE TASK DESCRIPTION OF THIS ORDER AND SECTION C, THE DESCRIPTION/SPECIFICATIONS OF THE BASIC CONTRACT. SUBMIT DATA IAW ATTACHMENT# 1 , THE CONTRACT DATA REQUIREMENTS LIST OF THE BASIC CONTRACT, AS IMPLEMENTED BY PARAGRAPH VI OF THE TASK DESCRIPTION.

4. ITEM NO.	5. QUANTITY*	6. PURCH UNIT	7. UNIT PRICE	8. TOTAL ITEM AMOUNT*
			$	$

SCTY CLAS | 10. ACRN | 11. NSN | 12. FSCM AND PART NUMBER | 13. CIRR

14. SITE CODES A.PGA B.ACP C.FOB | 15. NOUN | 16. SVC/AGENCY USE

17. PR/MIPR DATA | 18. AUTHORIZED RATE A.PROGRESS PAY % B.RECOUP % | 19. CONTRACT PERCENT FEE % | 20. SVC ID NO. | 21. ITEM/PROJ MGR

22. 1ST DISCOUNT A. % B.DAYS | 23. 2ND DISCOUNT A. % B.DAYS | 24. 3RD DISCOUNT A. % B.DAYS | 25. NET DAYS | 26. QUANTITY VARIANCE A. OVER % B. UNDER % | 27. TYPE CONTRACT | 28. OPR

29. DESCRIPTIVE DATA

*REPRESENTS NET AMOUNT OF INCREASE/DECREASE WHEN MODIFYING EXISTING ITEM NO.

N = NOT APPLICABLE
U = UNDEFINITIZED
NSP = NOT SEPARATELY PRICED

E = ESTIMATED
− (IN QTY AND $) = DECREASE
+ OR − (IN ITEM NO.) = ADDITION OR DELETION
CIRR: CONTROLLED ITEM RPT RQMT

SITE CODES: S = SOURCE, D = DESTINATION, O = INTERMEDIATE

AFSC FORM JAN 80 705 PREVIOUS EDITION WILL BE USED. AFB Md 1980

INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION (STAGE 2)
RICHARDS-GEBAUR AFB MO

15 018

I. DESCRIPTION OF WORK

The overall objective of the Installation Restoration Program (IRP) Phase II investigation is to assess potential contamination at past hazardous waste disposal and spill sites on Air Force installations. A series of staged field investigations may be required to meet this objective.

The intention of this staged investigation is to undertake a field and laboratory study at Richards-Gebaur AFB MO to: (1) confirm the presence or absence of contamination within the specified areas of investigation; (2) if possible, determine the extent and degree of contamination and the potential for migration of those contaminants in the various environmental media; (3) identify public health and environmental hazards of migrating pollutants based on state or Federal standards for those contaminants; and (4) delineate additional investigations required beyond this stage to reach the Phase II objectives.

The IRP Phase I Report and Phase II Stage 1 Report (mailed under separate cover) incorporate the background and description of the sites/zones for this task. To accomplish this survey effort, the contractor shall take the following actions:

A. General Requirements

1. Conduct a literature search of local hydrogeologic conditions to complement the Phase I and Phase II Reports (mailed under separate cover). Include the pertinent literature search information in an appendix of the Final Report. Develop the literature search data using the following guideline:

a. Topographic data

b. Geologic data

(1) Structure

(2) Stratigraphy

(3) Lithology

c. Hydrogeologic data

(1) Location of all existing and abandoned wells, observation wells, springs, ponds (natural and artificial) and seepages, that occur on or off the installation within a one-mile radius of sites to be investigated

(2) Groundwater table and piezometric contours

(3) Depth to groundwater

(4) Surface and groundwater quality

(5) Delineated areas of recharge, discharge and contributing areas

(6) Geologic setting, yield data and hydrographs of springs and natural seepages

d. Data on all existing and abandoned wells, including uncased boreholes, on or off the installation and within a one-mile radius of sites to be investigated

(1) Location, depth, diameter, well type, and lithologic logs associated with the well

(2) Static and pumping water levels, well hydrographs, yield, specific capacity, and related data

(3) Existing and projected groundwater development and use

(4) Well and screen corrosion, crustation, and similar operation and maintenance problems

(5) Observation and monitoring well networks, pumping influences, barrier and recharge boundaries, and related hydraulic interferences influencing aquifer behavior.

(6) Existing water sampling sites

e. Aquifer data

(1) Type, i.e., unconfined, artesian, or perched

(2) Thickness, depth to aquifer, and formational designation

(3) Barrier and recharge boundaries

(4) Transmissivity, storativity, and permeability (gpd/ft^2)

(5) Specific retention

(6) Delineation of discharge and recharge areas

(7) Ground and surface water relationships

(8) Aquifer models

f. Climatic data

(1) Precipitation (total and net)

(2) Evapotranspiration

2. Determine the areal extent of the sites by reviewing historical and current panchromatic and infrared aerial photography.

B. Technical Operations Plan

Immediately after the Notice To Proceed (NTP) for the delivery order, develop a Technical Operations Plan (TOP) based on the technical requirements specified in this task description. (See Sequence No. 19, Item VI below). Follow the TOP format (mailed under separate cover). Provide the TOP to the USAFOEHL within two weeks of the NTP.

C. Health and Safety

Comply with USAF, OSHA, EPA, state and local health and safety regulations regarding the proposed work effort. Use EPA guidelines for designating the appropriate levels of protection needed at the study sites. Prepare a written Health and Safety Plan for the proposed work effort and coordinate it directly with applicable regulatory agencies prior to commencing field operations. Provide an information copy of the Health and Safety Plan to the USAFOEHL after coordination with regulatory agencies. The Health and Safety Plan is specified in Sequence No. 7, Item VI below.

D. Drilling and Soils Work

1. Determine the exact location of all monitor wells, soil borings, and test pits during the planning/mobilization phase of the field investigation. Consult with base personnel to minimize disruption of base activities, to properly position wells with respect to exact site locations, and to avoid underground utilities. Direct the drilling and sampling and maintain a detailed log of the conditions and materials penetrated during the course of the work. Do not drill boreholes into or position wells in actual landfill areas, install wells at the landfill perimeter.

2. Monitor the ambient air during all well drilling, soil boring and test pit work with a photoionization meter or equivalent organic vapor detector to identify the generation of potentially hazardous and/or toxic vapors or gases. Include air monitoring results in the boring logs. If soil encountered during borehole drilling or test pit work is suspected to be hazardous because of abnormal discoloration, odor or air monitoring levels, containerize the soil cuttings in new, unused drums. Enter into the boring logs the depth(s) from which suspected contaminated soil cuttings were collected for containerization. Collect a maximum of 10 composite samples, one from the contents of each drum. Test each composite sample for EP Toxicity (metals). Use RCRA criteria to determine if soil cuttings must be classified as hazardous waste (40 CFR 261.24).

3. Groundwater Monitoring Wells

a. Installation of Groundwater Monitoring Wells

(1) Comply with U.S. EPA Publication 330/9-S1-002, NEIC Manual for Ground Water/Subsurface Investigations at Hazard Waste Sites for monitoring well installation.

(2) All well drilling, development, purging, sampling methods, and other activity pertaining to this effort must conform to state and other applicable regulatory agency requirements. Cite references in an appendix to the Final Report.

(3) Install wells at a sufficient depth to collect samples representative of aquifer quality and to intercept contaminants if they are present.

(4) Avoid, when possible, installing wells in depressions or areas subject to frequent flooding and standing water. If wells must be installed in such areas, design the wells such that standing water does not leak into the top of the casing or cascade down the annular space.

(5) Drill all monitoring wells using the following specifications:

(a) Drill wells using hollow-stem auger techniques. A center stem, plug, and bit attached to the stem may be inserted into the auger for use while drilling. This will prevent material from entering into the hollow stem of the auger.

(b) Take lithologic samples at five-foot intervals and prepare borehole log descriptions. Include pilot boring logs and well completion summaries in the Final Report (Item VI, below).

(c) Drill a maximum of 6 wells. Total footage for all wells in this task shall not exceed 200 linear feet. Refer to the site specific details in Section I.H.

(d) Construct each well with ~~four~~ two* inch inside diameter (I.D.) Schedule ~~80~~ 40* PVC casing. Use threaded screw-type joints, glued fittings are not permitted. Flush thread all connections. Screen each well using four-inch I.D. casing having up to 0.020 inch slots; slot size may be smaller based upon borehole geology. Screen material must be the same as that of the casing. Cap the bottom of the screen.

(e) Screen all wells so as to collect floating contaminants and to allow for yearly fluctuations of the water table. Screen all shallow wells a minimum of ten feet.

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* As per Capt. Johnson 6/23/86

(6) Complete all monitoring wells using the following specifications:

(a) Once the casing is installed, allow the soil formation to collapse around the well screen. Supplement the natural gravel-pack with washed and bagged rounded silica sand or gravel with a grain size distribution compatible with the screen and soil formation. Place the pack from the bottom of the borehole to two feet above the top of the screen. Tremie a five foot bentonite seal (granulated or pellets) above the sand/gravel pack. Ensure the bentonite forms a complete seal. Grout the remainder of the annulus to the land surface with a Type I Portland cement/bentonite slurry.

(b) Check with the Base point of contact (POC) to determine whether wells shall be completed flush or project above the ground surface.

1 If well stick-up is of concern in an area, complete the well flush with the land surface. Cut the casing two to three inches below land surface, and install a protective locking lid consisting of a cast-iron valve box assembly. Center the lid assembly in a three foot diameter concrete pad sloped away from the valve box. Ensure that free drainage is maintained within the valve box. Also, provide a screw-type casing cap to prevent infiltration of surface water. Maintain a minimum of one foot clearance between the casing top and the bottom of the valve box. Clearly mark the well number on the valve box lid.

2 If an above-ground-surface completion is used, extend the well casing two or three feet above land surface. Provide an end-plug or casing cap for each well. Shield the extended casing with a steel guard pipe which is placed over the casing and cap, and seated in a two-foot by two-foot by four-inch concrete surface pad. Slope the pad away from the well sleeve. Install a lockable cap or lid on the guard pipe. Install three, three-inch diameter steel guard posts if the Base POC determines the well is in an area which needs such protection. The guard posts shall be five feet in total length and installed radially from each wellhead. Recess the guard posts approximately two feet into the ground. Do not install the guard posts in the concrete pad placed at the well base. Paint the protective steel sleeve and clearly number the well on the sleeve exterior.

3 Provide locks for both flush and above-ground well assemblies. Turn over the lock keys to the Base POC following completion of the field effort.

(c) Develop each well as soon as practical after completion with a submersible pump, bailer, and/or airlift method. Continue well development until the discharge water is clear and free of sediment to the fullest extent possible. Measure the rate of water produced, the pH, specific conductance and water temperature during well development and include this information in the Final Report.

(d) Determine by survey the elevation of all newly installed monitoring wells to an accuracy of 0.01 foot. Notch the top of the

riser casing where well elevations are established. Horizontally locate the new wells to an accuracy of 1.0 foot and record the position on both project and site-specific maps. Bench marks used must have previously been established from and are traceable to a USCGS or USGS survey marker.

(e) Measure water levels at all monitoring wells as feet below the ground surface or below the top of casing elevation to the nearest 0.01 foot. Report as mean sea level (MSL). Measure static water levels in wells prior to well development and before all well purging which precedes sampling events.

b. Recommend a candidate well abandonment method(s) or technique(s) which is applicable to the type of monitoring wells installed and geological conditions. Consider that these wells will be abandoned at some future date after the study objectives have been met and there is no longer a need for the wells. The actual process of well abandonment is not a part of this task order. Assure that the recommended method(s) meets state and/or local well abandonment guidelines or regulations.

c. Complete permits, applications, and other documents which may be required by local and/or state regulatory agencies for the installation of monitoring wells. File these documents with appropriate agencies and pay all permitting and filing fees.

4. Soil Borings

a. Conduct a maximum of 12 soil borings not to exceed a total of 250 linear feet. Accomplish the borings using hollow stem auger techniques. Obtain split-spoon samples at five foot intervals, using ASTM Method D-1586. Refer to Section I.H. for collection details of soil samples requiring laboratory analysis. Where sample collection depths are not specified, take samples in zones of suspected contamination as determined by abnormal soil discoloration, odor or air monitoring levels.

b. Scan all split-spoon soil cores with a photoionization meter or equivalent organic vapor detector. Include monitoring results in the boring logs.

c. During the boring operations, describe lithologies encountered and prepare stratigraphic logs. Place special emphasis on field identification of contaminated soils encountered.

d. Whenever possible, measure water levels in all boreholes after the water level has stabilized. Examine the water surface for the presence of hydrocarbons. Include this information in the boring logs.

e. Tremie-grout all boreholes to the surface with bentonite. It is especially important to insure that they be adequately resealed to preclude future migration of contaminants.

f. Permanently mark each location where soil borings are drilled. Record the location on a project map for each specific site or zone, whichever is applicable.

g. Perform a maximum of three shallow soil augerings using a hand auger. Total footage shall not exceed 50 feet.

30 (from pg. 13)

5. Well and Borehole Cleanup

Remove all well/borehole cuttings and clean the general area following the completion of each well/borehole. Containerize and store cuttings suspected to be contaminated according to paragraph I.D.2. of this task order. Transport these drums to a location within the installation boundary designated by the Base POC. The base is responsible for ultimate disposal of contaminated soils using base resources.

E. Decontamination Procedures

1. Decontaminate all sampling equipment, including internal components, prior to use and between samples to avoid cross-contamination. Wash equipment with a laboratory-grade detergent followed by drinking quality water, solvent (methanol), and distilled water rinses. Allow sufficient time for the solvent to evaporate and the equipment to dry completely before reuse.

2. Dedicate for each well the monofilament line or steel wire used to lower sampling equipment into the well; do not use a line in more than one well. Decontaminate the calibrated water level probe for measuring well volume and water level elevation before use in each well.

3. Thoroughly clean and decontaminate the drilling rig and tools before initial use and after each borehole completion. As a minimum, steam clean drill bits after each borehole is installed. Drill from the "least" to the "most" contaminated sites, if possible.

F. Field Sampling

1. Strictly comply with the sampling techniques, maximum holding times, and sample preservation as specified in the following references: Standard Methods for the Examination of Water and Wastewater, 16th Edition (1985), pages 37-44; ASTM, Section 11, Water and Environmental Technology; Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 2nd Edition (USEPA, 1984); Methods for Chemical Analysis of Waters and Wastes, EPA Manual 600/4-79-020, pages xiii to xix (1983); and the Handbook for Sampling and Sample Preservation of Water and Wastewater, EPA Document 600/4-82-029 (1982).

2. Groundwater Monitoring Wells

a. After development, allow wells to stabilize for a minimum of seven days before sampling.

b. Prior to purging the wells, examine the surface of the water table for the presence of hydrocarbons and take water level measurements to the nearest 0.01 foot with respect to the established survey point on top of the well casing. If applicable, measure the thickness of the hydrocarbon layer.

c. Purge the well using a submersible pump, bailer, or other pertinent method. Purge until a minimum of three well volumes (based on borehole diameter) of water has been displaced and the pH, temperature, specific conductance, color, and odor of the discharge have stabilized using the following criteria: pH ± 0.1 unit, temperature ± 0.5°C, and specific conductance ± 10 µmhos. Include the final measurements in the Results section of the report.

d. Collect water samples with a Teflon bailer. However, to collect representative aquifer samples where floating hydrocarbons are present, use a "thief sampler" or similar device to minimize the influence of the free product.

e. If the well(s) cannot be sampled due to well development, well characteristics, or other reason(s), indicate the reason(s) in the report as specified in Item VI below.

f. Remeasure water levels after sampling and the wells have stablized.

3. For surface water/sediment samples, collect samples so as not to cause cross-contamination; obtain downstream samples first. Measure, on site, the pH, temperature, and specific conductance for all water samples.

4. Permanently mark the location where surface water or sediment samples are collected. Record the location on a project map for each specific site or zone, whichever applies.

5. Split all water and soil samples. Analyze one set and immediately deliver the other set (the same collection day) to the Base POC. The Base POC will select 10% of the split samples, package the selections with appropriate forms, and deliver them to the contractor within 24 hours of receipt. Supply all packing and shipping materials to the Base POC for packaging the split samples. Immediately ship (within 24 hours) the POC-selected samples through overnight delivery to:

USAFOEHL/SA
Bldg 140
Brooks AFB TX 78235-5501

For all split samples sent to the USAFOEHL, complete an AF Form 2752A "Environmental Sampling Data" and/or an AF Form 2752B "Environmental Sampling Data - Trace Organics", (working copies will be provided under separate cover) with the following information:

a. Date and time collected

b. Purpose of sample (analyte and sample group)

c. Installation name (base)

d. Sample number

e. Source/location and depth of sample

f. Contract Task Numbers and Title of Project

g. Method of collection (bailer, suction pump, air-lift pump, etc.)

h. Volumes removed before sample taken (well samples only)

i. Special conditions (use of surrogate standard, etc.)

j. Preservatives used

k. Collector's name or initials

In addition, label each sample container with a permanent ink pen (water-proof laundry marker) to reflect the data in a, b, c, d, j and k above.

6. For every 10 field samples collected, take at least one additional sample (a field duplicate) for quality control purposes. Table 1 provides a 10% allowance for these additional analyses. Duplicates shall be indistinguishable from other analytical samples so that personnel performing the analyses are not able to determine which samples are duplicates.

7. For every 20 field water samples collected, prepare and submit for analysis one field blank for all parameters analyzed in water. A minimum of one field blank for each parameter is required. Allowances for these additional analyses are included in Table 1.

8. Maintain chain-of-custody records for all samples, field blanks, and quality control samples.

G. Chemical Analyses

1. Analyze water and soil samples collected as specified in Section H below, Specific Site Work. The analytical parameters are summarized in Table 1 along with the required methods.

2. All analyses shall meet the required limits of detection for the applicable method identified in Table 1.

3. For those methods which employ gas chromatography (GC) as the analytical technique (SW8010, SW8020, E601, E602, E604, etc.) positive confirmation of identity is required for all analytes having concentrations higher than the Method Detection Limit (MDL). Conduct positive confirmation by second-column GC; however, gas chromatography/mass spectroscopy (GC/MS) can be used for positive confirmation if the quantity of each analyte to be confirmed is above the detection level of the GC/MS instrument. Analytes which cannot be confirmed will be reported as "Not Detected" in the body of

the report, but results of all second-column GC or GC/MS confirmational analyses are to be included in the report appendix along with other raw analytical data. Base the quantification of confirmed analytes on the first-column analysis. The maximum number of second-column confirmational analyses shall not exceed fifty percent (50%) of the actual number of field samples (to include duplicates). The total number of samples for each GC method listed in Table 1 includes this allowance. If GC/MS, or a combination of second-column GC and GC/MS, is used, the total cost of all such analyses for a particular parameter shall not exceed the funding allowed for positive confirmation using only second-column GC.

4. All chemical/physical analyses shall conform to state and other applicable Federal and local regulatory agency legal requirements. If a regulatory agency specifies that a type of analysis be performed in a certified laboratory, assure compliance with the requirement and furnish documentation showing laboratory certification with the first analytical data supplied to the USAFOEHL/TS.

5. Archive all raw data, including QA/QC and standards data, for not less than five years after project completion. Supply these data to the USAFOEHL/TS upon request.

H. Specific Site Work

In addition to items delineated in I.A. through I.G. above, conduct the following specific actions at the sites listed below:

1. South Landfill (Site 1)

a. Perform one soil boring to an approximate depth of 15 feet. Obtain a maximum of 3 soil samples from the boring. The selection of soil samples for chemical analysis shall be based on OVA or HNU meter readings, discoloration, odor, or other signs of contamination. Record the OVA/HNU readings and other observations with the soil boring logs. Take a water sample from the boring if groundwater is encountered.

b. Take a maximum of three soil or sediment samples along the perimeter of the landfill along Scope Creek. Take one background soil or sediment sample upstream of the landfill along the creek.

c. Take a maximum of three water samples from Scope Creek adjacent to the landfill or from any leachate seeps detected. Take one background water sample upstream along Scope Creek.

d. Analyze soil/sediment samples for petroleum hydrocarbons, aromatic volatile organics and halogenated volatile organics.

e. Analyze water samples for petroleum hydrocarbons, total dissolved solids (TDS), halogenated and aromatic volatile organics, 13 priority pollutant metals, extractable priority pollutants (GC/MS), common anions, and phenols.

2. Northeast Landfill (Site 2)

a. Locate and review any available new information dealing with the Northeast Landfill and nearby sewer lines. Locate and interpret any aerial photographs of the site when it was in operation.

b. Perform a magnetometer and an electromagnetic survey of the site.

c. Perform six soil borings each approximately 20 feet deep, three borings for the west trench and three borings for the double trench. Obtain a maximum of 3 soil samples per boring (a maximum of 18 total soil samples). Select the soil samples based on OVA or HNU meter readings, discoloration, odor or other signs of contamination. Obtain a water sample from each boring if water is encountered (a maximum of 5 water samples (Note: One boring will be coverted to a well).

d. Convert one boring into a monitoring well immediately downgradient of the newly discovered trench areas in the west part of the landfill. Install one background monitoring well immediately north of the landfill. Collect a water sample from each well.

e. Collect water samples from the three existing monitoring wells at the site.

f. Collect water samples from Scope Creek upgradient and downgradient of this landfill (2 samples).

g. Analyze soil samples for petroleum hydrocarbons, aromatic volatile organics, and halogenated volatile organics.

h. Analyze water samples for petroleum hydrocarbons, TDS, halogenated and aromatic volatile organics, 13 priority pollutant metals, extractable priority pollutants (GC/MS), common anions, and phenols.

3. North Burn Area (Site 6)

a. Perform soil gas analysis with a maximum of 30 holes/probes to characterize contamination from the site. Siting of borings and wells will be based on the results of the soil gas survey.

b. Perform three soil borings each approximately 15 feet deep along the perimeter of the pit. Obtain a maximum of 9 soil samples from the boreholes based on OVA/HNU meter readings, discoloration, odor, or other indications of contamination. Collect a water sample from each borehole if water is encountered for a maximum of three water samples.

c. Install 3 wells. Two of the wells shall be installed downgradient of the site and the other upgradient. Each well shall be sampled once for a total of three water samples.

d. Obtain six composite soil surface samples to a depth of 12 inches covering the area of overflow and along the surface drainage pathway.

e. Collect one surface water sample from any ponded water in the drainage pathways.

f. Analyze the soil samples for petroleum hydrocarbons, aromatic volatile organics and halogenated volatile organics.

g. Analyze water samples for petroleum hydrocarbons, aromatic and halogenated volatile organics.

4. Herbicide Burial Area (Site 8)

a. A maximum of four composite soil samples will be taken from areas of stressed vegetation. One water sample will be taken from the small pond which drains the site.

b. Analyze the soil samples for herbicides (EPA 8150), arsenic and mercury.

c. Analyze the water sample for pesticides (EPA 608, 509A, and 509B) arsenic, mercury, and TDS.

5. Oil Saturated Area (Site 9)

a. Perform 1 soil boring approximately 15 feet deep. Obtain a maximum of 3 split spoon soil samples for analysis based on OVA or HNU meter reading, discoloration, odor, or other indications of contamination. Collect a water sample from the borehole if water is encountered.

b. Collect a maximum of six composite surface soil samples from the area draining the oil saturated zone.

c. Collect a water sample from the surface water drainage pathway downgradient from the site.

d. Analyze the soil samples for petroleum hydrocarbons, lead and halogenated and aromatic volatile organics.

e. Analyze water samples for petroleum hydrocarbons, lead, TDS, and halogenated and aromatic volatile organics.

6. Hazardous Waste Drum Storage Area, Bldg 923 (Site 10)

a. Perform one soil boring inside the compound near the stained area approximately 15 feet deep. Obtain a maximum of 3 soil samples from the boring. Obtain a water sample from the borehole if water is encountered.

b. Collect six surface soil samples, one from the stained area, four downgradient, and one upgradient from the stained area.

c. Collect a maximum of two surface water samples from the surface drainage pathway, one upgradient and one downgradient from the stained area. The surface drainage pathway will only be sampled if water is present during fieldwork.

d. Analyze soil samples for petroleum hydrocarabons, EP toxicity (metals), and halogenated and aromatic volatile organics.

e. Analyze water samples for petroleum hydrocarbons, TDS, priority pollutant metals, barium, mercury and halogenated and aromatic volatile organics.

7. POL Storage Area (Site 12)

a. Hand auger three borings at locations selected in the field for a maximum of 30 feet of hand augering. Collect a maximum of 3 soil samples from each boring. Selection of samples will be based on indications of contamination detected in the field.

b. Install one downgradient well to an approximate depth of 20 feet. Collect one water sample from the well.

c. Collect two soil/sediment samples, one from each of the outfall drains from Bldg 953.

d. Collect three surface water samples, two from the stream draining the POL tank area and one from the drain outfall from Bldg 953.

e. Analyze the four water samples for petroleum hydrocarbons, TDS, and aromatic volatile organics.

f. Analyze soil samples for petroleum hydrocarbons and aromatic volatile organics.

I. Data Review

1. Tabulate field and analytical laboratory results, including field and laboratory parameters and QA/QC data, as they become available and incorporate them into the next monthly R&D Status Report (Sequence No.1, Item VI below) forwarded to the USAFOEHL. In addition to the results, report the following:

a. the time and dates of sample collection, extraction (if applicable) and analysis;

b. the method used and Method Detection Limits achieved;

c. the chain-of-custody forms;

d. a cross-reference of laboratory sample numbers and field sample numbers; and

e. a cross-reference of field sample numbers to wells, boreholes, sites, etc.

2. Upon completion of all analyses, tabulate and incorporate all results into an Informal Technical Information Report (Sequence No. 3, Item VI below) and forward the report to USAFOEHL for review a minimum of two weeks prior to submission of the draft report. Provide as a minimum the information specified in I.I.1 above.

3. Immediately report to the USAFOEHL Program Manager or his supervisor, via telephone, data/results generated during this investigation which indicate a potential health risk (for example, a contaminated drinking water aquifer). Follow the telephone notification with a written notice within three days; attach a copy of the laboratory raw data (e.g., chromatogram).

J. Reporting

1. Prepare a draft report delineating all findings of this field investigation and forward it to the USAFOEHL (as specified in Sequence No. 4, Item VI below) for Air Force review and comment. Strictly adhere to the USAFOEHL report format (mailed under separate cover). The format is an integral part of this delivery order. Draft reports are considered "drafts" only in the sense that they have not been reviewed and approved by Air Force officials. In all other respects, "drafts" must be complete, in the proper format, and free of grammatical and typographical errors. Include, as a minimum, discussion of the regional/site-specific hydrogeology, well and boring logs, data from water level surveys, groundwater surface and gradient maps, water quality and soil analysis results, available geohydrologic cross-sections, and laboratory and field QA/QC information. For states requiring the field work or technical effort be supervised by a state-registered geologist, engineering geologist or professional engineer, insert this information in the report to include registration numbers, certificates and seals (as appropriate).

2. Review the Results, Conclusions and Recommendations concerning the sites listed in this task which were investigated during a previous IRP Phase II staged work effort. Use this information and data from previous efforts to establish trends and develop conclusions and recommendations. Integrate all investigative work done at each site to date so the report reflects the total cumulative information for each site studied in this effort.

3. In the Results section, include water and soil analytical results and field quality control sample data. Report all internal laboratory quality control data (lab blanks, lab spikes and lab duplicates) and laboratory quality assurance information in an appendix of the report. Also provide second-column confirmation results and quantities, and include which columns were used, instrument operating conditions, and retention times. Summarize in the appendix the specific collection technique, analytical method (Standard Methods, EPA, etc.), holding time, and limit of detection for each analyte ..

4. Make estimates of the magnitude, extent and direction which detected contaminants are moving. Identify potential environmental

consequences of the discovered contaminants based upon state or Federal standards.

5. Plot and map all field data collected for each site according to surveyed positions.

6. In the Recommendation section, address each site and list them by category:

a. Category I consists of sites where no further action (including remedial action) is required. Data for these sites are considered sufficient to rule out unacceptable public health or environmental hazards.

b. Category II sites are those requiring an additional Phase II effort to determine the direction, magnitude, rate of movement and extent of detected contaminants. Identify potential environmental consequences of discovered contamination.

c. Category III sites are those that will require remedial action (ready for IRP Phase IV). In the recommendations for Category III sites, include a discussion of any possible influence on sites in Categories I and/or II due to their connection with the same hydrological system. Clearly state any dependency between sites in different categories. Include a list of candidate remedial action alternatives, including long term monitoring (LTM) as remedial action, and the corresponding rationale that should be considered in selecting the remedial action for a given site. List all alternatives that could potentially bring the site into compliance with environmental standards. For contaminants that do not have standards, EPA-recommended safe levels for noncarcinogens (Health Advisory or Suggested-No-Adverse-Response Levels) and target levels for carcinogens (1×10^{-8} cancer risk level) may be used. Unless specifically requested, do not perform any cost analyses, or cost/benefit review for remedial action alternatives. However, in those situations where field survey data indicate immediate corrective action is necessary, present specific, detailed recommendations.

7. For each category above, summarize the results of field data, environmental or regulatory criteria, or other pertinent information supporting conclusions and recommendations. Reduce this summary information into a table (or tables) and insert it (them) into the text and the Executive Summary.

8. Provide cost estimates by line item for future efforts recommended for Category II sites and LTM Category III sites. Submit these estimates concurrently with the approved Final Report in a separate document. Only the cost requirements outlined in Sequence No. 2, Item VI, need be submitted.

a. For Category II sites, develop detailed site-specific estimates using prioritized costing format (i.e., cost of conducting the required work on: the highest priority site only; the first two highest priority sites only; the first three highest priority sites only; etc., until all required work is discretely costed) for the proposed work effort. The Air Force determines the priority of sites from contractor recommendations.

Consider the type of contaminants, their magnitude, the direction and rate of their migration, and their subsequent potential for environmental and health consequences when developing recommendations for site prioritization.

b. For Category III sites slated for long term monitoring, develop site specific estimates which detail the costs associated with: (1) permanent installation of monitoring wells; (2) ground water sampling interface equipment, including permanent installation of pumps and sampling lines; and (3) four quarterly (1 year period) sample collections and laboratory chemical analyses of groundwater, etc.

9. Provide an inventory of all on-base wells, to include production, irrigation, monitoring, etc. If the well has been abandoned, note the reason, and identify those wells which have been permanently plugged or sealed.

10. Reference in an appendix any local, state and/or Federal regulations which require specific well drilling techniques, materials, well development, purging, and sampling methods for work specified in this effort.

K. Meetings

The contractor's project leader shall attend three meeting(s) to take place at a time to be specified by the USAFOEHL. Each meeting shall take place at Richards-Gebaur AFB for a duration of one eight-hour day.

II. SITE LOCATION AND DATES:

Richards-Gebaur AFB MO
Date to be established

III. BASE SUPPORT:

A. The Base Point of Contact (POC) will receive from the contractor the split samples and then select 10% of them, package them, and then deliver them back to the contractor within 24 hours for subsequent overnight shipment to USAFOEHL/SA as stated in paragraph I.A.6.

B. Base personnel will assign the disposal points within the installation for all hazardous drill cuttings and contaminated groundwater. Assignment shall occur prior to drilling.

C. Base personnel will provide access to all sites. This may necessitate the clearance of small areas to permit set-up and operation of drilling rigs and equipment.

D. Base personnel will provide traffic control where/when necessary during geophysical surveys or well construction on or adjacent to road rights-of-way.

E. Base personnel will ensure rights of easement and any other required licenses are obtained across private properties so as to perform nondestructive geophysical explorations, the boring and construction of one or

more monitoring wells, and other investigations that may be required in performance of this investigation.

F. Base personnel will designate a staging area on base for the contractor's drilling equipment and supplies. An area will also be designated where the contractor can decontaminate his drilling equipment between wells.

IV. GOVERNMENT FURNISHED PROPERTY: None

V. GOVERNMENT POINTS OF CONTACT:

1. USAFOEHL Technical Program Manager
Capt PatrickN. Johnson
USAFOEHL/TSS
Brooks AFB TX 78235-5501
(512) 536-2158
AUTOVON 240-2158/2159
1-800-821-4528

2. Base Point of Contact (POC)
Ms Felipita B. Benson, R.N.
Occupational Health Nurse
442 Combat Support Group (AFRes)
Richards-Gebaur AFB MO 64030-5000
AUTOVON 463-2144
(816) 348-2144

3. MAJCOM Monitor
Lt Col Victor E. Hiatt
HQ AFRes/SGPB
Robins AFB GA 31098-6001
AUTOVON 468-6441
(912) 926-6441

4. Base Civil Engineer POC
Mr John Hurd
422 Combat Support Grup (AFRes)
Richards-Gebaur AFB MO 64030-5000
(816) 348-2076

VI. In addition to sequence numbers 1, 5 and 11 listed in Attachment 1 to the contract, which apply to all orders, the sequence numbers listed below are applicable to this order. Also shown are dates applicable to this order.

Sequence No.	Para No.	Block 10	Block 11	Block 12	Block 13	Block 14
19 (TOP)*	I.B.	OTIME	19SEP86	19SEP86		15
7 (Health & Safety)	I.C.	OTIME	19SEP86	19SEP86		3
3 (Prelim Data)	I.I.2	OTIME	**	**		3
4 (Tech. Rpt)	I.J.	ONE/R	4MAR87	18MAR87	16SEP87	***
2 (cost data)	I.J.8.	OTIME	2SEP87	16SEP87		****
14		MONTHLY	12SEP86	12SEP86	*****	3
15		MONTHLY	12SEP86	12SEP86	*****	3

*The Technical Operations Plans (TOP) required for this stage is due within two weeks of the Notice to Proceed.

**Upon completion of the total analytical effort and before submission of the f draft report.

***Two draft reports (25 copies of each) and one final report (50 copies plus the original camera ready copy) are required. Incorporate Air Force comments into th second draft and final reports as specified by the USAFOEHL. Supply the USAFOEHL with an advance copy of the first draft, second draft, and final reports for acceptance prior to distribution. Distribute the remaining 24 copies of each draf report and 49 copies of the final report as specified by the USAFOEHL.

****Submit cost estimates (five copies) in a separately bound document with the Final Report only. Provide estimates for only those sites recommended for additional Phase II work (Category II) or Phase IV, long term monitoring, (Categor III).

*****Submit monthly hereafter.

Table 1

Analytical Methods, Detection Limits, and Number of Samples

Parameter	Method	Detection Limit	No. of Samples	QA	Total Sample
Halogenated Volatile Organics	SW5030/SW8010	a	58 soil	6 soil	96 soi
	EPA 601	a	29 water	4 water	50 wat
Aromatic Volatile Organics	SW5030/8020	a	69 soil	7 soil	114 soi
	EPA 602	a	33 water	5 water	57 wat
Extractable Priority Pollutants (GC/MS)	EPA 625	a	17 water	3 water	20 wat
Phenols	E604	a	17 water	3 water	30 wate
Petroleum hydrocarbons	EPA 418.1 modified for soils	1 mg/Kg	69 soil	7 soil	76 soil
	EPA 418.1	1 mg/L, water	33 water	6 water	39 wate
Total Dissolved Solids (TDS)	EPA 160.1	10 mg/L, water	34 water	6 water	40 wate
Priority Pollutant Metals (13 ea)	EPA 200.7	a	20 water	3 water	23 wate
	EPA 245.1(Hg)	1.0 µg/L	20 water	3 water	23 water
	EPA 206.2(As)	1.0 µg/L	20 water	3 water	23 water
	EPA 270.2(Se)	2.0 µg/L	20 water	3 water	23 water
Arsenic	EPA 206.2	1.0 µg/L	1 water	0 water	1 water
	SW 3050/SW7060	0.1 mg/Kg	4 soil	1 soil	5 soil
Barium	EPA 200.7	a	3 water	2 water	5 water
Lead	EPA 239.2	a	2 water	1 water	1 water
	SW3050/7420	a	9 soil	1 soil	10 soil
Mercury	EPA 245.1	1.0 µg/L	4 water	1 water	5 water
	SW 7471	0.1 mg/Kg	4 soil	1 soil	5 soil

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Common Anions	A429	a	17 water	3 water	20 w
Pesticides	EPA 608	a	1 water	1 water	3
	A 509A	a	1 water	1 water	3
	A 509B	a	1 water	1 water	3
	SW8150	a	4 soil	1 soil	8
pH (field test)			34 water		34 wa
Temperature (field test			34 water		34 w
Conductance (field test)			34 water		34 w
EP Toxicity (metals)	SW Manual	b	19 soil	2 soil	21 s

[a]Detection limits specified by the EPA or Standard Method

[b]

Metal	mg/L of leaching solution
As	0.002
Ba	0.1
Cd	0.005
Cr	0.05
Pb	0.1
Hg	0.0002
Se	0.002
Ag	0.01

[c]Not used.

[d]Total of 96 includes second column confirmation for 50% of the samples (32).

[e]Total of 50 includes second column confirmation for 50% of the samples (17).

[f]Total of 114 includes second column confirmation for 50% of the samples (38).

[g]Total of 57 includes second column confirmation for 50% of the samples (19).

[h]Total of 30 includes second confirmation for 50% of the samples (10).

[i]Total of 3 includes second column confirmation of 50% of the samples (1).

[j]Total of 8 includes second column confirmation for 50% of the samples (3).

APPENDIX 1
SAMPLING AND ANALYTICAL REQUIREMENTS

15 038

WATER

SITE	Halogenated Volatile Organics	Aromatic Volatile Organics	Pesticides As, Hg	Extractable Priority Pollutants (GC/MS)	Petroleum Hydrocarbons	Total Dissolved Solids	Priority Pollutant Metals (13 ea)	Lead	Phenols	Common Anions	Ba	Hg	pH	Temperature
Site 1	5	5		5	5	5	5		5	5			5	5
Site 2	12	12		12	12	12	12		12	12			12	12
Site 6	7	7			7	7							7	7
Site 8			1			1							1	1
Site [illegible]	2	2			2	2		2					2	2
Site 10	3	3			3	3	3				3	3	3	3
Site 12		4			4	4							4	4
	29	33	1	17	33	34	20	2	17	17	3	3	34	34

F33615-83-D-4003/0013

APPENDIX 1
SAMPLING AND ANALYTICAL REQUIREMENTS

SOIL

SITE	Halogenated Volatile Organics	Aromatic Volatile Organics	Nonhalogenated Volatile Organics	Extractable Priority Pollutants (GC/MS)	Petroleum Hydrocarbons	Total Dissolved Solids	Priority Pollutant Metals (13 ea)	Lead	Herbicide, As, Hg	EP Toxicity (Metals)			
Site 1	7	7			7								
Site 2	18	18			18								
Site 6	15	15			15								
Site 8									4				
Site 9	9	9			9			9					
Site 10	9	9			9					9			
Site 12		11			11								
	58	69			69			9	4	9			

F33615-83-D-4003/0013

PART I SECTION F OF THE SCHEDULE

SUPPLIES SCHEDULE DATA

1. PROC INSTRUMENT ID NO. (PIIN)	2. SPIIN	3. PAGE
F33615-83-D-4003	0013	26 OF 26

4. ITEM NO.	5. ACRN	6. TSP PRI	7. MILSTRIP DOC NO. AND SUFFIX	8. CON ITEM SERIAL NO.	9. ENDING SERIAL NO. (WHEN APPL)	10. CLIN IDENT EXHIBIT
0001	AA					

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*	14. SCTY CLAS	15. SHIP TO	16. MARK FOR
A. 87DEC16	A.	A. 1	U	FY7624	
B.	B.	B.			
C.	C.	C.			

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*
D.	D.	D.
E.	E.	E.

15 0

17. DESCRIPTIVE DATA

A. SEE SECTION H OF THE BASIC CONTRACT FOR FY7624 ADDRESS.

B. TECHNICAL EFFORT SHALL BE COMPLETED NO LATER THAN 87MAR04.

C. ALL DATA SHALL BE DELIVERED IAW ATTACHMENT# 1 OF THE BASIC CONTRACT AS IMPLEMENTED BY PARAGRAPH VI OF THE TASK DESCRIPTION NO LATER THAN 87SEP16.

D. THE DATA SHALL BE ACCEPTED BY THE GOVERNMENT NOT LATER THAN THE DATE SHOWN IN BLOCK 11A

4. ITEM NO.	5. ACRN	6. TSP PRI	7. MILSTRIP DOC NO. AND SUFFIX	8. CON ITEM SERIAL NO.	9. ENDING SERIAL NO. (WHEN APPL)	10. CLIN IDENT EXHIBIT
0002	AA					

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*	14. SCTY CLAS	15. SHIP TO	16. MARK FOR
A. 87DEC16	A.	A. 1	U	FY7624	
B.	B.	B.			
C.	C.	C.			

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*
D.	D.	D.
E.	E.	E.

17. DESCRIPTIVE DATA

A. SEE SECTION H OF THE BASIC CONTRACT FOR FY7624 ADDRESS.

B. TECHNICAL EFFORT SHALL BE COMPLETED NO LATER THAN 87MAR04.

4. ITEM NO.	5. ACRN	6. TSP PRI	7. MILSTRIP DOC NO. AND SUFFIX	8. CON ITEM SERIAL NO.	9. ENDING SERIAL NO. (WHEN APPL)	10. CLIN IDENT EXHIBIT
0004	AA					

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*	14. SCTY CLAS	15. SHIP TO	16. MARK FOR
A. 87DEC16	A.	A. 1	U	FY7624	
B.	B.	B.			
C.	C.	C.			

11. DEL SCHED DATE	12. ENDING DATE (WHEN APPL)	13. DEL SCHEDULE QTY*
D.	D.	D
E.	E.	E.

17. DESCRIPTIVE DATA

A. SEE SECTION H OF THE BASIC CONTRACT FOR FY7624 ADDRESS.

B. TECHNICAL EFFORT SHALL BE COMPLETED NO LATER THAN 87MAR04.

C. ALL CHEMICAL ANALYSIS DATA SHALL BE DELIVERED IAW ATTACHMENT# 2 AS IMPLEMENTED BY PARAGRAPH VI OF THE TASK DESCRIPTION NO LATER THAN 87SEP16.

D. THE DATA SHALL BE ACCEPTED BY THE GOVERNMENT NOT LATER THAN THE DATE SHOWN IN BLOCK 11A

ENTS A NET INCREASE/DECREASE WHEN NO + OR – APPEARS AFTER THE ITEM N .

= TIMATED

(IN QTY) = DECREASE

OR – (IN ITEM NO.) = ADDITION OR DELETION

15 041

CC

24 February 1986

Base Support Letter for IRP Phase II Stage 2 at Richards-Gebaur AFB

KCAD, R/G

1. The attached draft is provided for your information. You are aware that Phase I of this program was accomplished several years ago. This phase will finalize any speculation on past practices as identified in sites 1, 2, 3, 5, 6, 7, 8, 9; new site 11 (located near bldg 1010); and site 12 (POL storage area).

2. Since finalization will be to the benefit of all, and many of these sites are now located on Kansas City property, it is imperative that I have your written concurrence on:

a. Rights of easement and any other licenses necessary to cross your or your sublessees' properties so as to perform nondestructive geophysical explorations, the boring and construction of one or more monitoring wells, and oth r investigations that may be required in performance of this investigation.

b. Authorization for my personnel to provide limited traffic control where/ when necessary during geophysical surveys.

SIGNED

GAREY M. REEVES, Colonel, USAFR
Commander

2 Atch
1. USAF OEHL/TSS Ltr, 6 F b 86 w/1 atch (Draft SOW)
2. Map (Figure 6)(Added)

1st Ind, KCAD, R/G

TO: 442 CSG/CC

Rights of easement and traffic control indicated in paragraphs 2a and 2b above ar approved. Request your IRP Phase II contractor coordinate actual drilling and boring sites with this office.

OVID W. SEIFERS
Airport Manager

2 Atch w/d

NR: [illegible] on [illegible] 86

ATCH 2

Aviation Department

Administrative Offices

City of Kansas City, Missouri
Heart of America

1 International Square
Kansas City International Airport
P O Box 20047
Kansas City, Missouri 64195

Area Code 816

Aviation Administrator	243-5200
Accounting	243-5205
Data Processing	243-5206
Personnel	243-5213
Planning & Development	243-5207
Properties & Business	243-5203

April 11, 1986

15 042

Garey M. Reeves, Colonel, USAFR
Commander
Department of the Air Force
442 Combat Support Group (AFRES)
Richards-Gebaur AFB, MO 64030-5000

Dear Col. Reeves:

This is in response to your letter of February 24, 1986 to KCAD, R/G, Wayne Seifers, Airport Manager. That letter requests permission to carry out certain investigative activities under the Installation Restoration Program, Phase II (Stage 2), Richards-Gebaur.

The Department of the Air Force may proceed with the work described by Section III, Phase II-Stage 2 Statement of Work (SOW) as that SOW relates to 1. South Landfill (Site 1), and 2. Northeast Landfill (Site 2). Permission with respect to other sites is not granted. All activities are to be coordinated through Mr. Wayne Seifers. Mr. Seifers will work with Air Force representatives and contractors in a manner that will result in a minimum of difficulties.

Approval for further investigations is being limited to Sites 1 and 2 because, "Phase II - Field Evaluation", December 1983 - Final Report recommends further investigation only with respect to Sites 1 and 2.

Sincerely,

James P. Gerner
Assistant Director of Aviation
Properties and Business

JPG/sah

cc: Delbert Kanneier
Wayne Seifers
Brenton Myers

ATCH 5

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 442 COMBAT SUPPORT GROUP (AFRES)
RICHARDS GEBAUR AIR FORCE BASE, MISSOURI 64030-5000

15 043

REPLY TO ATTN OF: DE

1 May 1986

SUBJECT: Base Support Letter for IRP Phase II Stage 2 at Richards-Gebaur AFB

TO: OEHL/TSS (Capt Johnson)

1. Reference our several telecons on same subject and difficulties of obtaining the Cities' concurrence for Stage 2.

2. You are aware that many of the proposed sites are located outside of Air Force retained property and were either conveyed or sold to either City of Kansas City, MO, or City of Belton, MO (see Atch 1).

3. I have provided you with various correspondence for your file. I would have preferred the City of Kansas City provide access to all questionable sites. I did talk to Mr. Karmeier, Director of Aviation; Mr. Gerner, Asst Director; and Mr. Seifers, Airport Manager, and emphasized the reason for the IRP and the benefits of exploring any possible problems and advantages of receiving a "clean bill of health" and/or getting the area restored.

4. I personally feel that the Air Force had little or no serious hazardous waste practices, since the officials of the Kansas City Aviation Department knowingly declined most site inspections; therefore, I recommend we proceed with a SOW for only sites 1, 2, 6, 8, 9, 10, and 12.

5. This letter is confirmation that we will provide necessary support identified in the Draft SOW Section III: Base Support.

GARRY M. REEVES, Colonel, USAFR
Commander

5 Atch
1. Map
2. 442 CSG/CC Ltr, 24 Feb 86 to KCAD, R/G w/o atch
3. 442 CSG/CC Ltr, 27 Feb 86 to City of Belton w/o atch
4. Ltr, City of Belton, 31 Mar 86
5. Ltr, KC Aviation Dept, 11 Apr 86

cc: HQ AFRES/DEV/SGPB w/Atch 1-5
10 AF/CS w/Atch 2-5
442 TFW/CV w/Atch 2-5
442 CSG/SGPB w/Atch 2-5

REF 63X . (pE) 63X

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

2. PROC INSTRUMENT IDENT NO. (PIIN)	3. SPIIN	4. EFFECTIVE DATE	5. REQUISITION/PURCHASE REQUEST PROJECT NO.	6. SOLICITATION CALL NO.
F33615-83-D-4003	001301	MAIL DATE		

7. ISSUED BY CODE FQ8419
DEPARTMENT OF THE AIR FORCE
AIR FORCE SYSTEMS COMMAND
AERONAUTICAL SYSTEMS DIV/PMRSC
WRIGHT-PATTERSON AFB, OH 45433-6503
NEGOTIATOR: PATRICE M. HUTSON
PHONE: (513) 255-5911

8. ADMINISTERED BY (IF OTHER THAN BLOCK 7) CODE S3305A
DCASMA BUFFALO
1103 FEDERAL BLDG.
111 WEST HURON ST.
BUFFALO, NY 14202-2392

15 044

9. CONTRACTOR NAME AND ADDRESS CODE 8R642 FACILITY CODE

ECOLOGY & ENVIRONMENT, INCORPORATED
195 SUGG ROAD
P.O. BOX D
BUFFALO, NEW YORK 14225

COUNTY: ERIE

PHONE: (716) 632-4491

MAILING DATE

MAY 20 1988

DUPLICATE ORIGINAL

10. SECURITY CLASS U

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in Block 17. The hour and date specified for receipt of Offers ☐ is extended ☐ is not extended

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By signing and returning _____ copies of this amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE ISSUING OFFICE PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter provided such telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. PURCHASE OFFICE POINT OF CONTACT
LRX/L67/LRX

13. THIS BLOCK APPLIES ONLY TO MODIFICATIONS OF CONTRACTS

☐ THIS CHANGE IS ISSUED PURSUANT TO _____
THE CHANGES SET FORTH HEREIN ARE MADE TO THE ABOVE NUMBERED CONTRACT/ORDER.

☐ THE ABOVE NUMBERED CONTRACT IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (SUCH AS CHANGES IN PAYING OFFICE, APPROPRIATION DATA, ETC.) SET FORTH HEREIN.

☐ THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF _____
IT MODIFIES THE ABOVE NUMBERED CONTRACT AS SET FORTH HEREIN.

☒ THIS MODIFICATION IS ISSUED PURSUANT TO THE "ORDERING" CLAUSE OF THE CONTRACT CLAUSES

CONTRACT ADMINISTRATION DATA

A. KIND OF MOD	B. MOD ABST RECIPIENT ADP PT	C. DATE OF SIGNATURE MODIFICATION	D. CHANGE IN CONTRACT AMOUNT INCREASE (+) DECREASE (−)	E. LOSING PO CAO ON TRANSFER	F. GAINING PO/CAO ON TRANSFER	G. SVC AGENCY USE
B			$			

16. ENTER ANY APPLICABLE CHANGES

PAY CODE	B. EFFECTIVE DATE OF AWARD	C. CONTRACT (1) TYPE (2) KIND	D. TYPE CONTR	E. SURV CRIT	F. SPL CONTR PROVISIONS	G. PAYING OFC CODE	H. DATE SIGNED	I. SECURITY (1) CLAS (2) DATE OF DD 254

17. REMARKS (Except as provided herein, all items and conditions of the contract as heretofore changed, remain unchanged and in full force and effect.)

SUBJECT: REVISED TASK DESCRIPTION/TIME EXTENSION
MONITORING LAB: USAF OCCUPATIONAL & ENVIRONMENTAL HEALTH LABORATORY
PROJECT MONITOR: EMILE BALADI, USAFOEHL/TS, BROOKS AFB, TX 78235-5501
FINANCE OFFICE: (S2202A) DCASR BOSTON, 495 SUMMER STREET
BOSTON, MASSACHUSETTS 02210-2184

18. ☒ CONTRACTOR/OFFEROR IS NOT REQUIRED TO SIGN THIS DOCUMENT ☐ CONTRACTOR/OFFEROR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN _____ COPIES TO ISSUING OFFICE

19. CONTRACTOR/OFFEROR (Signature of person authorized to sign)
BY

20. NAME AND TITLE OF SIGNER (Type or print)

21. DATE SIGNED

22. UNITED STATES OF AMERICA (Signature of Contracting Officer)
BY Larry D. Haas

23. NAME OF CONTRACTING OFFICER (Type or print)
LARRY D. HAAS

24. DATE SIGNED
88 May 13

AFSC FORM 702 AUG 84 PREVIOUS EDITION WILL BE USED. AFSC—Andrews AFB, DC 1984

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ecology and environment

SCHEDULE OF CHANGES

FIRST: The Task Description, dated 87 Jun 17, is hereby amended as shown below:

a. Paragraph I.D.3.a.(5)(d), lines 1 and 4, delete the word "four-inch" and replace with "two-inch".

b. Paragraph I.D.3.a.(5)(d), line 2, delete "Schedule 80" and replace with "Schedule 40".

c. Paragraph I.F.5., line 1, delete the first sentence in its' entirety and replace with the following:

"Split all water and soil samples from the initial sampling round only."

d. Paragraph I.F.7., line 4, delete "Table 1" and replace with "Table 1a".

e. Paragraph I.G.2., line 2, delete "Table 1" and replace with "Table 1a".

f. Add paragraph I.H.2.i., as follows:

"Collect an additional water sample from each of the five wells at this site and analyze for the parameters in Appendix 2. Submit to USAFOEHL/TS the results of these analyses (Paragraph I.I.4)."

g. Add paragraph I.H.3.h., as follows:

"Collect an additional water sample from each of the three wells at this site and analyze for the parameters in Appendix 2. Submit to USAFOEHL/TS the results of these analyses (Paragraph I.I.4)."

h. Add paragraph I.H.4.d., as follows:

"Perform an EM31 conductivity survey at this site to locate the burial trench."

i. Paragraph I.H.7.f., lines 1 and 2, delete "hydrocarbons and aromatic volatile organics" and replace with "hydrocarbons, aromatic volatile organics, and halogenated volatile organics".

j. Add paragraph I.H.7.g., as follows:

"Collect an additional water sample from the well at this site and analyze for the parameters in Appendix 2. Submit to USAFOEHL/TS the results of these analyses (Paragraph I.I.4)."

k. Add paragraph I.H.7.h., as follows:

"Perform a soil gas survey downgradient of this site (maximum of 1.5 days) to define areas of potential contamination. Submit the results of this survey, in the form of grid maps with locations and results, to USAFOEHL/TS to accompany the results of the additional groundwater sampling (Paragraph I.I.4)."

l. Add paragraph I.H.8., as follows:

"West Burn Pit Area (Site 4)"

m. Add paragraph I.H.8.a., as follows:

"Perform a soil gas survey (maximum of 1.5 days) to define areas of potential contamination at this site. Submit the results of this survey, in the form of grid maps showing locations and results, to USAFOEHL/TS to accompany the results of the additional groundwater sampling (Paragraph I.I.4)."

n. Add paragraph I.H.8.b., as follows:

"Perform an EM31 conductivity survey at this site to determine the location and areal extent of the old fire training area."

o. Add paragraph I.I.4., as follows:

"Technical Information Report. Upon completion of the tasks I.H.2.i, I.H.3.h, I.H.4.d, I.H.7.g, I.H.7.h, I.H.8.a, and I.H.8.b, incorporate the data into an informal report (Sequence 3, Paragraph VI). Include all the items specified in I.I.1, and submit three copies as specified by USAFOEHL/TS no later than three weeks after all analyses are completed."

p. Paragraph I.J.8., delete in its' entirety. Mark the paragraph "Reserved".

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15 047

q. Paragraph I.J.8.a., delete in its' entirety. Mark the paragraph "Reserved".

r. Paragraph I.J.8.b., delete in its' entirety. Mark the paragraph "Reserved".

s. Add paragraph I.L.3., as follows:

"Cost Proposal. In a separate letter, submit a lump sum cost estimate for the effort required to perform the work detailed in the Recommendations section of the Final Report (Item VI, Sequence No. 2)."

t. Paragraph V.1., delete "Capt Patrick N. Johnson" and replace with "1Lt Franz J. Schmidt".

u. Change paragraph VI as follows:

DELETE

"SEQ No	Para	BLK10	BLK11	BLK12	BLK13	BLK14
4 (Tech Rpt)	I.J.	ONE/R	4MAR87	18MAR87	16SEP87	***"

REPLACE WITH

"SEQ No	Para	BLK10	BLK11	BLK12	BLK13	BLK14
4 (Tech Rpt)	I.J.	ONE/R	5MAY87	18MAY87	06MAY88	***"

DELETE

"SEQ No	Para	BLK10	BLK11	BLK12	BLK13	BLK14
2 (Cost data)	I.J.8	OTIME	02SEP87	16SEP87	---	****"

REPLACE WITH

"SEQ No	Para	BLK10	BLK11	BLK12	BLK13	BLK14
2 (Cost ltr)	I.L.3	OTIME	29APR88	06MAY88	---	1"

INSERT

"SEQ No	Para	BLK10	BLK11	BLK12	BLK13	BLK14
3	I.I.4	OTIME	**	**	---	3"

DELETE

"**Upon completion of the total analytical effort and before submission of the first draft report."

REPLACE WITH

"**Upon completion of the total analytical effort."

DELETE

"****Submit cost estimates (five copies)..."
"...long term monitoring, (Category III)."

v. Table 1, delete in its' entirety and replace with Table 1a, page 7 herein.

w. Appendix 1, WATER, delete in its' entirety and replace with Appendix 1a, page 9 herein.

x. Appendix 1a SOIL, delete in its' entirety and replace with Appendix 1a SOIL, page 10 herein.

y. Add "APPENDIX 2", page 11 herein.

z. Add "APPENDIX 3", page 12 herein.

aa. Add "NOTES" to Appendixes 2 and 3, page 13 herein.

SECOND: Section F, Supplies Schedule Data, (70H), is revised as shown on page 6 herein.

THIRD: The contractor's letters dated 88 Mar 24 and 88 March 31, indicating extension of the labor rates and concurrence with this action are incorporated by reference and made a part hereof.

PART I SECTION F OF THE SCHEDULE
SUPPLIES SCHEDULE DATA

1. PROC INSTRUMENT ID NO. (PIIN): F33615-83-D-4003
2. SPIIN: 001301
3. PAGE 6 OF 15

4. ITEM NO.: 0001
5. ACRN: AA
6. TSP PRI
7. MILSTRIP DOC NO. AND SUFFIX
8. CON ITEM SERIAL NO.
9. ENDING SERIAL NO. (WHEN APPL)
10. CLIN IDENT EXHIBIT

11. DEL SCHED DATE: A. 88JUL31
12. ENDING DATE (WHEN APPL): A.
13. DEL SCHEDULE QTY*: A. 1
14. SCTY CLAS: U
15. SHIP TO: FY7624
16. MARK FOR

B. B. B. D. D. D.
C. C. C. E. E. E.

17. DESCRIPTIVE DATA

15 049

SEE SECTION H OF THE BASIC CONTRACT FOR FY7624 ADDRESS.
TECHNICAL EFFORT SHALL BE COMPLETED NO LATER THAN 87 MAY 05.

ALL DATA SHALL BE DELIVERED IAW ATTACHMENT #1 OF THE BASIC CONTRACT AS IMPLEMENTED BY PARAGRAPH VI OF THE TASK DESCRIPTION NO LATER THAN 88 MAY 06.
THE DATA SHALL BE ACCEPTED BY THE GOVERNMENT NOT LATER THAN THE DATE SHOWN IN BLOCK 11A.

4. ITEM NO.: 0002
5. ACRN: AA
6. TSP PRI
7. MILSTRIP DOC NO. AND SUFFIX
8. CON ITEM SERIAL NO.
9. ENDING SERIAL NO. (WHEN APPL)
10. CLIN IDENT EXHIBIT

11. DEL SCHED DATE: A. 88JUL31
12. ENDING DATE (WHEN APPL): A.
13. DEL SCHEDULE QTY*: A. 1
14. SCTY CLAS: U
15. SHIP TO: FY7624
16. MARK FOR

B. B. B. D. D. D.
C. C. C. E. E. E.

17. DESCRIPTIVE DATA

SEE SECTION H OF THE BASIC CONTRACT FOR FY7624 ADDRESS.
TECHNICAL EFFORT SHALL BE COMPLETED NO LATER THAN 87 MAY 05.

4. ITEM NO.: 0004
5. ACRN: AA
6. TSP PRI
7. MILSTRIP DOC NO. AND SUFFIX
8. CON ITEM SERIAL NO.
9. ENDING SERIAL NO. (WHEN APPL)
10. CLIN IDENT EXHIBIT

11. DEL SCHED DATE: A. 88JUL31
12. ENDING DATE (WHEN APPL): A.
13. DEL SCHEDULE QTY*: A. 1
14. SCTY CLAS: U
15. SHIP TO: FY7624
16. MARK FOR

B. B. B. D. D. D.
C. C. C. E. E. E.

17. DESCRIPTIVE DATA

SEE SECTION H OF THE BASIC CONTRACT FOR FY7624 ADDRESS.
TECHNICAL EFFORT SHALL BE COMPLETED NO LATER THAN 87 MAY 05.

ALL CHEMICAL ANALYSIS DATA SHALL BE DELIVERED IAW ATTACHMENT #1 AS IMPLEMENTED BY PARAGRAPH VI OF THE TASK DESCRIPTION NO LATER THAN 88 MAY 06.
THE DATA SHALL BE ACCEPTED BY THE GOVERNMENT NOT LATER THAN THE DATE SHOWN IN BLOCK 11A.

*REPRESENTS A NET INCREASE/DECREASE WHEN NO + R – APPEARS AFTER THE ITEM NO.
E=ESTIMATED
(IN QTY) = DECREASE
OR – (IN ITEM NO.) = ADDITION OR DELETION

15 050

Table 1A

Analytical Methods, Detection Limits, and Number of Samples

Parameter	Method	Detection Limit	No. of Samples	QA	tal
Halogenated Volatile Organics	SW5030/SW8010	a	69 soil	7 soil	114 soil
	EPA 601	a	19 water	2 water	32 water
Aromatic Volatile Organics	SW5030/8020	a	69 soil	7 soil	114 soil
	EPA 602	a	22 water	3 water	47 water
Extractable Priority Pollutants (GC/MS)	EPA 625	a	17 water	3 water	20 water
Phenols	E604	a	17 water	3 water	30 water
Petroleum hydrocarbons	EPA 418.1 modified for soils	1 mg/Kg	69 soil	7 soil	76 soil
	EPA 418.1	1 mg/L, water	33 water	6 water	39 water
Total Dissolved Solids (TDS)	EPA 160.1	10 mg/L, water	34 water	6 water	40 water
Priority Pollutant Metals (13 ea)	EPA 200.7	a	20 water	3 water	23 water
	EPA 245.1(Hg)	1.0 µg/L	20 water	3 water	23 water
	EPA 206.2(As)	1.0 µg/L	20 water	3 water	23 water
	EPA 270.2(Se)	2.0 µg/L	20 water	3 water	23 water
Arsenic	EPA 206.2	1.0 µg/L	1 water	0 water	1 water
	SW 3050/SW7060	0.1 mg/Kg	4 soil	1 soil	5 soil
Barium	EPA 200.7	a	3 water	2 water	5 water
Lead	EPA 239.2	a	2 water	1 water	3 water
	SW3050/7420	a	9 soil	1 soil	10 soil
Mercury	EPA 245.1	1.0 µg/L	4 water	1 water	5 water
	SW 7471	0.1 mg/Kg	4 soil	1 soil	5 soil

Common Anions	A429	a	17 water	3 water	20 wat
Pesticides	EPA 608	a	1 water	0 water	1 wa
	A 509A	a	1 water	1 water	3 w
	A 509B	a	1 water	1 water	2 wa
	SW8150	a	4 soil	1 soil	6 soi
pH (field test)			34 water		34 wate
Temperature (field test			34 water	15 051	34 wate
Conductance (field test)			34 water		34 wate
EP Toxicity (metals)	SW Manual	b	19 soil	2 soil	21 soil

[a]Detection limits specified by the EPA or Standard Method

[b]

Metal	mg/L of leaching solution
As	0.002
Ba	0.1
Cd	0.005
Cr	0.05
Pb	0.1
Hg	0.0002
Se	0.002
Ag	0.01

[c]Not used.

[d]Not used.

[e]Total includes second column confirmation for a maximum of 50% of the samples.

[f]Total of 114 includes second column confirmation for 50% of the samples (38).

[g]Total includes second column confirmation for a maximum of 50% of the samples.

[h]Total of 30 includes second confirmation for 50% of the samples (10).

[i]Total includes second column confirmation for a maximum of 50% of the samples.

[j]Total of 8 includes second column confirmation for 50% of the samples (3).

15 052

APPENDIX 1A
SAMPLING AND ANALYTICAL REQUIREMENTS

WATER

SITE	Halogenated Volatile Organics	Aromatic Volatile Organics	Pesticides As, Hg	Extractable Priority Pollutants (GC/MS)	Petroleum Hydrocarbons	Total Dissolved Solids	Priority Pollutant Metals (1) ea)	Lead	Phenols	Common Anions	Ba	Hg	pH
Site 1	4	4		5	5	5	5		5	5			5
Site 2	8	8		12	12	12	12		12	12			12
Site 6	4	4			7	7							7
Site 8			1			1							1
Site 9	2	2			2	2		2					2
Site 10	1	1			3	3	3				3	3	3
Site 12		3			4	4							4
	19	22	1	17	33	34	20	2	17	17	3	3	34

15 053

ATTACHMENT 1A
SAMPLING AND ANALYTICAL REQUIREMENTS

SOIL

ITE	Halogenated Volatile Organics	Aromatic Volatile Organics	Nonhalogenated Volatile Organics	Extractable Priority Pollutants (GC/MS)	Petroleum Hydrocarbons	Total Dissolved Solids	Priority Pollutant Metals (13 ea)	Lead	Herbicide, As, Hg	EP Toxicity (Metals)
ite 1	7	7			7					
ite 2	18	18			18					
ite 6	15	15			15					
ite 8									4	
ite 9	9	9			9			9		
ite 10	9	9			9					9
ite 12	11	11			11					
	69	69			69			9	4	9

APPENDIX 2
Approximate Number of Analyses by Site
Groundwater Samples for Additional Sampling

PARAMETER	ANALYTICAL METHOD	Site 2	Site 6	Site 12	Total
Water Samples					
Specific Conductance (Field Test)	E120.1	5	3	1	9
pH (Field Test)	E150.1	5	3	1	9
Temperature (Field Test)	E170.1	5	3	1	9
Metal Screen (25 metals, dissolved)	SW6010/ SW3005	5	0	0	5
Lead (dissolved)	SW3005/ SW7421	5	3	1	9
Petroleum Hydrocarbons	E418 1	5	3	1	9
Purgeable Halocarbons	SW5030/ SW8010	5	3	0	8
Purgeable Aromatics	SW5030/ SW8020	5	3	0	8

15 051

APPENDIX 3
Analytical Methods, Detection Limits, and TOTAL Number of Analyses
Summary of Additional Groundwater Sampling

PARAMETER	ANALYTICAL METHOD (a)	DETECTION LIMIT (b)	REPORTING UNITS(c)	NUMBER OF ANALYSES	TRIP BLANKS	AMB COND BLANKS	EQUIP BLANKS	DUP/REP	SECOND COLUMN	TOTAL ANALYSES
Water Samples										
Specific Conductance (Field Test)	E120.1	-	umhos/cm	9			1	1		11
pH (Field Test)	E150.1	-	pH Units	9			1	1		11
Temperature (Field Test)	E170.1	-	deg C	9			1	1		11
Metal Screen (25 metals)	SW6010/ SW3005	(d)	mg/L	5			1	1		7
Lead	SW3005/ SW7421	0.005	mg/L	9			1	1		11
Petroleum Hydrocarbons	E418.1	1	mg/L	9			1	1		11
Purgeable Halocarbons	SW5030/ SW8010	(e)	ug/L	8	1	1	1	1	6	18
Purgeable Aromatics	SW5030/ SW8020	(h)	ug/L	8	1	1	1	1	6	18

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15 055

NOTES

a The methods cited are from the following sources:

15 056

"A" Methods — Standard Methods for the Examination of Water and Wastewater 16th Edition (1985)

"E" Methods — Methods for Chemical Analysis of Water and Wastes EPA Manual 600/4-79-020 (USEPA 1983 - with additions)

Methods for Organic Chemical Analysis of Municipal and Industrial wastewater 40 CFR 136 Appendix A

Inductively Coupled Plasma - Atomic Emission Spectrometer Method for Trace Element Analysis of Water and Wastes, 40 CFR 136 Appendix C

"SW" Methods — Test Methods for Evaluating Solid Waste Physical/Chemical Methods SW-846 3rd Edition (USEPA, 1986)

b Contractor shall comply to the established criteria for Limits of Detection in Annex B.

c For soil/sediment samples report results as mg/kg of dry soil or sediment. Report moisture content for each sample.

d Metals in water and soil/sediment samples. Limits of Detection must be at or below the values specified (SW6010)

Metal		Detection Limits Water (mg/L)	Soil/Sediment (mg/kg)
Aluminum	Al	0 2	20
Antimony	Sb	0.2	20
Arsenic	As	0 3	-
Barium	Ba	0.01	1
Beryllium	Be	0.002	0.2
Boron	B	0.03	3
Cadmium	Cd	0 005	2
Calcium	Ca	0.05	5
Chromium	Cr	0.03	4
Cobalt	Co	0.04	4
Copper	Cu	0.03	3
Iron	Fe	0.04	4
Lead	Pb	0.2	20
Magnesium	Mg	0.2	20
Manganese	Mn	0.01	1
Molybdenum	Mo	0 04	4
Nickel	Ni	0.015	5
Potassium	K	(determine at time of analysis)	
Selenium	Se	0.4	-
Silica		0.3	30
Silver	Ag	0.03	4
Sodium	Na	0.9	90
Thallium	Tl	0 2	20
Vanadium	V	0.04	4
Zinc	Zn	0.01	1

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Volatile Halocarbons in water and soil/sediment samples. Limits of detection must be at or below the values specified. (E601, SW8010)

15 057

Parameter	Detection Limits Water (ug/L)	Soil/Sediment (mg/kg)
Bromodichloromethane	0.5	0.1
Bromoform	1	0.1
Bromomethane	6	0.1
Carbon tetrachloride	0.6	0.1
Chlorobenzene	1.2	0.1
Chloroethane	3	0.1
2-Chloroethyl vinyl ether	0.7	0.1
Chloroform	0.2	0.1
Chloromethane	0.4	0.1
Dibromochloromethane	0.5	0.1
1,2-Dichlorobenzene	0.5	0.1
1,3-Dichlorobenzene	1	0.1
1,4-Dichlorobenzene	0.5	0.1
Dichlorodifluoromethane	9	0.1
1,1-Dichloroethane	0.4	0.1
1,2-Dichloroethane	0.2	0.1
1,1-Dichloroethene	0.7	0.1
trans-1,2-Dichloroethene	0.5	0.1
1,2-Dichloropropane	0.2	0.1
cis-1,3-Dichloropropene	1	0.1
trans-1,3-Dichloropropene	2	0.1
Methylene chloride	2	0.1
1,1,2,2-Tetrachloroethane	0.2	0.1
Tetrachloroethene	0.2	0.1
1,1,1-Trichloroethane	0.2	0.1
1,1,2-Trichloroethane	0.1	0.1
Trichloroethene	0.6	0.1
Trichlorofluoromethane	5	0.1
Vinyl Chloride	0.2	0.1
Benzyl chloride	-	0.1
Bromobenzene	-	0.1
Bis(2-chloroethoxy)methane	-	0.1
Bis(2-chloroisopropyl) ether	-	0.1
Chloroacetaldehyde	-	0.1
Chloral	-	0.1
1-Chlorohexane	-	0.1
Chloromethyl methyl ether	-	0.1
2-Chlorotoluene	-	0.1
Dibromomethane	-	0.1
1,1,1,2-Tetrachloroethane	-	0.1
1,2,3-Trichloropropane	-	0.1

A. Purgeable aromatic compounds in water and soil sediment samples. Limits of detection must be at or below the values specified. (SW8020)

Analyte	Detection Limits Water (ug/L)	Soil/Sediment (mg/kg)
Benzene	0.7	0.2
Chlorobenzene		0.2
1,2-Dichlorobenzene	2	0.2
1,3-Dichlorobenzene	2	0.2
1,4-Dichlorobenzene	0.5	0.2
Ethylbenzene	1	0.2
Toluene	1	0.2
Xylenes	2	0.2

15 053

APPENDIX C

HEALTH AND SAFETY PLAN

15 063

HAZARDOUS AND TOXIC MATERIALS TEAM
SITE SAFETY PLAN

A. GENERAL INFORMATION

SITE: Richards-Gebaur Job No.: DF-4000

LOCATION: Belton, MO near Kansas City

PLAN PREPARED BY: Paul Kopsick DATE:

APPROVED BY: William Hooke DATE: 9-12-86

OBJECTIVE(S): Phase II Stage 2 Field Investigation
Soil, sediment surface water and groundwater sampling.

PROPOSED DATE OF INVESTIGATION: September 1986 - December 1986

BACKGROUND REVIEW: Complete: X Preliminary: ____

DOCUMENTATION/SUMMARY: Overall Hazard: Serious: ____ Moderate: ____
Low: X Unknown: ____

B. SITE/WASTE CHARACTERISTICS

WASTE TYPE(S): Liquid X Solid X Sludge ____ Gas ____
Corrosive ____ Ignitable ____ Radioactive ____ Volatile ____
Toxic ____ Reactive ____ Unknown ____ Other (Name) ____

FACILITY DESCRIPTION: Air Force Base with areas of Aircraft and Vehicle maintenance and onsite landfill of municipal refuse. Storage of pesticedes and solvents associated with normal operations.

Principal Disposal Method (type and location): Landfills drum storage areas

Unusual Features (dike integrity, power lines, terrain, etc.): NONE

Status: (active, inactive, unknown) In-active - active

History: (injuries: complaints: previous agency action): No significant history of environmental problems. Phase I report contains history of individual site.

C. HAZARD EVALUATION
(Use Supplemental Sheets if Necessary)

Summary (attach copy of available chemical information from Saxs, Merck, Index, Chmtads, etc.): Non-specific organic compounds

General industrial solvents: Trichloroethylene
Perchloroethylene

Heavy Metals: Lead
Mercury

Non-specific herbicide (Containing Mercury circa 1971)

See attachments for hazard evaluation and data sheets

D. SITE SAFETY WORK PLAN

PERIMETER ESTABLISHMENT: Map/Sketch Attached? Yes Site Secured? Yes

Perimeter Identified? NO Zone(s) of Contamination Identified? NO

This task will identify the perimeters and extent of contamination. Borings to be made outside of contaminated material.

PERSONAL PROTECTION:

Level of Protection: A ____ B ____ C X D X

Modifications: Upgrade to Level C for samples with positive HNU readings. Level C for monitoring all drilling.

Surveillance Equipment and Materials: HNU with 10.2 eV probe.
tape) TLD Badge
Rad mini particle counter

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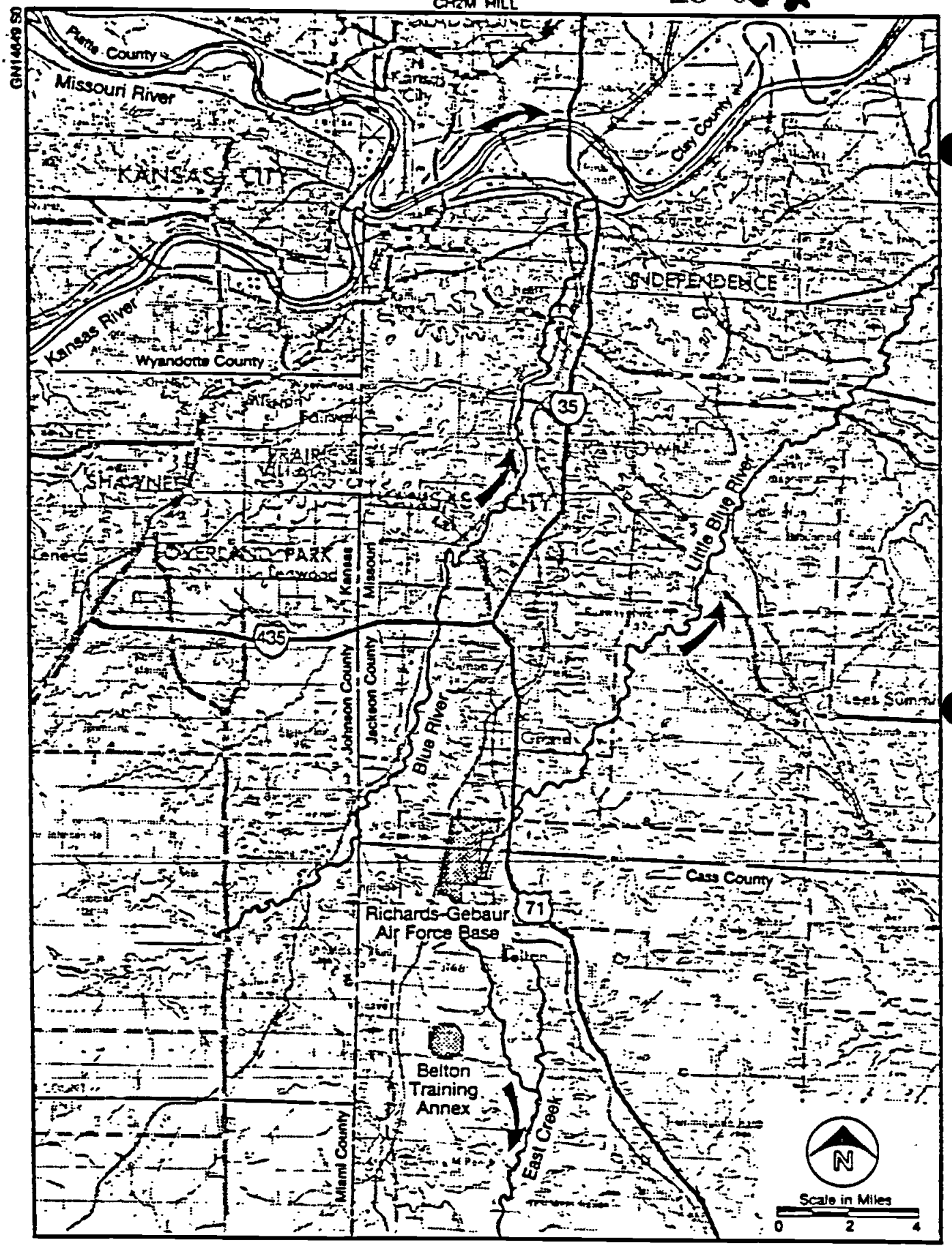

FIGURE 2. Location map of Richards-Gebaur AFB, Missouri.

SPECIAL SITE CONSIDERATIONS: See Hazard Evaluation for specific areas of site and the associated hazards.

DECONTAMINATION PROCEDURES:

Personal: Wash boot and gloves with soap and water. Launder coveralls upon return from the field. All Personnel should shower immediately upon return home.

Equipment: Detergent wash, water rinse

INVESTIGATION - DERIVED MATERIAL DISPOSAL: (Note - If material is proposed to be left on site, written authorization is to be received by the Project Team Leader prior to the initiation of on site activities): Disposable material will be double bagged and left on the base. Suspected contaminated soils will be drummed and stored at the base.

SITE ENTRY PROCEDURES: Coordination with base security.
Safety meeting each morning.
No special proceedures required.

Team Member	Responsibility
Paul Kopsick	Co-Project Mgr./Team Leader
James Jackson	Co-Project Mgr./Admin.
Mark Mayo	Field Tech./SSC
Joe Chandler	Field Tech./SSC
Mila Michalowski	Field Tech.
John Cook	Field Tech.
Sharon Martin	Geophysics

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E. EMERGENCY INFORMATION

(Use Supplemental Sheets if Necessary)

15 064

EMERGENCY PRECAUTIONS

Acute Exposure Symptoms	First Aid
Irritation of eyes, nose & throat.	
Headache, nausea.	
*Environmental concentrations	
normally give no acute exposure	
symptoms.	

LOCAL RESOURCES
(Name, Address and Phone Number)

Ambulance 911

Hospital Emergency Room 942-4400 - St. Joseph Hospital

Poison Control Center 1-234-3000 - Childrens Mercy Hospital

Police (incl. Local, County Sheriff, State) 911

Fire Department 911

Airport Richards Gebaurs AFB

Explosives Unit N/A

Agency Contact (EPA, State, Local, USCG, etc.) Diana Bailey 236-2856

Local Laboratory NONE

UPS/Federal Express 6600 College Blvd. - (across from Black & Veatch) East of Met

Client Contact Cpt. Patrick Johnson, OEHL TX 1-800-821-4528

SITE RESOURCES

Water Supply Base Civil Engineer John Hurd

Telephone 816-348-2076

Radio

Other

15 065

ecology and environment, inc.

ON-SITE SAFETY MEETING

Project _____

Date _____ Time _____ Job No. _____

Address _____

Specific Location _____

Type of Work _____

SAFETY TOPICS PRESENTED

Protective Clothing/Equipment _____

Chemical Hazards _____

Physical Hazards _____

Emergency Procedures _____

Hospital/Clinic _____ Phone _____

Hospital Address _____

Special Equipment _____

Other _____

ATTENDEES

Name Printed	Signature

Meeting Conducted By: _____ _____

Name Printed Signature

Site Safety Officer _____ Team Leader _____

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Emergency Contacts

1. Mr. Raymond Harbison (University of Arkansas) ..... (501) 661-5766 or 661-5767
   (501) 370-8263 (24 hour)

2. Ecology and Environment, Inc., Safety Coordinator/
   Dr. Paul Jonmaire .....(716) 684-8060 (office)
   (716) 655-1260 (Home)

Medtox Hotline

1. Twenty-four hour answering service - (501) 370-8263

   What to Report:

   - State: "This is an emergency."
   - Your name, region, and site.
   - Telephone number to reach you.
   - Your location.
   - Name of person injured or exposed.
   - Nature of emergency.
   - Action taken.

2. One of three toxicologists (Drs. Raymond Harbison, Richard Freeman, or Robert James) will contact you. Repeat the information given to the answering service.

3. If a toxicologist does not return your call within 15 minutes, call the following persons in order until contact is made:

   E & E Corporate Headquarters (EST 0830-1700) - (716) 684-8060

   a. Twenty-four hour line - (716) 631-9530
   b. Corporate Safety Director - Paul Jonmaire - 716/655-1260 (Home)
   c. Assistant Corporate Safety Officer - Steve Sherman (home - (716) 688-0084)

Emergency Routes

Directions to Hospital (incl. MAP) Andrews Rd. to Outer Belt Road. Outer Belt Road to St. Joseph's Hospital. Hospital is on South side of road.

Other _____

7/84 Revised 3/85

F. EQUIPMENT CHECKLIST

PROTECTIVE GEAR

LEVEL A

SCBA	___
SPARE AIR TANKS	___
ENCAPSULATED SUIT	___
SURGICAL GLOVES	___
NEOPRENE SAFETY BOOTS	___
BOOTIES	___
GLOVES (TYPE ___)	___
OUTER WORK GLOVES	___
HARD HAT	___
CASCADE SYSTEM	___
___	___
___	___
___	___
___	___

LEVEL B

SCBA	___
SPARE AIR TANKS	___
CHEMICAL RESISTANT COVERALLS	___
PROTECTIVE COVERALL (TYPE ___)	___
RAIN SUIT	___
BUTYL APRON	___
SURGICAL GLOVES	___
GLOVES (TYPE ___)	___
OUTER WORK GLOVES	___
NEOPRENE SAFETY BOOTS	
BOOTIES	
HARD HAT WITH FACE SHIELD	___
CASCADE SYSTEM	___
MANIFOLD SYSTEM	___

LEVEL C

ULTRATWIN RESPIRATOR	X
POWER AIR PURIFYING RESPIRATOR	___
CARTRIDGES (TYPE GMC-H)	X
ROBERTSHAW ESCAPE MASK	___
CHEMICAL RESISTANT COVERALLS	X
PROTECTIVE COVERALL (TYPE Tyvek/Saranex)	X
RAIN SUIT	___
BUTYL APRON	___
SURGICAL GLOVES	X
GLOVES (TYPE Nitrile/Butyl	X
OUTER WORK GLOVES	___
NEOPRENE SAFETY BOOTS	X
HARD HAT WITH FACE SHIELD	X
Booties	X

LEVEL D

ULTRA-TWIN RESPIRATOR (AVAILABLE)	X
CARTRIDGES (TYPE GMC-H)	X
ROBERTSHAW ESCAPE MASK (AVAILABLE)	___
CHEMICAL RESISTANT COVERALLS	X
PROTECTIVE COVERALL (TYPE Tyvek/Saranex)	X
RAIN SUIT	___
NEOPRENE SAFETY BOOTS	X
BOOTIES	X
WORK GLOVES	___
HARD HAT WITH FACE SHIELD	X
SAFETY GLASSES	X
___	___
___	___

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INSTRUMENTATION		DECON EQUIPMENT (CONT.)	
OVA		PLASTIC SHEETING	
THERMAL DESORBER		TARPS	
O2/EXPLOSIMETER		TRASH BAGS	X
EXPLOSIMETER CALIBRATION KIT		TRASH CANS	
HNU	X	MASKING TAPE	
~~[illegible]~~ Rad Mini	X	DUCT TAPE	X
MAGNETOMETER		PAPER TOWELS	
PIPE LOCATOR		FACE MASK	X
WEATHER STATION		FACE MASK SANITIZER	X
DRAEGER PUMP		FOLDING CHAIRS	
BRUNTON COMPASS		STEP LADDERS	

FIRST AID EQUIPMENT		SAMPLING EQUIPMENT	
FIRST AID KIT	X	Drill Rig (Subcontract)	X
OXYGEN ADMINISTRATOR			
STRECHER			
PORTABLE EYE WASH			
BLOOD PRESSURE MONITOR			
RADIATION BADGES	X		
FIRE EXTINGUISHER	X		

DECON EQUIPMENT		
WASH TUBS	X	
BUCKETS		
SCRUB BRUSHES	X	
PRESSURIZED SPRAYER	X	
DETERGENT (TYPE Alconox)	X	
SOLVENT (TYPE Hexane or D,1,1 TCE	X	

1/84 Revised

APPENDIX A
STATEMENT OF MEDICAL FITNESS

This is to confirm that the following employees may be engaged in field activities at _____ (name of site) in connection with the Subcontract Agreement between E & E and _____, dated _____, 19__, and that all of said employees are medically fit both to perform required field activities and to utilize respiratory equipment in accordance with 29 CFR, Part 1910 and "USEPA Standard Operating Safety Guides," 1984.

_____

_____

_____

_____

_____

_____
Authorized Subcontractor
Representative

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EXPOSURES/INJURIES

ONSITE EXPOSURES OR INJURIES:

* should be given appropriate medical attention. Hospital care for chemical exposures must be coordinated with Doctor Harbison (501) 370-2863 (24 hrs)

* injuries without exposures should be given appropriate medical attention

* all exposures/injuries must be reported to the regional office within twenty-four hours (24 hrs)

OFFSITE INJURIES

I. IF AN INJURY OCCURS WHILE YOU ARE "OUT OF TOWN" FOR THE PURPOSES OF SITE WORK, the injury is given appropriate medical attention and reported to the Region Office within 24 hours .

II. IF AN INJURY OCCURS WHILE USING EQUIPMENT OWNED OR OPERATED FOR E&E, the injury should be treated and rep rted within 24 hours.

II. IF THE INJURY OCCURRED ON YOUR OWN TIME, AND HAS NOTHING TO DO WITH E&E PROPERTY OR EQUIPMENT, report the injury to the Regional Program Manager (Jim Buchanan r his designee Bill Kwoka) if:

* Medication is being taken
* The injury may adversely affect job performance including your ability to work in the field, at the garage, driving, etc.

Medtox Hotline

1. Twenty-four hour answering service - (501) 370-8263

What to Report:

- State: "This is an emergency."
- Your name, region, and site.
- Telephone number to reach you.
- Your location.
- Name of person injured or exposed.
- Nature of emergency.
- Action taken.

One of three toxicologists (Drs. Raymond Harbison, Richard Freeman, or Robert James) will contact you. Repeat the information given to the answering service.

If a toxicologist does not return your call within 15 minutes, call the following persons in order until contact is made:

E & E Corporate Headquarters (EST 0830-1700) - (716) 684-8060

a. Twenty-four hour line - (716) 631-9530

b. Corporate Safety Director - Paul Jonmaire (home - (716) 655-1260)

c. Assistant Corporate Safety Officer - Steve Sherman (home - (716) 688-0084)

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I. IF AN INJURY OCCURS WHILE YOU ARE "OUT OF TOWN" FOR THE PURPOSES OF SITE WORK, the injury is given appropriate medical attention and reported to the Region Office within 24 hours .

II. IF AN INJURY OCCURS WHILE USING EQUIPMENT OWNED OR OPERATED FOR E&E, the injury should be treated and reported within 24 hours.

II. IF THE INJURY OCCURRED ON YOUR OWN TIME, AND HAS NOTHING TO DO WITH E&E PROPERTY OR EQUIPMENT, report the injury to the Regional Program Manager (Jim Buchanan or his designeee Bill Kwoka) if:

* Medication is being taken
* The injury may adversely affect job performance including your ability to work in the field, at the garage, driving, etc.

FIELD SAFETY DATA SHEET

Chemical Name: Mercury Compounds (Inorganic)

(1)CAS NO: 7439-97-6 M.W.: _____ Phys. State Solids

(* 1)TLV 0.05 Mg/m3 (ppm or MG/M3)(*)Ceiling Limit _____ (ppm or MG/M3)

15 073

APPEARANCE:

(*)Pure: _____

(*)Soil: _____

(*)Water: _____

ODOR:

(*)Odor Threshold _____ (ppm or MG/M3)

(*)Odor Description No odor expected

DETECTION:

(*)HNU Detection Efficiency: 0 (10.2 EV Probe) Assumed

(*)OVA Detection Effiency: 0 Assumed

(*)Other Detection Methods: Mini ram particle counter for sites

COMMENTS: where Environmental concentrations are less than 15,000 PPM

PROTECTIVE EQUIPMENT:

	Mg/m3		
(*)	0 TO 0.005	Level-D	
(*)	.005 TO 0.05	Level-C (Cartridge GMC-H) AP-3	
(*)	____ TO ____	Level-B	
(*)	Above ____	Level-A	

Action Levels can be Changed by the RSC to reflect the maximum anticipated concentrations

ROUTES OF EXPOSURE: Inhalation, Absorption, Ingestion

(* 2)Acute Effects: Kidney damage anorexia, Muscle tremors, Neurotic disorders

(* 2)Chronic Effects: Digestive & Nervous system Ailments, Gingivitis

Other Hazards: Ignit no Flam no Oxid no Corr Yes

Explosive possible Toxic YES Carcin no Radio no

Terat _____ Repro _____ Muta _____

( )Vapor Density > air (*) B.P. _____ (*) LEL NA

( )Soluble (H2O) YES (*) Specif. Grav. _____ (*) UEL NA

DECONTAMINATION: _____

(*) FIRST AID: _____

REFERENCE SECTION:

1). ACGIH, TLVs 1983-1984

2). ILO, Encyclopedia of Occupational Health & Safety

3).

4).

5).

6).

7).

8).

9).

10).

FIELD SAFETY DATA SHEET

15 074

Chemical Name: Lead and its Compounds (inorganic only)

(*1)CAS NO: 7439-92-1 M.W.: _____ Phys. State solid

(1)TLV 0.15 (ppm or MG/M3) (*)Ceiling Limit 0.45 (ppm or MG/M3)

TWA 0.05 mg/M3 (*)IDLH _____

APPEARANCE:

(*2)Pure: various solids

(*2)Soil: indistinguishable except at high concentrations

(*2)Water: indistinguishable except at high concentrations.

ODOR:

(*)Odor Threshold _____ (ppm or MG/M3)

(*2)Odor Description none- metallic taste at high conc.

(* 2) Vapor Pressure insignificant except at high temp.

DETECTION:

(*)HNU Detection Efficiency: 0 (10.2 EV Probe)

(*2)OVA Detection Effiency: 0

(*)Other Detection Methods: Atomic absorption or ICAP

COMMENTS: Human Health Effects at blood Pb = 20 micrograms/dl (Ref) (Hypertension)

mg/m3

PROTECTIVE EQUIPMENT:

(*3) 0 TO .002 Level-D

(*3) .002 TO .02 Level-C (Cartridge type-H) or GMC-H

(*3) .02 TO ____ Level-B

(*) Above ____ Level-A

ROUTES OF EXPOSURE: Inhalation, Absorption, Ingestion

(*4)Acute Effects: Fatigue, sleep disturbance, headache, muscle aches alters blood forming tissues, impairs enzymes

(*4)Chronic Effects: nerve and brain damage

Other Hazards: Ignit no Flam no Oxid no Corr no

Explosive no Toxic no Carcin no Radio no

Terat _____ Repro _____ Muta _____

(* 4)Vapor Density na (* 4) B.P. ventous (*) LEL NA

(*4)Soluble (H20) varies (* 4) Specif. Grav. =11 (*) UEL NA

DECONTAMINATION: Soap & Water

(*) FIRST AID: _____

REFERENCE SECTION:

1). ACGIH, TLVS 1983-1984

2). Professional Judgement

3). Corporate Guidelines

4). ILO, Encyclopedia of Occupational Health & Safety

5). Environmental Reporter 5/31/85 p197

6).

7).

8).

9).

10).

FIELD SAFETY DATA SHEET

Chemical Name: ORGANIC VAPORS NOS

( )CAS NO: N/a M.W.: Phys. State
(*)TLV (ppm or MG/M3)(*)Ceiling Limit (ppm or MG/M3)

APPEARANCE:
(*)Pure:
(*)Soil:
(*)Water:

ODOR:
(*)Odor Threshold (ppm or MG/M3)
(*)Odor Description

DETECTION:
(*)HNU Detection Efficiency: 30-50% assumed (10.2 EV Probe)
(*)OVA Detection Effiency: 50% assumed
(*)Other Detection Methods:

COMMENTS:

PROTECTIVE EQUIPMENT:
(*1) 0 TO 1 ppm Level-D
(*1) 1 TO 5 ppm Level-C (Cartridge combination organic/ high efficiency filter
(*) TO ppm Level-B
(*) Above ppm Level-A

ROUTES OF EXPOSURE: Inhalation, Absorption, Ingestion

(*2)Acute Effects: nausea unknown, headache, eye, nose & throat irritation
(*)Chronic Effects:

Other Hazards: Ignit yes Flam yes Oxid no Corr no
Explosive no Toxic yes Carcin yes Radio no
Terat yes Repro yes Muta yes

(*)Vapor Density (*) B.P. (*) LEL
(*)Soluble (H20) (*) Specif. Grav. (*) UEL

DECONTAMINATION: Soap & water wash, water rinse. Assumes properties similar to the most common solvents.

(*) FIRST AID: no special actions.

REFERENCE SECTION:
1). Corporate guidelines
2). other values are assumed based uron the solvent properties
3). most often encountered in field work.
4).
5).
6).
7).
8).
9).
10).

recycled paper

THRESHOLD LIMIT VALUE (TLV) AND SOURCE
50 ppm TWA 150ppm STEL ACGIH 1982

EFFECTS OF OVEREXPOSURE Inhalation of TCE above the TLV can irritate nose & throat, with dizziness, drowsiness, headache, nausea, unconsciousness, & even death resulting from excessive exposure. Eye irritation and lacrymati n can result from exposure to vapor or liquid. Skin contact causes irritation and, when prolonged or repeated, dermatitis.*

EMERGENCY FIRST AID PROCEDURES Eye Contact: Wash immediately with plenty of running water. Continue washing to minimize discomfort. Get prompt medical attention. Skin Contact: Remove contaminated clothing. Wash with soap & warm water. Inhalation: Remove to fresh air; store breathing if required. Keep at rest & warm. Immediately contact physician; advise him not to give adrenalin. Ingestion: Get immediate medical help. Do not induce vomiting unless directed by a physician. (Authorities differ; professional decision required).

VIII REACTIVITY DATA

☐ UNSTABLE ☒ STABLE | CONDITIONS TO AVOID

INCOMPATIBILITY (MATERIALS TO AVOID) Reacts with NaOH, KOH, or other strong alkali to form explosive mixtures of chloroacetylenes.

HAZARDOUS DECOMPOSITION PRODUCTS Requires stabilization against oxidation, degradation & polymerization. When exposed to high temperatures, hydrogen chloride & phosgene (highly tox

HAZARDOUS POLYMERIZATION | ☒ MAY OCCUR ☐ WILL NOT OCCUR | CONDITIONS TO AVOID

IX SPILL OR LEAK PROCEDURES

PROCEDURES TO CONTAIN AND CLEAN UP LEAKS AND SPILLS Clean up personnel should use respiratory & liquid contact protection. Provide ventilation. Confine spill to as small an area as possible. Do not allow run off to the sewer. Pick up spill with vacuum or on an absorbent & store in cl sed container for disposal.

REPORTING PROCEDURE

WASTE DISPOSAL METHOD Waste can be processed to recover TCE, or it can be burned in an appropriately equipped, high temperature incinerator. Disposal through a licensed waste disposal company should also be considered. Follow Federal, State & local regulations.

X PROTECTION INFORMATION

RESPIRATORY PROTECTION (SPECIFY TYPE) Use self-contained breathing equipment above 1000 ppm; canister respirators for limited exposures

VENTILATION	LOCAL EXHAUST	SPECIAL
	MECHANICAL (GENERAL)	OTHER

PROTECTIVE GLOVES Neoprene gloves, aprons, etc. | EYE PROTECTION Gas-tight goggles should be used b maintenance & emergency personnel.

OTHER PROTECTIVE EQUIPMENT AND CLOTHING An eyewash station should be available where splashing is probable.

XI SPECIAL PRECAUTIONS

HANDLING AND STORAGE CONDITIONS Store in a cool, well-ventilated area & use with adequate ventilation, including floor level ventilation. No smoking in use or storage areas. Avoid collecting aluminum fines or chips in vapor degreaser. Regularly monitor TCE stabilizer level. Only trained personnel should operate vapor degreaser.

OTHER

XII INFORMATION SUBMITTED BY

NAME	DATE 2/83
COMPANY	SOURCES OSHA

CONTINUATION/NOTES

*Ingestion irritates the digestive tract & may cause nausea & rapid drowsiness partial paralysis, unconsciousness & kidney failure can result in severe cases.

CHEMSAFE™

15 077

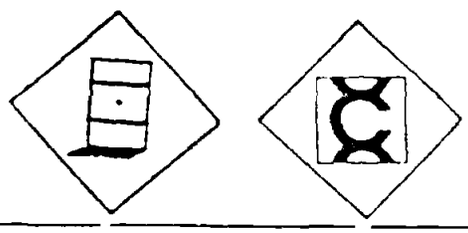
MATERIAL SAFETY DATA SHEET

I IDENTIFICATION

MANUFACTURER'S NAME	EMERGENCY TELEPHONE NO
ADDRESS (Number Street City State and ZIP Code)	CAS NUMBER 000 079 01E
CHEMICAL NAME AND SYNONYMS Trichloroethylene	TRADE NAME AND SYNONYMS
CHEMICAL FAMILY Chlorinated Alkene	FORMULA $ClHCCCl_2$

II CHEMSAFE™ INSTRUCTIONAL* CLASSIFICATION

Affix Appropriate Chemsafe™ Instructional Classification Label



*Refer to CHEMSAFE™ instructional booklets for data regarding the properties appropriate safe use and storage and emergency response for this class of substance

III HAZARDOUS INGREDIENTS

INGREDIENT NAME	%	TLV AND SOURCE (units)	INGREDIENT NAME	%	TLV AND SOURCE (units)
1 Trichloroethylene	100	50 ppm TWA	4		
2		ACGIH	5		
3		1982	6		

IV PHYSICAL DATA

Boiling Point at 760 mm Hg 1 atm, deg F (C)	188 (87)	Specific Gravity (H_2O = 1) 20 C	1.45-1.47*
Vapor Pressure (mm Hg at 20 °C) mm Hg	58	Percent Volatile By Volume (%)	ca 100
Vapor Density (Air = 1)	4.54	Evaporation Rate (Butyl Acetate = 1) (CCl_4=1)	-0.69
Solubility In Water (% by Weight) @ 25°C, %	0.1	Melting Point (°F)	NA

Appearance and Odor Colorless, mobile liquid with a characteristic, sweet, ether-like odor whose recognition threshold is 21.4 ppm in air (unfatigued, 100% of test panel). *Depends on stabilizer & level used.

V FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used) None	Flammable Limits in Air (%, by Volume)	Lower (LEL)	Upper (UE

Extinguishing Media Use that which is appropriate for surrounding fire. Trichloroethylene is normally considered noncombustible. However, when 15% vapor in air at 33C is exposed to intense heat (electric arc) or to ordinary flame at vapor-air temps. exceeding 50C, it can be made to burn mildly. Combustibility increases in O_2 enriched air.

Fire Fighting Procedures Self-contained breathing apparatus should be used for protection against TCE vapors & their toxic & corrosive decomposition products in a fire situation.

Fire and Explosion Hazards

VI LOCATIONS USED AND STORED (Completed By User)

Locations Used

Locations Stored

While Springborn Regulatory Services Inc. (SRS) believes that the data contained herein are factual and believes that the opinions expressed are those of qualified experts, the data are not to be taken as a warranty or representation for which SRS assumes legal responsibility. They are offered solely for your consideration, investigation and verification. Any use of this data and information must be determined by the user to be in accordance with applicable federal, state and local laws and regulations.

Chemical Name: Perchloroethylene syn. tetrachloroethylene

(*1)CAS NO: 127-18-4 M.W.: 166 Phys. State liquid
(*1)TLV 50 PPM (ppm or MG/M3)(*)Ceiling Limit 200 PPM(ppm or MG/M3)
IDLH 500 PPM (ref 4) 15 078

APPEARANCE:
(*)Pure: colorless to pale yellow liquid
(*)Soil:
(*)Water:

ODOR:
(*)Odor Threshold (ppm or MG/M3)
(*4)Odor Description similar to chloroform

DETECTION:
(*2)HNU Detection Efficiency: (10.2 EV Probe) I.P. 9.32
(*2)OVA Detection Effiency: 70%
(*2)Other Detection Methods: Drager tubes, Gas Chromatography

COMMENTS:

PROTECTIVE EQUIPMENT:
(*3) 0 TO 5 ppm Level-D
(*3) 5 TO 50 ppm Level-C (Cartridge Combination: Organic High efficiency filter
(*) TO ppm Level-B
(*) Above ppm Level-A

ROUTES OF EXPOSURE: Inhalation, Absorption, Ingestion

(*4)Acute Effects: irritation of eyes, nose throat, CNS depressant
(*4)Chronic Effects: liver and kidney damage

Other Hazards: Ignit no Flam no Oxid no Corr no
Explosive no Toxic yes Carcin Radio no
Terat Repro Muta

( )Vapor Density (* 4) B.P. 250°F (*) LEL na
(*4)Soluble (H20) 1,500 (* 5) Specif. Grav. 1.62 (*) UEL na

DECONTAMINATION: soap and water wash, water rinse

(*) FIRST AID: Take victim to fresh air and remove contaminated clothing. Give artificial respiration if necessary.

REFERENCE SECTION:
1). ACGIH, TLVs 1984-1985
2). Manufacturer's Literature
3). Corporate Guidelines
4). Niosh / Osha Pocket Guide to Chemical Hazards 1980 revision
5).
6).
7).
8).
9).
10).

HAZARD EVALUATION:

This project has several phases. The phases include surface soil sampling, subsurface soil sampling, sediment sampling , surface water sampling and groundwater sampling. The subsurface sampling efforts will include subcontractors to drill borings and/or install monitoring wells.

Hazards Present:
volatile organic compounds: Inhalation hazard
- paint thinners and solvents
  - generally a mixture of aliphatic organics and aromatic compounds
- degreaser and solvents for the removal of paint
  - generally chlorinated volatile organic compounds such as trichloroethene, methylene chloride, 1,1,1-trichloroethane.

Non-volatile organics:
- direct contact hazard
  - generally petroleum products for vehicle fuels, lubrication although they can be considered to be direct contact hazards, they generally have low toxicity.

Pesticides: direct contact hazard
- The pesticides which are reported to have been disposed of on this site are limited to a mercury containing compound which was used as a herbicide. No other description of the herbicide was made. It is assumed that the compound will be toxic by direct contact only and will probably not be an acetocholinesterase inhibitor since the mercury compounds are not associated with organophosphate or organocarbamate pesticides.

  Other pesticides are in use on the air base at the present time but are not believed to be in the landfill areas. The present pesticides include several of the acetanilide derivatives, and organophosphates and organochlorine compounds. One of the named compounds was Silvex. Silvex is a 2,4,5-T formulation and has the potential for TCDD contamination.

  At this time, no PCBs or Dioxins are known to be or thought to be on the site in the areas of investigation.

Physical hazards:
- The physical hazards associated with this site will be greatest around the drill rig operation. All utility lines pipes etc. will be located prior to the start of drilling. At least two people will be present at the drill rig while it is in operation. The route to the nearest hospital will be explained to the drillers and/or an E&E person familiar with the route will be present.
- constant monitoring of the breathing zone will be performed during the drilling operations. Additional monitoring will be done to detect potentially high concentrations which could reach the breathing zone.

The overall hazards consist of the following:

Inhalation: volatil organic compounds (including carcinogens)
Heavy metals (particulates)
Pesticides

Direct ContacT:
Volatile Organics
Carcinogens: chlorinated organics (volatile)
Pesticides
Mercury (from pesticide)
Lead (from Paint)

- Level-C protection is recommended for those activities which disturb the subsurface soils and for the collection of soil samples which have the potential for contamination with the mercury containing herbicide or carcinogens. GMC-H cartridges.
- Skin protection should include disposable outerwear to protect against particulates. Since the drillers will not drill into the fill material, no direct contact with concentrated chemicals is anticipated.

ACTION LEVELS:

If the HNU/OVA measures organic vapor concentrations in excess of five parts per million above background, the team is to withdraw from the site. Site work is not to continue until th respiratory protection is increased or enough information is provided to the Regional Safety Coordinator for him to determine that level-C respiratory protection is still appropriate. Level-B operation requires the approval of the RSC.

If above background levels of radiation are detected in any of the areas, the work is to stop for that area until the hazard is evaluated and approval is granted.

Subcontracts:

As of 9-12-86 the subcontract has not been finalized. The Statements of medical fittness must be recieved for this safety plan to be valid for subcontract work. The subcontractors must also be informed to the hazards and monitoring . . antiwipated to be present/done.

Site Number one:

The only anticipated wastes which are hazardous are:
paints
paint thinner
  alcohol
  aliphatic organics
  turpentine
Strippers
  chlorinated hydrocarbons such as
    TCE
    Carbon tetrachloride
    1,1,1-Trichloroethane

The quantities are reportedly very small. This is partly due to the practise of burning the solvents rather than just landfilling them.

ACTION LEVELS:
1 PPM organic vapors goto Level-c protection
5 PPM organic vapors withdraw from the site area
Above Background Radiation: Withdraw from the area and report the situation to the RSO.

Site Number 2 (The Northeast Landfill)

Hazardous wastes are present in very small quantities. The volatiles which were disposed of were not containerized. Waste paint and thinners were spread on the ground surface until 1978. Since no concentrated wastes are known to be containerized in the disposal area, high concentrations of vapors are very unlikely.

Action Levels: Same as for site NO.1

Note: Over 400 55-gallon drums are stored at the site. Most of the drums are empty, but some of the drums have unknown contents. If the wind direction places the site downgradient of the drums, there is potential for exposures through leakage and other releases. Inform the team/drillers of that potential and withdraw if unexpected odors occur or if there is irritation of mucus membranes such as in the nose or throat. Eye irritation or headaches are also common signs of exposure .

Site Number 5, The South Burn Pit:

This site was used to burn oil and solvents during training exercises for firefighting personnel. Although there is potential for volatile organics to be present here, the quantities are anticipated to be small due the history.

Level-D respiratory protection is recommended unless the organic vapor concentrations exceed 1 PPM.above background.

Site Number 6: The North Burn Pit:

Hazardous wastes:
- -Waste oils
- -Solvents
- -Fuels: only JP-4 fuel similar to kerosene

History is the same as for site 5. Use the same respiratory guidelines.

Site Number 8, The Herbicide Burial Site:

Hazardous Wastes:
- -four cases of mercury containing herbicide estimated to be less than 50 pounds total
- - no description of the chemical or its trade name.

It will be assumed that the bottles are intact or that they have been broken by their burial. Since the herbicide is in pint bottles, it is unlikely that the borings will break more than one or two. Visu al observation is very important if the perimeter is not well defined. If the perimeter is well defined, there is no chance of striking the bottles.

In the event that the perimeter is poorly defined, the drillers and monitoring personnel should take particular care to examine soil cuttings for signs of organics. The signs could includ a sheen on the water/soil, odors like solvents, fragments of broken glass, etc. Since the characteristics of the herbicide are not defined it is not known if the HNU or OVA will respond to it. For the purposes of this safety plan, we are assuming that both instruments will not detedt the pesticide. You are to assume that herbicide is present.

Hand protection will consist of surgical gloves under nitrile or butyl gloves. Foot protection will be a minimum of rubber boots (safety). Outerwear should be disposable coveralls such as tyvek or saranex suits.

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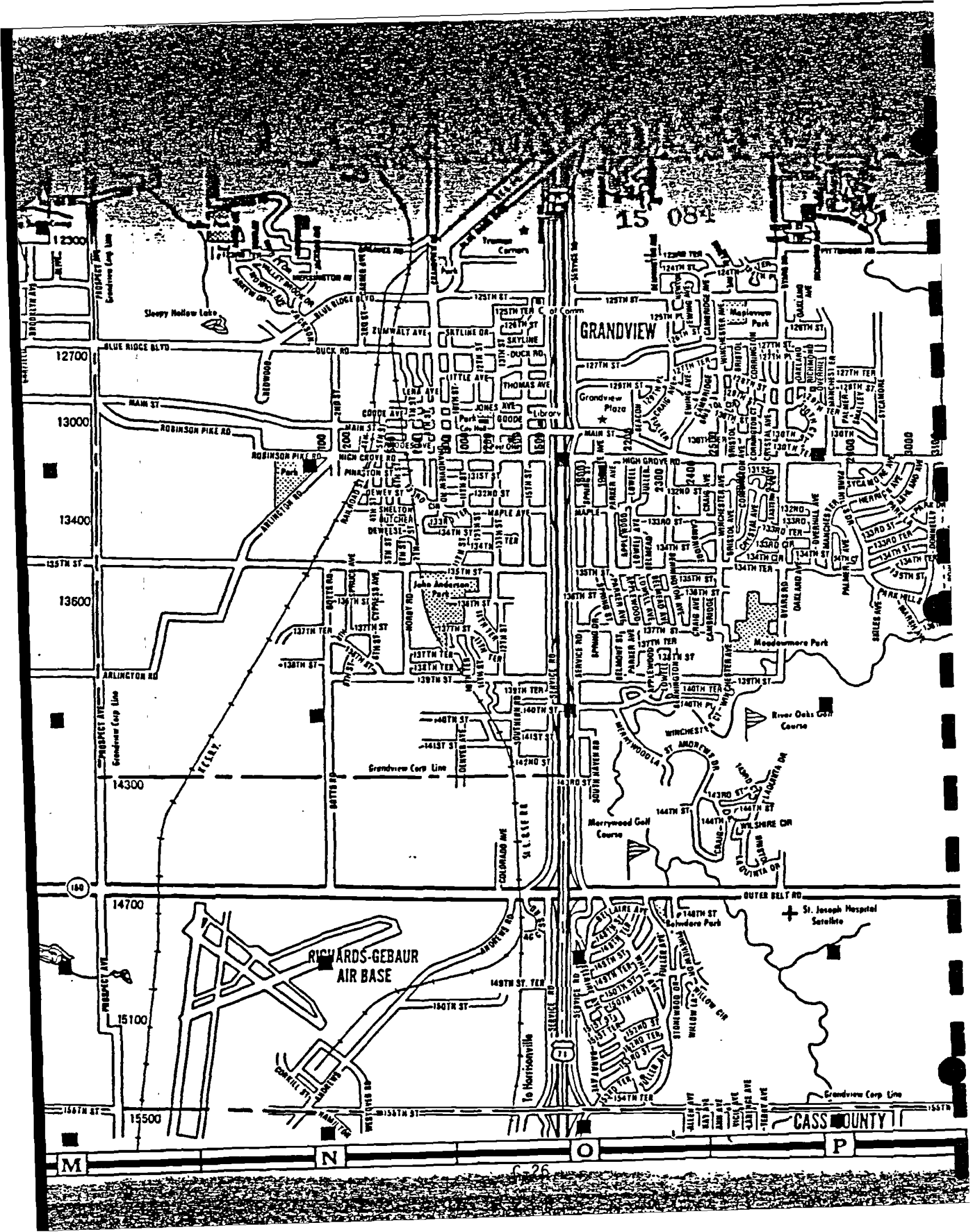
Site Number 9, An Oil Saturated Area

An oil contaminated area is located in an area which was previously used for storage of petroleum products such as fuels, oils and greases.

This area is reported to have been heavily contaminated by relatively non-toxic materials. Due to the nature of the contaminants, and the fact that the site is in an open area, respiratory protection will not be required. Respiratory protection is optional at organic vapor concentrations which reach 5 PPM.


15 084
GRANDVIEW
Grandview Plaza
Mapleview Park
Sleepy Hollow Lake
John Anderson Park
Meadowmore Park
River Oaks Golf Course
Merrywood Golf Course
Belvidere Park
St. Joseph Hospital Satellite
RICHARDS-GEBAUR AIR BASE
Grandview Corp Line
To Harrisonville
CASS COUNTY
BLUE RIDGE BLVD
DUCK RD
MAIN ST
ROBINSON PIKE RD
HIGH GROVE RD
ARLINGTON RD
OUTER BELT RD
125TH ST
127TH ST
129TH ST
135TH ST
139TH ST
140TH ST
141ST ST
142ND ST
143RD ST
144TH ST
148TH ST
149TH ST. TER
150TH ST
155TH ST
SERVICE RD
SOUTH HAVEN RD
COLORADO AVE
PROSPECT AVE
12300
12700
13000
13400
13600
14300
14700
15100
15500
M
N
O
P

APPENDIX D

BORING LOGS/MONITORING WELL DATA

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15 086

Client: Ecology & Environment Inc.

Owner: U.S. Air Force

SUMMARY OF BORING

PROJECT and LOCATION: Subsurface Investigation, Northeast Landfill, Richards Gebaur AFB, Belton, Missouri

JOB NO. DF 4000-2	BORING NO. BP-10	DRILL RIG CME-55	AMOUNT OF CUT OR FILL
LOCATION OF HOLE off Andrews road in hayfield	DRILLING METHOD CME Continuous Sampling	TOPOGRAPHY AND DRAINAGE Flat Fair	DATE 10-17-86
ELEV.	AUGER SIZE 3.75' / BIT TYPE H.S. Auger	SURFACE MATERIAL Grass/Soil	TOTAL DEPTH 8.5'
DATUM	TYPE AND SIZE OF SAMPLERS 3.75 Auger borings	GWL DEPTH AND TIME OF READING	DRILLER MANIACI / HELPER MEYER
			INSPECTOR

FIELD DATA

DEPTH IN FT. or ELEV (1)	SAMPLE DATA (2)	OVA (ppm) (3)	COLOR (4)	MOISTURE (5)	TEXTURAL CLASSIF. (6)	CONSISTENCY or DENSITY (7)	GEOLOGICAL DESCRIPTION and OTHER REMARKS (8)
0							Surface
1	DF 4054		Yellowish Brown	MOIST	SL CL		No Manganese
2							
3		3.0 at 3.1'					
4	DF 4055		gray yellow		SL CL		Firm
5		8.0 at					
6			Brown		gravel chert		Manganese
7	DF 4056		Brown Yellow		SL CL		Plastic when wet Mottled
8							
9							Bedrock - Limestone (not weathered) 8.5'
10							

LABORATORY DATA

MOISTURE IN % (9)	DRY DENSITY PCT. (10)	UNCONFINED COMPRESSIVE STRENGTH TSF (11)	CLASSIF. DATA (12)

15 087

Client: Ecology & Environment Inc.

Owner:

SUMMARY OF BORING

PROJECT and LOCATION Subsurface Investigation of Northeast Landfill Richards Gebaur AFB Belton, Missouri

JOB NO	BORING NO	DRILL RIG	AMOUNT OF CUT OR FILL	DATE IN
DF 4000-2	BP-9	CME-55		10-17-86

LOCATION OF HOLE	DRILLING METHOD	TOPOGRAPHY AND DRAINAGE	TOTAL DEPTH
Side of access road Other	CME Continuous Sampler	Flat Fair-Poor	13.0' ≈

ELEV.	AUGER SIZE	BIT TYPE	SURFACE MATERIAL	DRILLER	HELPER
	3.75"	45. Auger	Soil/Grass	MANIACI	MEYER

DATUM	TYPE AND SIZE OF SAMPLERS	GWL DEPTH AND TIME OF READING	INSPECTOR
	3.75 Auger borings	9.7' 1555	

FIELD DATA								LABORATORY DATA			
DEPTH IN FT. or ELEV (1)	SAMPLE DATA (2)	OVA (ppm) (3)	COLOR (4)	MOISTURE (5)	TEXTURAL CLASSIF. (6)	CONSISTENCY or DENSITY (7)	GEOLOGICAL DESCRIPTION and OTHER REMARKS (8)	MOISTURE IN % (9)	DRY DENSITY PCF. (10)	UNCONFINED COMPRESSIVE STRENGTH TSF (11)	CLASSIF. DATA (12)
1			Dark to Black	damp	Clayey loam	Tight Loose	Soil to ≅ 6'				
2											
3		40 at 3'		moist							
4	DF 4051						90 ppm OVA screening				
5											
6	DF 4052 *										
7			Dark Gray		Clay	Tight	Fairly plastic Low porosity (permeability)				
8		45 at 8'									
9	DF 4053						Chert/Gravel				
10			Gray Black	wet	Sh		Water in cuttings				
11											
12											
13		10 at 13' TD					* Duplicate Sample Taken				

T.D = TOTAL DEPTH

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15 088

Client: Ecology & Environment Inc.

Owner: U.S. Air Force

SUMMARY OF BORING

PROJECT and LOCATION: Subsurface investigation of North east landfill Richards Gebaur Belton, Missouri

JOB NO. DF 4000 2	BORING NO. BP-8	DRILL RIG: CME 55	AMOUNT OF CUT OR FILL	DATE IN: 10-17-86
LOCATION OF HOLE: South of Turn-a-round		DRILLING METHOD: CME Continuous Sampling	TOPOGRAPHY AND DRAINAGE: Flat - Fair to Poor	TOTAL DEPTH: 7.9'
ELEV.		AUGER SIZE: 3.75" / BIT TYPE: U.S. Auger	SURFACE MATERIAL: Gravel	DRILLER: MANIACI / HELPER: MEYER
DATUM		TYPE AND SIZE OF SAMPLERS: 3.75" Auger borings	GWL DEPTH AND TIME OF READING: w/in 1st 3' 1450	INSPECTOR

FIELD DATA								LABORATORY DATA			
DEPTH IN FT. or ELEV (1)	SAMPLE DATA (2)	OVA (ppm) (3)	COLOR (4)	MOISTURE (5)	TEXTURAL CLASSIF. (6)	CONSISTENCY or DENSITY (7)	GEOLOGICAL DESCRIPTION and OTHER REMARKS (8)	MOISTURE IN % (9)	DRY DENSITY PCF. (10)	UNCONFINED COMPRESSIVE STRENGTH TSF (11)	CLASSIF. (12)
0											
1			Dark gray to gray	↑	Clayey Loam	Tight	Soil				
2											
3		240 at 2.9'	gray	damp ↑ WET	SL CL	Tight	Water at 3' / Somewhat plastic				
4											
5					Fill Material	Loose					
6											
7	DF4050		gray		SL CL	tight	Low porosity				
8		200 at 7.9'					rags brought up w/ cuttings				
9											
10											

15 083

Client: Ecology & Environment Inc.

Owner: U.S. Air Force

SUMMARY OF BORING

PROJECT and LOCATION Subsurface Investigation of South Land Fill RICHARDS GEBAUR AFB BELTON, MISSOURI

JOB NO	BORING NO	DRILL RIG	AMOUNT OF CUT OR FILL	DATE IN
DF 4000-2	BP - 7	CME - 55		10-17-86

LOCATION OF HOLE	DRILLING METHOD	TOPOGRAPHY AND DRAINAGE	TOTAL DEPTH
Along road adjacent to hay field.	CME Continuous Sampling	FLAT - Poor to Fair	7.1 ft

ELEV	AUGER SIZE	BIT TYPE	SURFACE MATERIAL	DRILLER	HELPER
	3.75"	H.S. Auger	Soil - Surface Veg	MANIACI	MEYER

DATUM	TYPE AND SIZE OF SAMPLERS	GWL DEPTH AND TIME OF READING	INSPECTOR
	3.75" Auger Borings	4' 1400	

FIELD DATA / **LABORATORY DATA**

DEPTH IN FT. or ELEV (1)	SAMPLE DATA (2)	OVA (ppm) (3)	COLOR (4)	MOISTURE (5)	TEXTURAL CLASSIF. (6)	CONSISTENCY or DENSITY (7)	GEOLOGICAL DESCRIPTION and OTHER REMARKS (8)	MOISTURE IN % (9)	DRY DENSITY PCF. (10)	UNCONFINED COMPRESSIVE STRENGTH TSF (11)	CLASSIF. DATA (12)
0											
1			DARK Brown	Dry	Clayey Loam	Friable when dry					
2			Dark reddish Brown		Clay	Plastic	Low porosity good structure				
3		40 at 3.1'									
4			orange stain	WET		Loose	1st notice of water (running into hole when auger was removed).				
5											
6											
7		8.0 at 7.1'					Rock + Rock fragments (				
8							Auger refusal at 7.1'				
9											
10											

recycled paper

SUMMARY OF BORING

Client: Ecology & Environment Inc.

Owner: U.S. Air Force

PROJECT and LOCATION: Subsurface Investigation of Hazardous Waste Storage (Former) Area RICHARDS GEBAUR AFB BELTON MISSOURI

JOB NO. DF 4000-2	BORING NO. BP-6	DRILL RIG: CME-55	AMOUNT OF CUT OR FILL
LOCATION OF HOLE: Former Hazardous Waste Storage		DRILLING METHOD: CME Continuous Sampling	TOPOGRAPHY AND DRAINAGE: FLAT FAIR TO POOR
ELEV.		AUGER SIZE: 3.75"	BIT TYPE: H.S. Auger
DATUM		TYPE AND SIZE OF SAMPLES: 3.75 Auger Borings	SURFACE MATERIAL: Grass/Soil
			GWL DEPTH AND TIME OF READING

DATE IN: 10-17-86	TOTAL DEPTH	
DRILLER: MANIACI	HELPER: MEYER	
INSPECTOR		

FIELD DATA

DEPTH IN FT. or ELEV (1)	SAMPLE DATA (3)	OVA (ppm) (2)	COLOR (4)	MOISTURE (5)	TEXTURAL CLASSIF. (6)	CONSISTENCY or DENSITY (7)	GEOLOGICAL DESCRIPTION and OTHER REMARKS (8)
0	SAMPLE 4042	NO READINGS ABOVE BACKGROUND	reddish gray		Clay	stiff plastic	no real top soil mottled
2							
4	SAMPLE 4044		MOTTLES				mottles indicate poor drainage
6							No water found in bore.
8							
10	SAMPLE 4043		gray Brown				
12			yellowish Brown		CHERT ROCK FRAGMENTS		Thickness of Chert layer not specified Some structure Clay is crumbly
14		4.0 at 15'		dry	clay		TOTAL DEPTH = 15.0'
16							
18							

LABORATORY DATA

MOISTURE IN % (9)	DRY DENSITY PCT. (10)	UNCONFINED COMPRESSIVE STRENGTH TSF (11)	CLASSIF.

15 091

Client: Ecology & Environment Inc

Owner: U.S. Air Force

SUMMARY OF BORING

PROJECT and LOCATION Subsurface Investigation of Meter Pad Area RICHARDS GEBAUR AFS RELTON, MISSOURI

JOB NO: DE 4000-2	BORING NO: BP-5	DRILL RIG: CME-55	AMOUNT OF CUT OR FILL	DATE (s): 10-17-86
LOCATION OF HOLE: Southwest Corner of Meter Pad		DRILLING METHOD: CME Continuous Sampling	TOPOGRAPHY AND DRAINAGE: FLAT FAIR DX POOR	TOTAL DEPTH: 16.51'
ELEV		AUGER SIZE: 3.75" / BIT TYPE: H.S Auger	SURFACE MATERIAL: Gravel	DRILLER: MAWIAKI / HELPER: MEYER
DATUM		TYPE AND SIZE OF SAMPLERS: 3.75" Auger Borings	GWL DEPTH AND TIME OF READING	INSPECTOR

FIELD DATA								LABORATORY DATA			
DEPTH IN FT. or ELEV (1)	SAMPLE DATA (2)	OVA (ppm) (3)	COLOR (4)	MOISTURE (5)	TEXTURAL CLASSIF. (6)	CONSISTENCY or DENSITY (7)	GEOLOGICAL DESCRIPTION and OTHER REMARKS (8)	MOISTURE IN % (9)	DRY DENSITY PCF. (10)	UNCONFINED COMPRESSIVE STRENGTH TSF (11)	CLASSIF. DATA (12)
0											
2			gray	Dry	gravel		at surface gravel — clay to about 2.5' medium permeability				
			yellow		clay						
4	4039 Sample 3'-4'	200 at 3'	Dark gray to Black	Damp	Clay Loam	hard blocky					
6			Lt Gray Brown grades to a Darker Gray Brown	dry	Clay	Hard & Lumpy Plastic	Fine texture				
8	4040 Sample 8'-9'	100 at 8'									
10							manganese				
12							Mottles				
14		50 at 13'	Gray Brown	dry	Clay						
16	4041 Sample 15.5'-16.5'										
18		120 at T.D					OVA reading in open bore hole — 20 ppm				

recycled paper

D-7

T.D = TOTAL DEPTH

15 092

Client: Ecology & Environment, Inc

Owner: U.S. AIR FORCE

SUMMARY OF BORING

PROJECT and LOCATION: SUBSURFACE INVESTIGATION OF NORTH BURN AREA @ RICHARDS GEBAUR AFB, BENTON, MO.

JOB NO. DF 4000 2	BORING NO. BP-3	DRILL RIG CME 55	AMOUNT OF CUT OR FILL	DATE IN 10/15/86
LOCATION OF HOLE NORTH-EAST END OF BURN PIT		DRILLING METHOD CME CONTINUOUS SAMPLER	TOPOGRAPHY AND DRAINAGE FLAT - FAIR TO POOR	TOTAL DEPTH
ELEV.		AUGER SIZE 3 3/4" / BIT TYPE H-S AUGER	SURFACE MATERIAL GRAVEL	DRILLER M. MANIACI / HELPER D. MEYE
DATUM		TYPE AND SIZE OF SAMPLERS 3 3/4" AUGER BORINGS	GWL DEPTH AND TIME OF READING	INSPECTOR

FIELD DATA / **LABORATORY DATA**

DEPTH IN FT. or ELEV (1)	SAMPLE DATA (2)	OVA (ppm) (3)	COLOR (4)	MOISTURE (5)	TEXTURAL CLASSIF. (6)	CONSISTENCY or DENSITY (7)	GEOLOGICAL DESCRIPTION and OTHER REMARKS (8)	MOISTURE IN % (9)	DRY DENSITY PCF. (10)	UNCONFINED COMPRESSIVE STRENGTH TSF (11)	CLASSIF. (12)
				DRY	COURSE	LOOSE	GRAVEL, WELL-GRADED				
		200 @ 1.5'	RED/BR BR BR→GR	DAMP	SL-CL	MED. STIFF	THIN LAYER, MED POROSITY				
2	DF 4033	20@25	RED/BR Mn	DRY		LOOSE	GRAVEL, GROUTED CAP @ 2.0'				
4											
	DF 4034		GR→BR Mn	MOIST	SL-CL	STIFF	FAIRLY PLASTIC				
6			LESS Mn								
8		500 @ 8.0'	BR→GR		CHERT						
					CHERT						
10			Mn		SL-CL		FAIRLY PLASTIC				
			BR→R.BR								
	DF 4035			MOIST		STIFF ↓ MED. STIFF					
12			R.BR Mn		CHERT		CHERT, SHARP GRAVEL MIX @ 12.0'				
14					CHERT		BEDROCK				
							BOTTOM OF BORING @ 14.4' NO WATER FOUND NO WATER SAMPLES TAKEN				
16											

15 096

Client: Ecology & Environment, Inc

Owner: U.S. AIR FORCE

SUMMARY OF BORING

PROJECT and LOCATION Subsurface Investigation of North Burn Area @ Richards Gebaur AFB, Benton, MO.

JOB NO: DF 4000 2	BORING NO: BP-2	DRILL RIG: CME 55	AMOUNT OF CUT OR FILL	DATE IN: 10/15/86
LOCATION OF HOLE: South-East End of Burn Pit		DRILLING METHOD: CME Continuous Sampler	TOPOGRAPHY AND DRAINAGE: FLAT - FAIR TO POOR	TOTAL DEPTH: 13.0'
ELEV.		AUGER SIZE: 3 3/4" / BIT TYPE: H-S Auger	SURFACE MATERIAL: GRAVEL	DRILLER: M. Maniaci / HELPER: D. Meyer
DATUM		TYPE AND SIZE OF SAMPLERS: 3 3/4" Auger Borings	GWL DEPTH AND TIME OF READING	INSPECTOR

FIELD DATA

DEPTH IN FT. or ELEV (1)	SAMPLE DATA (2)	OVA (ppm) (3)	COLOR (4)	MOISTURE (5)	TEXTURAL CLASSIF. (6)	CONSISTENCY or DENSITY (7)	GEOLOGICAL DESCRIPTION and OTHER REMARKS (8)
1				DRY	COURSE	LOOSE	HIGH POROSITY GRAVEL, WELL-GRADED LITTLE OR NO FINES
2	DF 4030	40@2.0'	DK GR	DAMP	SL-CL		LOW POROSITY GRAVEL/CLAY MIX @ 2.0' @ 2.0' GROUTING CAP
3		>100x @3.0'	GR/BN Mn.	DAMP	SL-CL		LOW POROSITY
4							CUTTINGS >100x ON OVA @ 4.0' → 5.0'
5	DF 4031		TO -	TO			
6		30 @6.0'	RED-BROWN	MOIST	SL-CL		HIGH PLASTICITY
7		50 @7.0'	LESS Mn				
8							
9			BR/GR Mn.	MOIST	SL-CL		LOW POROSITY HIGH PLASTICITY
10			CHERT @9.8'				
11	DF 4032		RED-BRN/GREY Mn.	MOIST	SL-CL		LOW POROSITY HIGH PLASTICITY
12							
13		300 @13.0'					WEATHERED BEDROCK
							BOTTOM OF BORING @ 13.0' NO WATER FOUND NO WATER SAMPLES TAKEN

LABORATORY DATA

MOISTURE IN % (9)	DRY DENSITY PCF. (10)	UNCONFINED COMPRESSIVE STRENGTH TSF (11)	CLASSIF. DATA (12)

recycled paper

15 094

Client: ECOLOGY & ENVIRONMENT, INC

Owner: U.S. AIR FORCE

SUMMARY OF BORING

PROJECT and LOCATION SUBSURFACE INVESTIGATION OF NORTH BURN AREA @ RICHARDS GEBAUR AFB, BENTON, MO.

JOB NO. DF 4000 2	BORING NO BP-1	DRILL RIG CME 55	AMOUNT OF CUT OR FILL	DATE (s) 10/15/86
LOCATION OF HOLE SOUTH-WEST END OF BURN PIT		DRILLING METHOD CME CONTINUOUS SAMPLER	TOPOGRAPHY AND DRAINAGE FLAT - FAIR TO POOR	TOTAL DEPTH 12.9'
ELEV.		AUGER SIZE 3 3/4" / BIT TYPE H-S AUGER	SURFACE MATERIAL GRAVEL	DRILLER M. MANIACI / HELPER D. MEYER
DATUM		TYPE AND SIZE OF SAMPLERS 3 3/4" AUGER BORINGS	GWL DEPTH AND TIME OF READING	INSPECTOR

FIELD DATA								LABORATORY DATA			
DEPTH IN FT. or ELEV (1)	SAMPLE DATA (2)	OVA (ppm) (3)	COLOR (4)	MOISTURE (5)	TEXTURAL CLASSIF. (6)	CONSISTENCY or DENSITY (7)	GEOLOGICAL DESCRIPTION and OTHER REMARKS (8)	MOISTURE IN % (9)	DRY DENSITY PCF. (10)	UNCONFINED COMPRESSIVE STRENGTH TSF (11)	CLASSIF. DATA (12)
1				DRY	COURSE	LOOSE	HIGH POROSITY GRAVEL, WELL-GRADED LITTLE OR NO FINES				
2			DK GR	DAMP	SL-CL	MEDIUM STIFF	LOW POROSITY GRAVEL/CLAY MIX				
3			GR/BLK	MOIST	SL-CL	STIFF	GROUTING CAP @ 2.0' D LOW POROSITY MED. PLASTICITY				
4	DF 4027	60 @ 3.3'+8.3'									
5							LOW POROSITY				
6			BR/GR	MOIST	SL-CL	STIFF	HIGHLY PLASTIC				
7							ENCOUNTERED OBSTRUCTION @ 7.9'				
8	DF 4028										
9							LOW POROSITY HIGHLY PLASTIC TO HARD				
10		>100	GR/BLK Mn.	MOIST	SL-CL	STIFF ↓ V. STIFF					
11											
12	DF 4029						WEATHERED BEDROCK				
13						D-10.	BOTTOM OF BORING @ 12.9' NO WATER FOUND NO WATER SAMPLES TAKEN				

Client: Ecology & Environment Inc

Owner: U S Air Force

SUMMARY OF BORING

PROJECT and LOCATION Groundwater Investigation at NORTHEAST LANDFILL RICHARDS GEBAUR AFB BELTON, MISSOURI

JOB NO	BORING NO	DRILL RIG	AMOUNT OF CUT OR FILL	DATE (s)
DF 4002-2	MW 6	CME 55		

LOCATION OF HOLE	DRILLING METHOD	TOPOGRAPHY AND DRAINAGE	TOTAL DEPTH
NORTHEAST LANDFILL 20 YARDS INSIDE FENCE	CONTINUOUS SAMPLER	FLAT FAIR TO POOR	

ELEV	AUGER SIZE	BIT TYPE	SURFACE MATERIAL	DRILLER	HELPER
	3.75"	HS AUGER	GRASS/SOIL	MANIACI	MEIER

DATUM	TYPE AND SIZE OF SAMPLERS	GWL DEPTH AND TIME OF READING	INSPECTOR
	1.25" PVC BAILER ≅ 3' L	N/A	

FIELD DATA / LABORATORY DATA

DEPTH IN FT. or ELEV (1)	SAMPLE DATA (2)	OVA (ppm) (3)	COLOR (4)	MOISTURE (5)	TEXTURAL CLASSIF (6)	CONSISTENCY or DENSITY (7)	GEOLOGICAL DESCRIPTION and OTHER REMARKS (8)	MOISTURE IN % (9)	DRY DENSITY PCF (10)	UNCONFINED COMPRESSIVE STRENGTH TSF (11)	CLASSIF. DATA (12)
0	Cement		DRK BWN	DAMP to DRY	TOPSOIL	FIRM	ORGANIC MATTER				
1–2			DARK BROWN to GRAY		Clayey Loam	Firm + PLASTIC	DECREASING AMOUNTS OF ORGANIC MATTER				
3	Bentonite	16 at 31'									
4–5			Gray Brown		Clay	FIRM					
6			Gray								
					CHERT	HARD BRITTLE					
7			Gray		Clay	FIRM					
					CHERT	HARD BRITTLE					
8			Yellow Gray ↕ DRK GRY		Clay	FIRM					
9			DRK GRY		COAL	SOFT	≅ 9.0' to 9.5'				
10			LIGHT GRAY		SHALE	SOFT FRIABLE					
11–12	Blank Pipe						Blank PIPE				
13						D-11	TD = 13.1' NO WATER				

IN FEET

Screen 6.1' to 11.1'

Sand

NO READINGS FROM 3.1' to T.D

recycled paper

15 096

SUMMARY OF BORING

Client: Ecology & Environment

Owner: U.S. Air Force

PROJECT and LOCATION: Groundwater Investigation at NORTHEAST LANDFILL RICHARDS GEBAUR AFB BELTON, MISSOURI

JOB NO: DF 4000-2	BORING NO: MW-5	DRILL RIG: CME-55	AMOUNT OF CUT OR FILL	DATE IN: 10-16-86
LOCATION OF HOLE: NORTHEAST LANDFILL 65 YARDS WEST OF TURN-A-ROUND		DRILLING METHOD: Continuous Sampler	TOPOGRAPHY AND DRAINAGE: FLAT - FAIR TO POOR	TOTAL DEPTH: 17.1'
ELEV.		AUGER SIZE: 3 3/4" / BIT TYPE: H.S. AUGER	SURFACE MATERIAL: GRASS	DRILLER: MANIACI / HELPER: MEYER
DATUM		TYPE AND SIZE OF SAMPLERS: 1 1/4" PVC BAILER ≅ 3' L	GWL DEPTH AND TIME OF READING: 17.1' 1630	INSPECTOR

FIELD DATA | **LABORATORY DATA**

DEPTH IN FT. or ELEV (1)	SAMPLE DATA (2)	OVA (ppm) (3)	COLOR (4)	MOISTURE (5)	TEXTURAL CLASSIF. (6)	CONSISTENCY or DENSITY (7)	GEOLOGICAL DESCRIPTION and OTHER REMARKS (8)	MOISTURE IN % (9)	DRY DENSITY PCF. (10)	UNCONFINED COMPRESSIVE STRENGTH TSF (11)	CLASSIF. (12)
0	CEMENT						TOP SOIL ≅ 6"				
2	BENTONITE	-10 at 2½'	Reddish Brown	DAMP	Clay Loam		Increasing clay content w/ depth				
4			Yellow Brown								
6			gray Brown								
8		-40 at 7½'	Yellow Brown								
10	SAND		gray Brown								
12	SCREEN	-38 at 12½'			Clay						
14											
16		2 at T.D	Yellow Brown	MOIST			T.D ≅ 17.1' (to bedrock) water at bottom				
18											
20											
IN FEET											

T.D = Total Depth

15 U.

Client: ECOLOGY & ENVIRONMENT, INC

Owner: U S AIR FORCE

SUMMARY OF BORING

PROJECT and LOCATION GROUND WATER INVESTIGATION OF POL FUEL STORAGE AREA AT RICHARDS-GEBAUR AFB, BELTON, MO

JOB NO: DF 4000 2	BORING NO: MW-4	DRILL RIG: CME 55	AMOUNT OF CUT OR FILL:	DATE (s): 10/16/86
LOCATION OF HOLE: WEST OF POL (FLAMABLE) FUEL STORAGE AREA		DRILLING METHOD: CME CONTINUOUS SAMPLING	TOPOGRAPHY AND DRAINAGE: FLAT - FAIR	TOTAL DEPTH: 10.0'
ELEV.		AUGER SIZE: 3 3/4" / BIT TYPE: H S AUGER	SURFACE MATERIAL: GRASS	DRILLER: M. MANIACI / HELPER: D. MEYER
DATUM		TYPE AND SIZE OF SAMPLERS: 1 1/4" PVC BAILERS @ 3.0' L	GWL DEPTH AND TIME OF READING: 10.0' @ 1525 HRS	INSPECTOR

FIELD DATA								LABORATORY DATA			
DEPTH IN FT. or ELEV (1)	SAMPLE DATA (2)	OVA (ppm) (3)	COLOR (4)	MOISTURE (5)	TEXTURAL CLASSIF (6)	CONSISTENCY or DENSITY (7)	GEOLOGICAL DESCRIPTION and OTHER REMARKS (8)	MOISTURE IN % (9)	DRY DENSITY PCT. (10)	UNCONFINED COMPRESSIVE STRENGTH TSF (11)	CLASSIF. DATA (12)
			DK BR	DAMP			TOPSOIL @ 6" D. ROOT HAIRS CEMENT CAP				
1			DK BR	DAMP	SL-CL	STIFF	@ 2' GROUT CASING				
2		<1.0 (1x) @2.5'									
3							@ 2' BETONITE PELLETS FOR SEALING				
4							6' SAND FILL TO BOTTOM OF BORING				
5											
6											
7			GR-BR		SL-CL	STIFF	5' SCREEN INSTALLED				
8			YL/BR				CHERT @ 8.0'				
9											
10							BEDROCK, WATER ENCOUNTERED BOTTOM OF BORING @ 10.0'				
11											

recycled paper

Ecology & Environment, Inc.

Client: ECOLOGY & ENVIRONMENT, INC

Owner: U.S. AIR FORCE

SUMMARY OF BORING

PROJECT and LOCATION: GROUND WATER INVESTIGATION OF NORTH BURN AREA @ RICHARDS GEBAUR AFB, BELTON, MO

JOB NO. DF 40002	BORING NO MW-3	DRILL RIG CME 55	AMOUNT OF CUT OR FILL	DATE IN 10/16/86
LOCATION OF HOLE NORTHWEST CORNER OF BURN PIT COMPOUND		DRILLING METHOD CME CONTINUOUS SAMPLER	TOPOGRAPHY AND DRAINAGE FLAT - FAIR TO POOR	TOTAL DEPTH 7.5'
ELEV.		AUGER SIZE 3 3/4" / BIT TYPE H.S AUGER	SURFACE MATERIAL GRAVEL	DRILLER M. MANIACI / HELPER D. MEYER
DATUM		TYPE AND SIZE OF SAMPLERS 1 1/4" PVC BAILER @ 3.0'L	GWL DEPTH AND TIME OF READING DRY	INSPECTOR

FIELD DATA / LABORATORY DATA

DEPTH IN FT. or ELEV (1)	SAMPLE DATA (2)	OVA (ppm) (3)	COLOR (4)	MOISTURE (5)	TEXTURAL CLASSIF. (6)	CONSISTENCY or DENSITY (7)	GEOLOGICAL DESCRIPTION and OTHER REMARKS (8)	MOISTURE IN % (9)	DRY DENSITY PCF. (10)	UNCONFINED COMPRESSIVE STRENGTH TSF (11)	CLASSIF. (12)
1				DRY	COURSE	LOOSE	GRAVEL, WELL-GRADED HIGH POROSITY LITTLE OR NO FINE ESTIMATED 1.5' DEPTH				
2							GROUT CASING @ 2.0' D				
		>100x @ 2.5'					OVA READING TAKEN THROUGH CARBON FILTER & STILL >100x, POSSIBLY METHANE GAS				
3			DK BR	MOIST	SL-CL	STIFF	HIGH PLASTICITY, LOW POROSITY				
4							2.0' BETONITE PELLETS FOR SEALING				
5							3.5' SAND FILL TO BOTTOM OF BORING				
6							CHERT @ 6.0'				
							2.5' SCREEN INSTALLED				
7	DF 4057 (1)	>100 @ 7.5'	DK BR	MOIST	SL-CL	STIFF	HIGH OVA READING FROM PROBABLE METHANE GAS BEDROCK				
8							BOTTOM OF BORING @ 7.5' NO WATER FOUND (10/16/86)				

(1) = VERY LITTLE WATER FOUND ON 10/17/86. < 6.0'

15 093

Client: ECOLOGY & ENVIRONMENT, INC

Owner: U.S AIR FORCE

SUMMARY OF BORING

PROJECT and LOCATION GROUND WATER INVESTIGATION OF NORTH BURN AREA @ RICHARDS-GEBAUR AFB, BELTON, MO.

JOB NO: DF 4000 2	BORING NO: MW-2	DRILL RIG: CME 55	AMOUNT OF CUT OR FILL	DATE (s): 10/16/86
LOCATION OF HOLE: SOUTHEAST CORNER OF BURN PIT COMPOUND		DRILLING METHOD: CME CONTINUOUS SAMPLER	TOPOGRAPHY AND DRAINAGE: FLAT - FAIR TO POOR	TOTAL DEPTH: 10.5'
ELEV.		AUGER SIZE: 3 3/4" / BIT TYPE: HS AUGER	SURFACE MATERIAL: GRASS	DRILLER: M. MANIACI / HELPER: D. MEYER
DATUM		TYPE AND SIZE OF SAMPLERS: 1 1/4" PVC BAILER @ 3.0' L	GWL DEPTH AND TIME OF READING: DRY	INSPECTOR

FIELD DATA								LABORATORY DATA			
DEPTH IN FT. or ELEV (1)	SAMPLE DATA (2)	OVA (ppm) (3)	COLOR (4)	MOISTURE (5)	TEXTURAL CLASSIF (6)	CONSISTENCY or DENSITY (7)	GEOLOGICAL DESCRIPTION and OTHER REMARKS (8)	MOISTURE IN % (9)	DRY DENSITY PCF. (10)	UNCONFINED COMPRESSIVE STRENGTH TSF (11)	CLASSIF. DATA (12)
			RED/BR	DAMP	CL	STIFF	TOPSOIL, ≤ 6" D, MED PLASTICITY ROOT HAIRS CEMENT CAP				
1							GROUT CASING @ 20' D				
2		0.0 @2.5'									
3			DK BRN	MOIST	SL-CL	STIFF	MED PLASTICITY				
4											
5							3.0' BETONITE PELLETS FOR SEALING				
6							5.0' SAND FILL TO BOTTOM OF BORING				
7							CHERT @ 7.4'				
8		120 @ 7.5'									
9					SL-CL		4.0' SCREEN INSTALLED				
10		0.0 (or) @ 10.5'					BEDROCK				
11							BOTTOM OF BORING @ 10.5' NO WATER FOUND				

recycled paper

SUMMARY OF BORING

Client: ECOLOGY & ENVIRONMENT, INC

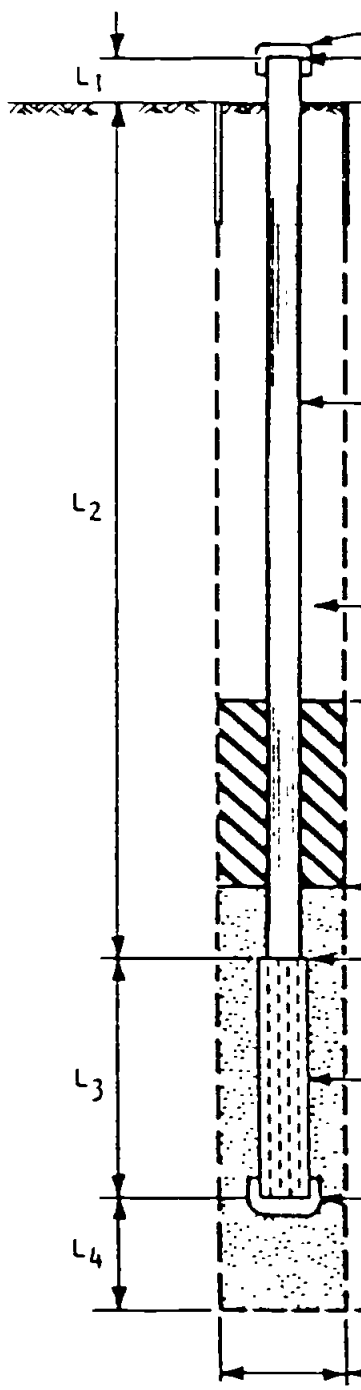
Owner: U.S. AIR FORCE

PROJECT and LOCATION GROUND WATER INVESTIGATION O NORTH BURN AREA @ RICHA GEBAUR AFB, BELTON, M

JOB NO. DF 4000 2	BORING NO. MW-1	DRILL RIG CME 55	AMOUNT OF CUT OR FILL	DATE (s) 10/16/86
LOCATION OF HOLE NORTHEAST CORNER OF BURN PIT COMPOUND		DRILLING METHOD CME CONTINUOUS SAMPLER	TOPOGRAPHY AND DRAINAGE FLAT – FAIR TO POOR	TOTAL DEPTH 20.0'
ELEV.		AUGER SIZE 3 3/4" / BIT TYPE H.S. AUGER	SURFACE MATERIAL GRASS	DRILLER M. MANJACI / HELPER D. MEYER
DATUM		TYPE AND SIZE OF SAMPLERS 1 1/4" PVC BAILER @ 3.0'L	GWL DEPTH AND TIME OF READING DRY	INSPECTOR

FIELD DATA								LABORATORY DATA			
DEPTH IN FT. or ELEV (1)	SAMPLE DATA (2)	OVA (ppm) (3)	COLOR (4)	MOISTURE (5)	TEXTURAL CLASSIF. (6)	CONSISTENCY or DENSITY (7)	GEOLOGICAL DESCRIPTION and OTHER REMARKS (8)	MOISTURE IN % (9)	DRY DENSITY PCF. (10)	UNCONFINED COMPRESSIVE STRENGTH TSF (11)	CLASSIF. DATA (12)
			DK BR	DAMP	SL-CL	STIFF	TOPSOIL @ 6" D. MED. PLASTIC ROOT HAIRS CEMENT CAP				
2							GROUT CASING @ 2.0' D MED. PLASTICITY				
4				DAMP	SL-CL	MED. STIFF	SAND FILL TO @ 7.0' D.				
6							10' OF 2" PVC MONITORING PIPE INSTALLED				
8		1.0 @ 7.5'					BELT AT @ 9.0'				
10			YL/BR	MOIST	SL-CL	STIFF	MED. PLASTICITY				
12		4.0 @ 12.5'					10' OF SCREEN TO BOTTOM				
14							BETONITE SEAL EQUIVALANT @ 5.0' (15.0' DEPTH)				
16							SAMPLES FOR OIL IN CUTTING @ 17.5' WITH NONE DETECTED				
18		3.0 @ 20'		MOIST	SL-CL	V. STIFF	BETONITE PELLETS AROUND SCREEN TO DEPTH @ 2.0' WEATHERED CLAY				
20							NO BEDROCK ENCOUNTERED AT 20.0' NO WATER FOUND (10/16/86)				

Ground Elevation and Datum: _____ 15 10



Vented cap

Elevation of top of riser pipe: +2.0'

Determined by

☐ Survey

☐ Estimated

I.D. of riser pipe / Type of riser pipe: 2" PVC Sch 40

Type of backfill around riser: Cement grout

Thickness of seal / Type of seal: Bentonite pellet Seal 5.0' Thick

Elevation of top of filter sand: 7.0

Elevation of bottom of riser: 10.0

Slotted section / Screen gauge or size of openings: 0.010"

Elevation of bottom of piezometer: 20.0'

Elevation of bottom of borehole: 20.0'

Diameter of borehole: 7.5"

L_1 = 2.0 ft

L_2 = 10.0 ft

L_3 = 10.0 ft

L_4 = 0.0 ft

GROUNDWATER MONITORING WELL

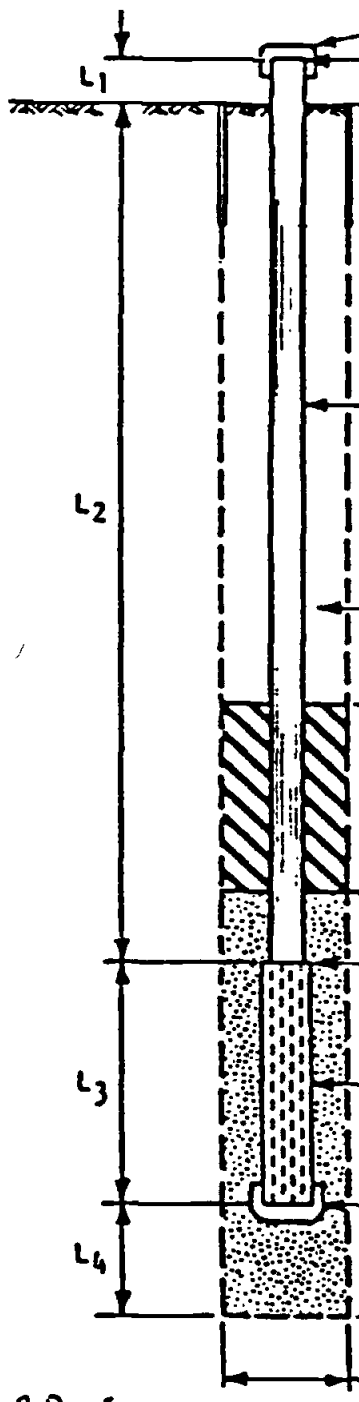
MW #1

GEOTECHNOLOGY, INC.

recycled paper

Gr und Elevati n and Datum: _____

15 192



Vented cap

Elevation of top of riser pipe +2.0'
Determined by:
- [ ] Survey
- [ ] Estimated

I.D. of riser pipe 2" PVC SCH 40
Type of riser pipe

Type of backfill around riser Cement grout

Thickness of seal 3.0' Thick
Type of seal* Bentonite Pellet Seal

Elevation of top of filter sand 5.0

Elevation of bottom of riser 6.5

Slotted section
Screen gauge or size of openings 0.010"

Elevation of bottom of piezometer 10.5'

Elevation of bottom of borehole 10.5'

Diameter of borehole 7.5"

L_1 = 2.0 ft

L_2 = 6.5 ft

L_3 = 4.0 ft

L_4 = 0.0 ft

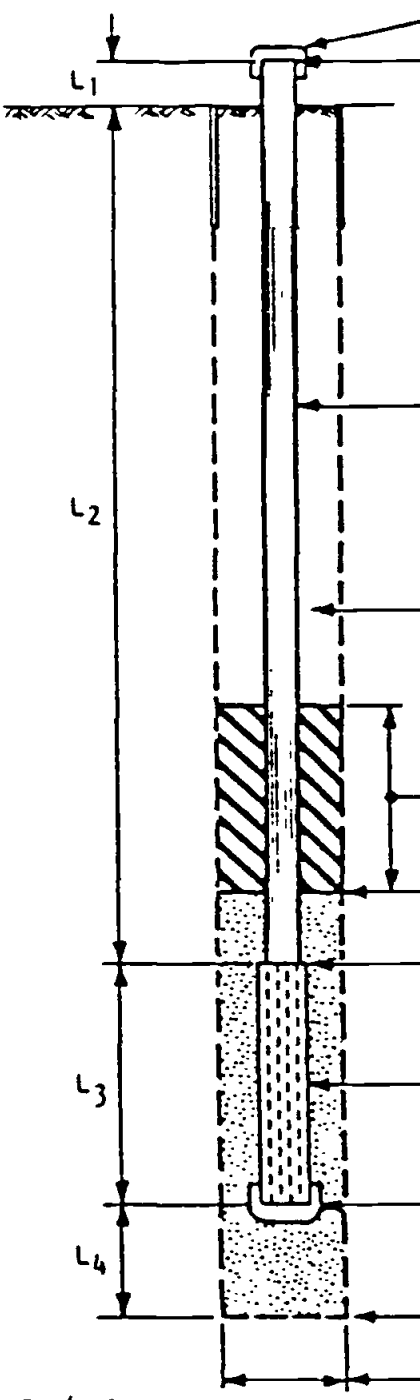
GROUNDWATER MONITORING WELL

MW#2

GEOTECHNOLOGY, INC.

Ground Elevation and Datum: _____

15 103



Elevation of top of riser pipe +2.0'
Determined by:
- [ ] Survey
- [ ] Estimated

I.D. of riser pipe 2" PVC SCH 40
Type of riser pipe

Type of backfill around riser Cement Grout

Thickness of seal 2.0' Thick
Type of seal* Bentonite Pellet Seal

Elevation of top of filter sand 4.0'

Elevation of bottom of riser 5.0'

Slotted section
Screen gauge or size of openings 0.010"

Elevation of bottom of piezometer 7.5'

Elevation of bottom of borehole 7.5'

Diameter of borehole 7.5"

L_1 = 2.0' ft

L_2 = 5.0 ft

L_3 = 2.5' ft

L_4 = 0.0' ft

GROUNDWATER MONITORING WELL

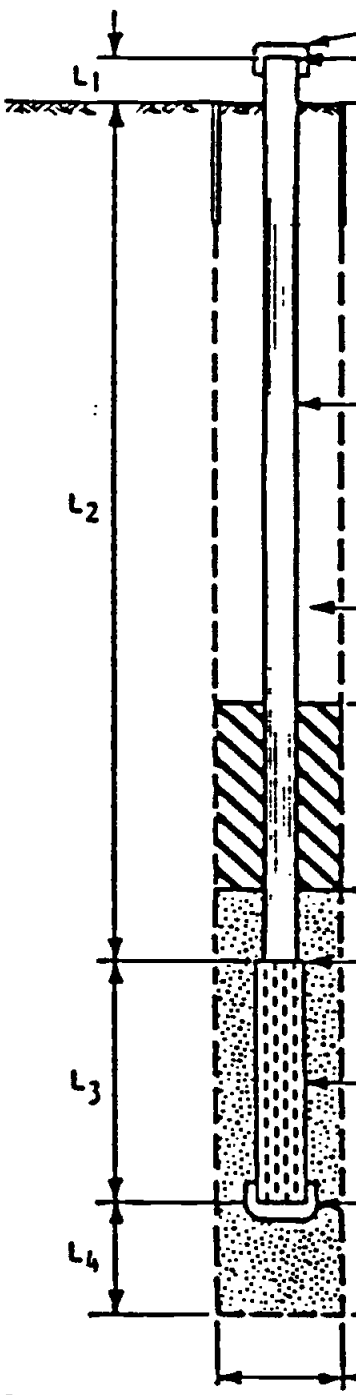
MW#3

recycled paper

GEOTECHNOLOGY, INC.

Gr und Elevation and Datum: _____

15 104



Elevation of top of riser pipe +2.0'
Determined by:
☐ Survey
☐ Estimated

I.D. of riser pipe / Type of riser pipe: 2" PVC SCH 40

Type of backfill around riser: Cement grout

Thickness of seal / Type of seal*: Bentonite Pellet Seal 2.3' Thick

Elevation of top of filter sand: 4.8'

Elevation of bottom of riser: 5.8'

Slotted section / Screen gauge or size of openings: 0.010"

Elevation of bottom of piezometer: 9.8'

Elevation of bottom of borehole: 9.8'

Diameter of borehole: 7.5"

L_1 = 2.0 ft

L_2 = 5.8 ft

L_3 = 4.0 ft

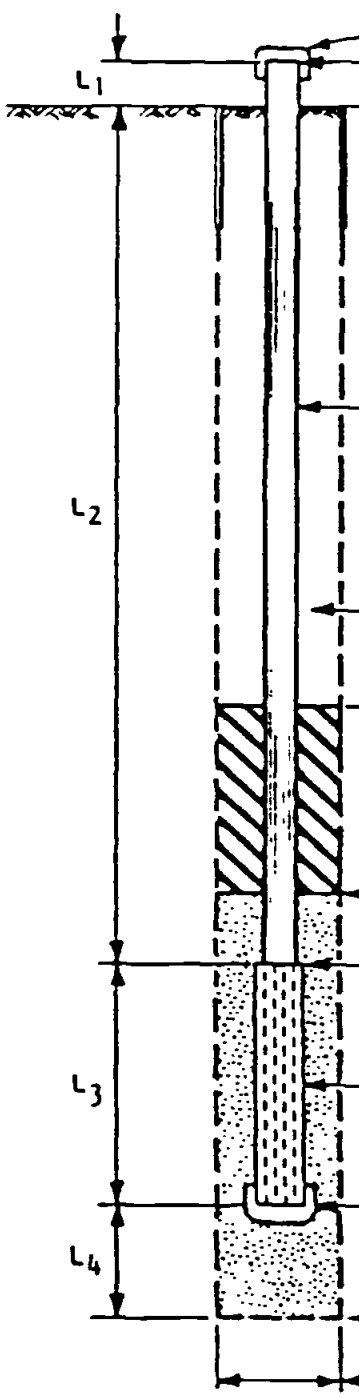
L_4 = 0.0 ft

GROUNDWATER MONITORING WELL

MW-4

GEOTECHNOLOGY, INC.

Ground Elevation and Datum: _____ 15 105



Elevation of top of riser pipe 42.0'
Determined by:
- [ ] Survey
- [ ] Estimated

I.D. of riser pipe / Type of riser pipe: 2" PVC SCH 40

Type of backfill around riser: Cement Grout

Thickness of seal / Type of seal*: Bentonite Pellet Seal 3.0' Thick

Elevation of top of filter sand: 5.0'

Elevation of bottom of riser: 7.1'

Slotted section / Screen gauge or size of openings: 0.010'

Elevation of bottom of piezometer: 17.1'

Elevation of bottom of borehole: 17.1'

Diameter of borehole: 7.5"

L_1 = 2.0 ft

L_2 = 7.1 ft

L_3 = 10.0 ft

L_4 = 0.0 ft

GROUNDWATER MONITORING WELL

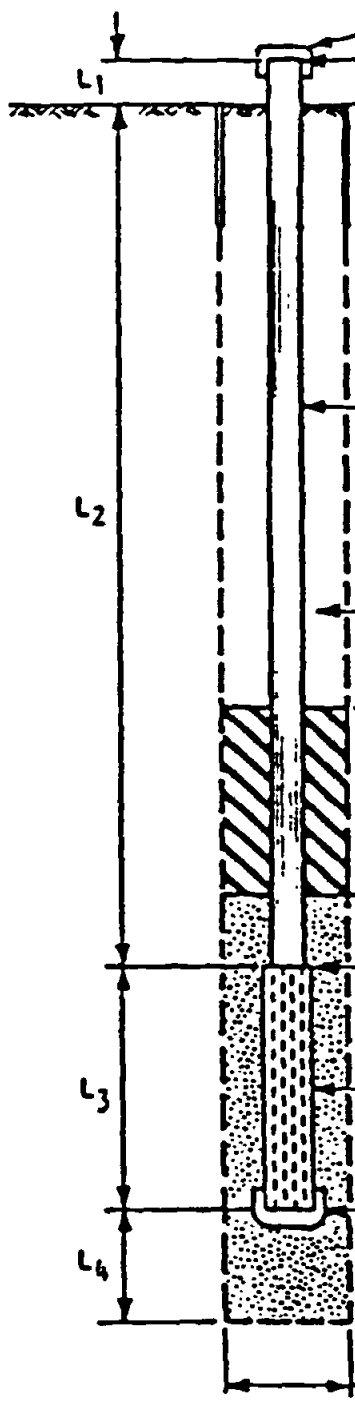
MW #5

GEOTECHNOLOGY, INC.

recycled paper

Ground Elevation and Datum: _____

15 106



Elevation of top of riser pipe +2.0'

Determined by:

- [ ] Survey
- [ ] Estimated

I.D. of riser pipe / Type of riser pipe: 2" PVC SCH 40

Type of backfill around riser: Cement Grout

Thickness of seal / Type of seal*: Bentonite Pellet Seal 2.0' Thick

Elevation of top of filter sand: 5.0

Elevation of bottom of riser: 6.1'

Slotted section / Screen gauge or size of openings: 0.010"

Elevation of bottom of piezometer: 11.1'

Elevation of bottom of borehole: 13.1'

Diameter of borehole: 7.5"

L_1 = 2.0 ft

L_2 = 6.1 ft

L_3 = 5.0 ft

L_4 = 2.0 ft

GROUNDWATER MONITORING WELL

MW-6

GEOTECHNOLOGY, INC.

Project: RICHARDS-GEBAUR AFB PHASE II STAGE 2 INVESTIGATION

Boring No. MW-1 **Date of Boring** 10/16/86 **Project No.** DF4000 **Sheet** 1 **of** 1

Sample No. and Method	Blows/Foot (N)	Unconfined Compressive Strength (TSF)	Penetrometer Value (TSF)	Moisture Content (%)	Dry Unit Weight (PCF)	Unified System Symbol	Depth (Feet)	Description	Water Table Observations
							Surface	NORTH BURN AREA	
								TOPSOIL, DK BROWN SILTY CLAY	
								BROWN SILTY CLAY, MED. PLASTICITY/ DAMP	
							5		
								OVA = 1.0 PPM	
								CHERT	
							10	YELLOWISH BROWN SILTY CLAY, MED. PLAST. MOIST	
								OVA = 4.0 PPM	
							15		
							20	OVA = 2.0 PPM	
								TOTAL DEPTH = 20.0'	
								NO BEDROCK	
								NO WATER.	
							25		
							30		
							35		
							40		

Remarks:
DRILLING CO.: GEOTECHNOLOGY, INC.
DRILLER: M. MANIACI HELPER: D. MEYER
CME CONTINUOUS SAMPLER

Note: All Shelby tube [ST] unconfined compression tests performed in the laboratory.

FIELD BORING LOG

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Project: RICHARDS-GEBAUR AFB PHASE II STAGE 2 INVESTIGATION

Boring No. MW-2 Date of Boring 10/16/86 Project No. DF4000 Sheet 1 of 1

Sample No. and Method	Blows/Foot (N)	Unconfined Compressive Strength (TSF)	Penetrometer Value (TSF)	Moisture Content (%)	Dry Unit Weight (PCF)	Unified System Symbol	Depth (Feet)	Description	Water Table Observations
							Surface	NORTH BURN AREA	
								TOP SOIL, RED BROWN CLAY	
								DK BROWN SILTY CLAY MEDIUM PLACTICITY, MOIST	
								OVA = 0 ppm	
							5		
								OVA = 120 ppm CHERT	
								DK. BROWN SILTY CLAY	
							10		
								BEDROCK TOTAL DEPTH = 10.5'	
								NO WATER	
							15		
							20		
							25		
							30		
							35		
							40		

Remarks:
DRILLING CO.: GEOTECHNOLOGY, INC.
DRILLER: M. MANIACI HELPER: D. MEYER
CME CONTINUOUS SAMPLER

Note: All Shelby tube (ST) unconfined compression tests performed in the laboratory.

FIELD BORING LOG

ecology and environment, inc.

Project: RICHARDS-GEBAUR AFB PHASE II STAGE 2 INVESTIGATION

Boring No. MW-3 **Date of Boring** 10/16/86 **Project No.** DF4000 **Sheet** 1 **of** 1

Sample No. and Method	Blows/Foot (N)	Unconfined Compressive Strength (TSF)	Penetrometer Value (TSF)	Moisture Content (%)	Dry Unit Weight (PCF)	Unified System Symbol	Depth (Feet)	Description	Water Table Observations
								Surface — NORTH BURN AREA	
								GRAVEL, WELL GRADED, DRY	
								OVA >100ppm — DK. BROWN SILTY CLAY HIGHLY PLASTIC, STIFF MOIST	
							5	CHERT	
								OVA >100PPM — DK. BROWN SILTY CLAY, MOIST	
								BEDROCK — TOTAL DEPTH = 7.5'	
							10	NO WATER	
							15		
							20		
							25		
							30		
							35		
							40		

Remarks:
DRILLING CO.: GEOTECHNOLOGY, INC.
DRILLER: M. MANIACI HELPER: D. MEYER
CME CONTINUOUS SAMPLER

Note: All Shelby tube [ST] uncontined compression tests performed in the laboratory.

FIELD BORING LOG

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Project: RICHARDS-GEBAUR AFB PHASE II STAGE 2 INVESTIGATION

Boring No. MW-4 Date of Boring 10/16/86 Project No. DF4000 Sheet 1 of 1

Sample No. and Method	Blows/Foot (N)	Unconfined Compressive Strength (TSF)	Penetrometer Value (TSF)	Moisture Content (%)	Dry Unit Weight (PCF)	Unified System Symbol	Depth (Feet)	Description	Water Table Observations
							Surface	POL STORAGE AREA	
								TOP SOIL, DAMP, DK BROWN	
								OVA = < 1.0 PPM DARK BROWN SILTY CLAY, DAMP	
							5	GRAYBROWN SILTY CLAY	
								YELLOW BROWN CHERT	
								GRAY BROWN SILTY CLAY	
							10	BEDROCK	
								TOTAL DEPTH = 10.0'	
								WATER IN WELL.	
							15		
							20		
							25		
							30		
							35		
							40		

Remarks:
DRILLING CO.: GEOTECHNOLOGY, INC.
DRILLER: M. MANIACI HELPER: D. MEYER

Note: All Shelby tube [ST] unconfined compression tests performed in the laboratory.

FIELD BORING LOG

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Project: RICHARDS-GEBAUR AFB PHASE II STAGE 2 INVESTIGATION

Boring No. MW-5 **Date of Boring** 10-16-86 **Project No.** DF4000 **Sheet** 1 **of** 1

Sample No. and Method	Blows/Foot (N)	Unconfined Compressive Strength (TSF)	Penetrometer Value (TSF)	Moisture Content (%)	Dry Unit Weight (PCF)	Unified System Symbol	Depth (Feet)	Description	Water Table Observations
							Surface	NORTHEAST LANDFILL	
								TOP SOIL, REDDISH BROWN	
								RED DISH BROWN CLAY LOAM, DAMP	
								OVA = 10ppm	
								YELLOW BROWN CLAY LOAM	
							5	GRAY BROWN GRADING	
								OVA = 40ppm	
								YELLOW BROWN TO	
							10	GRAY BROWN CLAY	
								OVA = 30ppm WITH	
								DEPTH	
							15	YELLOW BROWN	
								OVA = 2ppm BEDROCK CHERT	
								TOTAL DEPTH = 17.1'	
								WATER IN WELL.	
							20		
							25		
							30		
							35		
							40		

Remarks:
DRILLING CO.: GEOTECHNOLOGY, INC.
DRILLER: M. MANIACI HELPER: D. MEYER

Note: All Shelby tube [ST] unconfined compression tests performed in the laboratory.

FIELD BORING LOG

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Project: RICHARDS-GEBAUR AFB PHASE II STAGE 2 INVESTIGATION

Boring No. MW-6 BP-4 **Date of Boring** _____ **Project No.** DF4000 **Sheet** 1 **of** 1

Sample No. and Method	Blows/Foot (N)	Unconfined Compressive Strength (TSF)	Penetrometer Value (TSF)	Moisture Content (%)	Dry Unit Weight (PCF)	Unified System Symbol	Depth (Feet)	Description	Water Table Observations
							Surface	DK. BR. TOPSOIL NORTHEAST LANDFILL	
								DARK BROWN TO GRAY CLAYEY LOAM PLASTIC, ORGANICS DECREASING WITH DEPTH.	
								OVA=16	
						CL	5	GRAY BROWN CLAY ↓ GRAY	
								CHERT	
						CL		GRAY CLAY	
								CHERT	
						CL		YELLOW GRAY TO DK GRAY CLAY	
								COAL, DK. GRAY SOFT	
							10	SHALE	
								TOTAL DEPTH = 13.1'	
							15	NO WATER IN WELL.	
							20		
							25		
							30		
							35		
							40		

Remarks:
DRILLING CO.: GEOTECHNOLOGY, INC.
DRILLER: M. MANIACI HELPER: D. MEYER
CME CONTINUOUS SAMPLER

Note: All Shelby tube [ST] unconfined compression tests performed in the laboratory.

FIELD BORING LOG

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Project: RICHARDS-GEBAUR AFB PHASE II STAGE 2 INVESTIGATION

Boring No. BP-1 **Date of Boring** 10/15/86 **Project No.** DF4000 **Sheet** 1 **of** 1

Sample No. and Method	Blows/Foot (N)	Unconfined Compressive Strength (TSF)	Penetrometer Value (TSF)	Moisture Content (%)	Dry Unit Weight (PCF)	Unified System Symbol	Depth (Feet)	Description	Water Table Observations
							Surface	NORTH BURN AREA	
								GRAVEL, WELL GRADED, DRY	
								DARK GRAY SILTY CLAY GRAVEL MIX, DAMP	
								GRAY BLACK SILTY CLAY, MOIST, MED. PLASTICITY	
DF4027									
							5	OVA = 60ppm	
								BROWN GRAY SILTY CLAY, MOIST, HIGHLY PLASTIC.	
								← CINDRT	
DF4028									
								GRAY BROWN SILTY CLAY, MOIST HIGHLY PLASTIC, VERY STIFF	
							10	OVA = >100ppm	
DF4029									
								WEATHERED BEDROCK	
								TOTAL DEPTH = 12.9'	
							15	NO WATER IN BORING.	
							20		
							25		
							30		
							35		
							40		

Remarks:
DRILLING CO.: GEOTECHNOLOGY, INC. CME CONTINUOUS SAMPLER
DRILLER: M. MANIACI HELPER: D. MEYER

Note: All Shelby tube [ST] uncontined compression tests performed in the laboratory.

Project: RICHARDS-GEBAUR AFB PHASE II STAGE 2 INVESTIGATION

Boring No. BP-2 Date of Boring 10/15/86 Project No. DF4000 Sheet 1 of 1

Sample No. and Method	Blows/Foot (N)	Unconfined Compressive Strength (TSF)	Penetrometer Value (TSF)	Moisture Content (%)	Dry Unit Weight (PCF)	Unified System Symbol	Depth (Feet)	Description	Water Table Observations
								Surface NORTH BURN AREA	
								WELL GRADED GRAVEL	
								OVA = 40 PPM GRAVEL CLAY MIXTURE	
DF4030								OVA > 100% SILTY CLAY, DARK GRAY, DAMP	
							5	OVA > 100% GRAY BROWN SILTY CLAY HIGHLY PLASTIC, DAMP	
DF4031								OVA = 30 PPM GRADES TO RED BROWN, MOIST	
								OVA = 50 PPM	
								BROWN GRAY SILTY CLAY, HIGHLY PLASTIC MOIST	
								CHERT	
							10	RED BROWN GRAY SILTY CLAY HIGHLY PLASTIC MOIST	
DF4032								OVA = 300 PPM	
								WEATHERD BEDROCK TOTAL DEPTH = 13.0' NO WATER IN BORING	
							15		
							20		
							25		
							30		
							35		
							40		

Remarks:
DRILLING CO.: GEOTECHNOLOGY, INC.
DRILLER: M. MANIACI HELPER: D. MEYER
CME CONTINUOUS SAMPLER.

Note: All Shelby tube [ST] unconfined compression tests performed in the laboratory.

FIELD BORING LOG

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Project: RICHARDS-GEBAUR AFB PHASE II STAGE 2 INVESTIGATION

Boring No. BP-3 **Date of Boring** 10/15/86 **Project No.** DF4000 **Sheet** 1 **of** 1

Sample No. and Method	Blows/Foot (N)	Unconfined Compressive Strength (TSF)	Penetrometer Value (TSF)	Moisture Content (%)	Dry Unit Weight (PCF)	Unified System Symbol	Depth (Feet)	Description	Water Table Observations
								Surface — NORTH BURN AREA	
								GRAVEL WELL GRADED, DRY	
								OVA = 200ppm RED BROWN SILTY CLAY	
DF4033								OVA = 50ppm GRAVEL, DRY	
							5	GRAY TO BROWN SILTY CLAY MEDIUM PLASTICITY, MOIST	
DF4034								OVA = 500ppm CHERT, BROWN GRAY	
							10	BROWN TO REDDISH BROWN SILTY CLAY, PLASTIC MOIST	
DF4035								CHERT GRAVEL	
								CHERT	
							15	BEDROCK — TOTAL DEPTH = 14.4' NO WATER IN BORING	
							20		
							25		
							30		
							35		
							40		

Remarks:
DRILLING CO.: GEOTECHNOLOGY, INC.
DRILLER: M. MANIACI HELPER: D. MEYER
CME CONTINUOUS SAMPLER

Note: All Shelby tube (ST) unconfined compression tests performed in the laboratory.

FIELD BORING LOG

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Project: RICHARDS-GEBAUR AFB PHASE II STAGE 2 INVESTIGATION

Boring No. BP-5 Date of Boring 10/17/86 Project No. DF4000 Sheet 1 of 1

Sample No. and Method	Blows/Foot (N)	Unconfined Compressive Strength (TSF)	Penetrometer Value (TSF)	Moisture Content (%)	Dry Unit Weight (PCF)	Unified System Symbol	Depth (Feet)	Description	Water Table Observations
								Surface OIL SATURATED AREA	
								GRAVEL AT SURFACE	
						CL		CLAY, GRAY TO BROWN FILL	
								OVA = 200PPM DARK GRAY TO BROWN DAMP CLAY LOAM (TOPSOIL)	
DF4039									
							5		
								LT. GRAY BROWN CLAY, PLASTIC DRY	
						CL		OVA = 100PPM GRADES TO DARK GRAY BROWN. DRY	
DF4040									
							10		
								GRAY BROWN CLAY DRY	
								OVA = 50PPM	
							15		
DF4041								OVA = 20PPM	
								TOTAL DEPTH = 16.5'	
							20		
							25		
							30		
							35		
							40		

Remarks:
DRILLING CO.: GEOTECHNOLOGY, INC. CME CONTINUOUS SAMPLER
DRILLER: M. MANIACI HELPER: D. MEYER

Note: All Shelby tube [ST] unconfined compression tests performed in the laboratory.

FIELD BORING LOG

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Project: RICHARDS-GEBAUR AFB PHASE II STAGE 2 INVESTIGATION

Boring No. BP-6 **Date of Boring** 10/17/86 **Project No.** DF4000 **Sheet** 1 **of** 1

Sample No. and Method	Blows/Foot (N)	Unconfined Compressive Strength (TSF)	Penetrometer Value (TSF)	Moisture Content (%)	Dry Unit Weight (PCF)	Unified System Symbol	Depth (Feet)	Description	Water Table Observations
							Surface	HAZARDOUS WASTE STORAGE AREA	
DF4042								REDDISH GRAY CLAY STIFF PLASTIC	
DF4044							5	GRADES TO GRAY BROWN	
DF4043							10		
								CHERT	
								YELLOWISH BROWN CLAY WITH ROCKFRAGMENTS	
							15	OVA = 4.0ppm TOTAL DEPTH 15.0'	
							20		
							25		
							30		
							35		
							40		

Remarks:
DRILLING CO.: GEOTECHNOLOGY, INC.
DRILLER: M. MANIACI HELPER: D. MEYER

CME CONTINUOUS SAMPLER

Note: All Shelby tube [ST] unconfined compression tests performed in the laboratory.

FIELD BORING LOG

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Project: RICHARDS-GEBAUR AFB PHASE II STAGE 2 INVESTIGATION

Boring No. BP-7 Date of Boring 10/17/86 Project No. DF4000 Sheet 1 of 1

Sample No. and Method	Blows/Foot (N)	Unconfined Compressive Strength (TSF)	Penetrometer Value (TSF)	Moisture Content (%)	Dry Unit Weight (PCF)	Unified System Symbol	Depth (Feet)	Description	Water Table Observations
								Surface SOUTH LANDFILL	
								DARK BROWN CLAYEY LOAM	
								DARK REDDISH BROWN CLAY PLASTIC W/ORANGE STAIN FROM 2.5'	
								40PPM	
								CHERT	
							5	DARK REDDISH BROWN SILTY CLAY W/ORANGE STAIN WET	
								QVA=8.0PPM ROCK FRAGMENTS	
								AUGER REFUSAL = 7.1'	
							10		
							15		
							20		
							25		
							30		
							35		
							40		

Remarks:
DRILLING CO.: GEOTECHNOLOGY, INC.
DRILLER: M. MANIACI HELPER: D. MEYER

CME CONTINUOUS SAMPLER

Note: All Shelby tube (ST) unconfined compression tests performed in the laboratory.

FIELD BORING LOG

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Project: RICHARDS-GEBAUR AFB PHASE II STAGE 2 INVESTIGATION

Boring No. BP-8 **Date of Boring** 10/17/80 **Project No.** DF4000 **Sheet** 1 **of** 1

Sample No. and Method	Blows/Foot (N)	Unconfined Compressive Strength (TSF)	Penetrometer Value (TSF)	Moisture Content (%)	Dry Unit Weight (PCF)	Unified System Symbol	Depth (Feet)	Description	Water Table Observations
								Surface NORTHEAST LANDFILL	
								TOPSOIL, CLAYEY LOAM DARK GRAY TO GRAY, DAMP	
								OVA = 240 ppm GRAY SILTY CLAY, SOMEWHAT PLASTIC	▽
							5	FILL MATERIAL	
								GRAY SILTY CLAY	
DF4050								OVA = 200 ppm	
								TOTAL DEPTH = 7.9' RAGS IN CUTTINGS	
							10		
							15		
							20		
							25		
							30		
							35		
							40		

Remarks:
DRILLING CO.: GEOTECHNOLOGY, INC.
DRILLER: M. MANIACI HELPER: D. MEYER

CME CONTINUOUS SAMPLER

Note: All Shelby tube [ST] unconfined compression tests performed in the laboratory.

FIELD BORING LOG

ecology and environment, inc.

Project: RICHARDS-GEBAUR AFB PHASE II STAGE 2 INVESTIGATION

Boring No. BP-9 **Date of Boring** 10/17/86 **Project No.** DF4000 **Sheet** 1 **of** 1

Sample No. and Method	Blows/Foot (N)	Unconfined Compressive Strength (TSF)	Penetrometer Value (TSF)	Moisture Content (%)	Dry Unit Weight (PCF)	Unified System Symbol	Depth (Feet)	Description	Water Table Observations
							Surface	NORTHEAST LANDFILL	
								← GRAVEL; CLAYEY LOAM DARK TO BLACK, DAMP TO MOIST	
								OVA = 4.0	
DF4051							5	OVA 90ppm	
DF4052								CLAY, PLASTIC, DARK GRAY; OVA = 4.5	
								CHERT/GRAVEL	
DF4053							10	GRAY, BLACK, SILTY CLAY WET	
								OVA = 1.0 SHALE	
								TOTAL DEPTH 13.0'	
							15		
							20		
							25		
							30		
							35		
							40		

Remarks: CME CONTINUOUS SAMPLER

DRILLING CO.: GEOTECHNOLOGY, INC.
DRILLER: M. MANIACI HELPER: D. MEYER

Note: All Shelby tube [ST] unconfined compression tests performed in the laboratory.

FIELD BORING LOG

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Project: RICHARDS-GEBAUR AFB PHASE II STAGE 2 INVESTIGATION

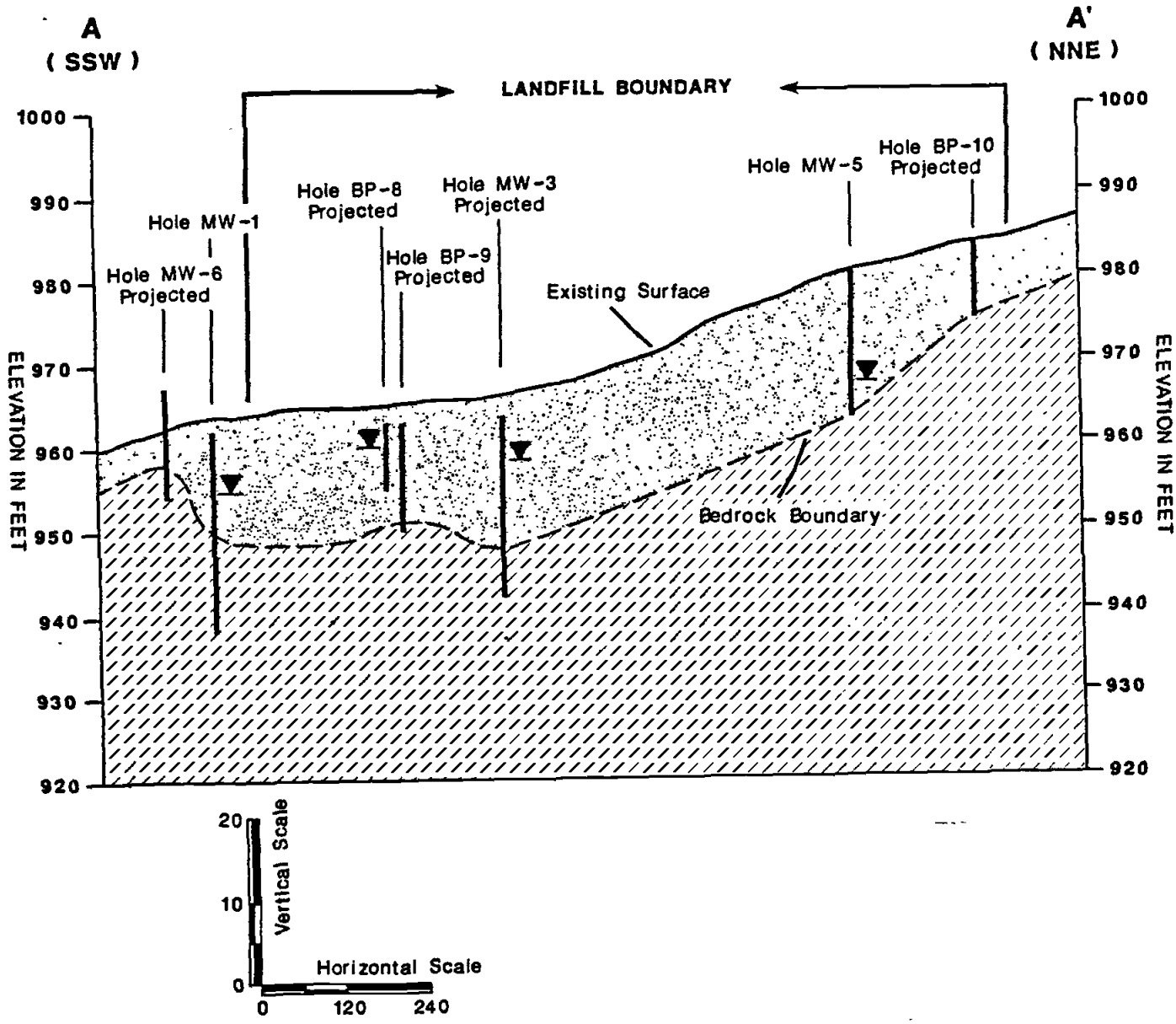
Boring No. BP-10 **Date of Boring** 10/17/86 **Project No.** DF4000 **Sheet** 1 **of** 1

Sample No. and Method	Blows/Foot (N)	Unconfined Compressive Strength (TSF)	Penetrometer Value (TSF)	Moisture Content (%)	Dry Unit Weight (PCF)	Unified System Symbol	Depth (Feet)	Description	Water Table Observations
								Surface NORTHEAST LANDFILL	
DF4054						SL CL		YELLOWISH BROWN, MOIST SILTY CLAY OVA READING = 3.0ppm	
DF4055						SL CL	5	FIRM, GRAY, YELLOW ↕ MOIST OVA = 8.0ppm	
								BROWN, GRAVEL, CHERT	
DF4056						SL CL		BROWN, YELLOW, PLASTIC, MOTTLED	
							10	BED ROCK, LIMESTONE (NOT WEATHERED) @ 8.5'	
							15		
							20		
							25		
							30		
							35		
							40		

Remarks:
DRILLING CO.: GEOTECHNOLOGY, INC. CME CONTINUOUS SAMPLER
DRILLER: M. MANIACI HELPER: D. MEYER

Note: All Shelby tube [ST] unconfined compression tests performed in the laboratory.

FIELD BORING LOG **ecology and environment, inc.**



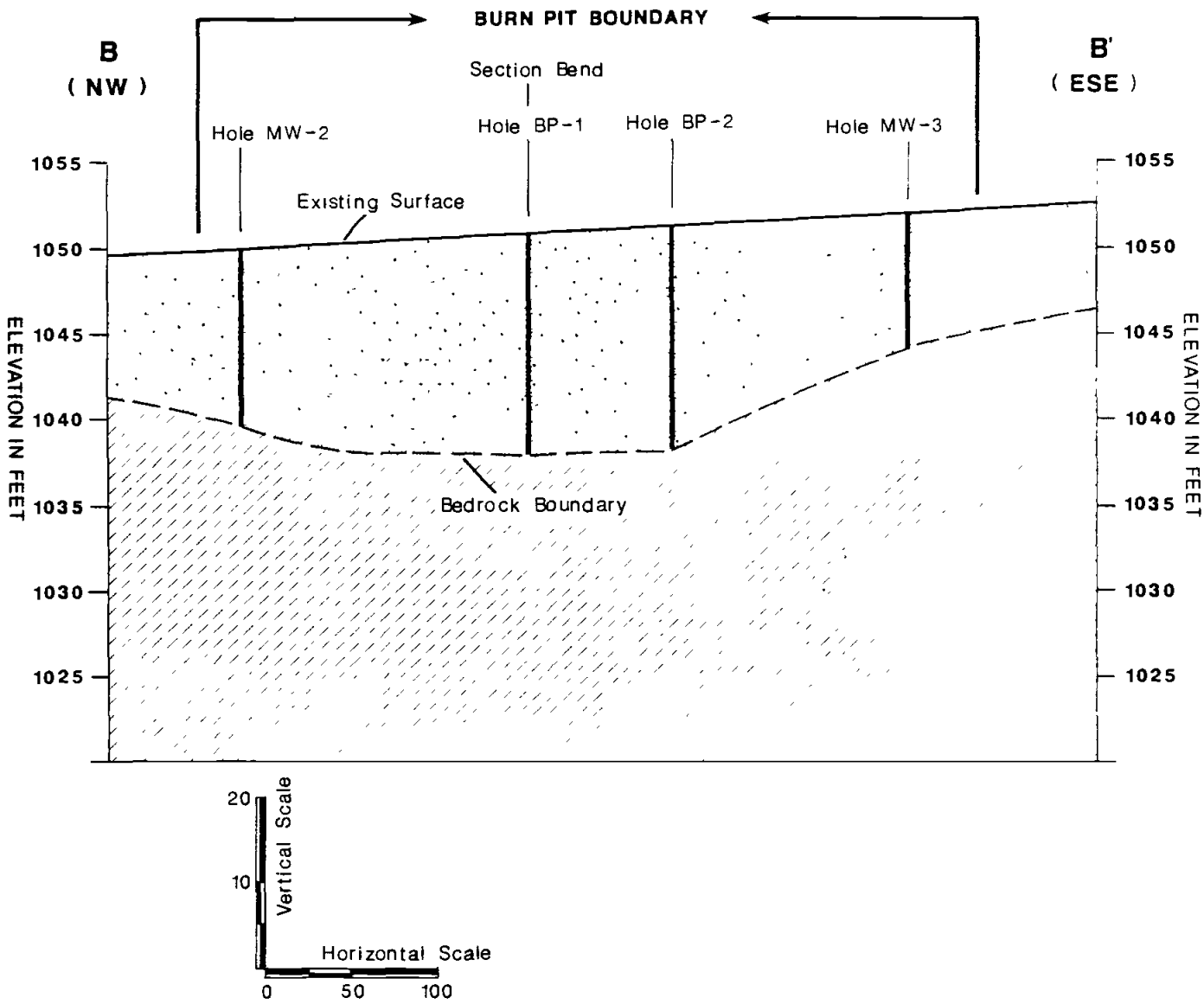
LEGEND

SURFICIAL DEPOSITS
Clayey silt and clay with scattered gravel lenses

BEDROCK
Shale, limestone and chert with scattered coal lense

Groundwater level in the well

GEOLOGICAL CROSS SECTION
A-A'
RICHARDS-GEBAUR AFB
NORTEAST LANDFILL



LEGEND

SURFICIAL DEPOSITS
Silty clay with scattered gravel lenses

BEDROCK
Chert and shale

GEOLOGICAL CROSS SECTION
B-B'
RICHARDS-GEBAUR AFB
NORTH BURN PIT AREA

APPENDIX E

CHAIN-OF-CUSTODY FORMS

ecology and environment, inc.
195 SUGG ROAD, P.O. BOX O, BUFFALO, N.Y., 14225, TEL. 716-632-4491
International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Project No.: DF-4000
Project Name: Richards Gebaur AFB
Project Manager: Paul R Kopsick
Sampiers: (Signatures) Paul R Kopsick, Mark Myer, Michael Mikolowski
Field Team Leader: Paul R. Kopsick

STATION NUMBER	DATE	TIME	SAMPLE TYPE: COMP	GRAB	AIR	SAMPLE INFORMATION / EXPECTED COMPOUNDS (Concentration)*	STATION LOCATION	NUMBER OF CONTAINERS	40 mL VOA	8 oz JAR	1 L Amber				REMARKS: Depth	OVA
DF-4036	10/16	1855		X		VOA, Pet. Hydro	NE LF Boring 4	3	2	1					1-2'	(8963)
37	10/16	1900		X					2	1					6-7'	8964
38	10/16	1905		X					2	1					8/8.5	8965
39	10/17	1000		X		VOA, Pet. Hydro., Lead	Oil Stain Area Boring 5		2	1					3-4	8966
40	10/17	1000		X					2	1					8-9	8967
41	10/17	1000		X					2	1					15.5/16.5	8968
42	10/17	1010		X		VOA, Pet, Hydro, Ep Tox metals	HWSA - Boring 6		2	1					.5-1.5'	8969
43	10/17	1100		X					2	1					9-10'	8970
44	10/17	1030		X					2	1					4.5-5.5'	8971
45	10/17	133		X		VOA, Pet, Hydro	POL TANKS		2	1	1				upstream - Pet Hydro H_2SO_4	8983
46	10/17	1330		X		VOA, Pet. Hydro	POL TANKS		2	1	1				downstream - H_2SO_4	8984
47	↓	14		X		VOA, Pet. Hydro	South LF Boring 7		2	1						8972
48		14		X		VOA, Pet. Hydro			2	1						8973
49	↓	14		X		VOA, Pet Hydro			2	1						8974

Relinquished By: (Signature)	Date/Time	Received By: (Signature)	Relinquished By: (Signature)	Date/Time	Received By: (Signature)
Paul R Kopsick	10/17/1830	FED EXP			
Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)
Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	Relinquished By (Signature)	Date/Time:	Received For Laboratory By: (Signature)
FED EXP	10/18/86 2300	R Marsh			

Ship Via: Fed X
BL/Airbill Number:
Date: 10/17/86

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CHAIN-OF-CUSTODY RECORD

Project No: DF4000
Project Name: RICHARDS-GEBAUR AFB
Project Manager: Paul Kopsick
Samplers (Signatures): Paul Kopsick, Mark Mayer
Field Team Leader: Paul Kopsick

STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP	SAMPLE TYPE GRAB	SAMPLE TYPE AIR	SAMPLE INFORMATION / EXPECTED COMPOUNDS (Concentration)*	STATION LOCATION	NUMBER OF CONTAINERS	40 ml VOA	8oz Jar					REMARKS / DEPTH	
DF4050	10/17	1500		✓		VOA, PET Hydro	NE Landfill Boring 8		2	1					7.0'-7.9'	[illegible]
DF4051	10/17	1550		✓		VOA, PET Hydro	NE LF Boring 9		2	1					40'-50	[illegible]
52	10/17	1540		✓					2	1					6.0'-7.0'	[illegible]
520	10/17	1540		✓					2	1					6.0'-7.0' (Duplicate)	[illegible]
53	10/17	1600		✓					2	1					9.0'-10.0'	[illegible]
DF4054	10/17	1800		✓		VOA PET Hydro	North of NE Lf Boring 10		2	1					1.0'-2.0	[illegible]
55	10/17	1805		✓					2	1					4.0'-5.0'	[illegible]
56	10/17	1810		✓					2	1					7.0'-8.0'	[illegible]

Relinquished By (Signature)	Date/Time	Received By (Signature)	Relinquished By (Signature)	Date/Time	Received By (Signature)
Paul Kopsick	1830 10/17	FED EXP			
Relinquished By (Signature)	Date/Time	Received By (Signature)	Relinquished By (Signature)	Date/Time	Received By (Signature)
Relinquished By (Signature)	Date/Time	Received For Laboratory By (Signature)	Relinquished By (Signature)	Date/Time	Received For Laboratory By (Signature)
FED EXP	10/18/86 0900	[illegible]			

Ship Via: Fed Ex
BL/Airbill Number:
Date: 10/17/86

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CHAIN-OF-CUSTODY RECORD

Project No.: DF4000
Project Name: Richards-Gebaur AFB
Project Manager: PAUL KOPSICK
Samplers: (Signatures) Paul R Kopsick, Mark Mayo, Michael Mahlowski, Joe Chandler
Field Team Leader: PAUL KOPSICK

STATION NUMBER	DATE	TIME	SAMPLE TYPE: COMP	SAMPLE TYPE: GRAB	SAMPLE TYPE: AIR	SAMPLE INFORMATION / EXPECTED COMPOUNDS (Concentration)*		STATION LOCATION	NUMBER OF CONTAINERS	2 40 mL VOA	1 Liter Poly metals TDS anions	1 Liter Amber Pet Hydro	½ Gal Amber Phenols Extract	8oz JAR	REMARKS: PH	COND	Temp	
57	10/21			x		VOA, Petro Hydro	9076	North Burn NWMW	1	½								only 1 VOA
58	10/21			x		VOA, Petro. Hydro	9077	North Burn NEMW	2	1		1			7.75	288	75.5	
59	10/21			x		VOA, Petro. Hydro	9078	North Burn SEMW	1	½								only 1 VOA
60	10/21	1025		x		VOA, Petro. Hydro. TDS	9079	POL Monitoring Well	3	1	1	1						
61	10/21			x		VOA, Petro, Hydro, TDS, Extract, PP Metals, Anions, Phenols	9080	Northeast LF Bkg Well	7	1	3	1	2		7.26	548	67.8	
62	10/21			x			9081	Gate Well	7	1	3	1	2		7.22	1207	65.4	
63	10/21	1330		x			9082	PII well 1	6	1	3	1	2		7.24	554	67.0	phenol jug broke
64	10/21	1340		x			9083	PII well 2	7	1	3	1	2		7.32	888	66.2	
65	10/21	1350		x			9084	PII well 3	7	1	3	1	2		7.35	741	68.5	
66	10/21	1430		x			9085	South LF Marking Bales	7	1	3	1	2		8.24	427	67.6	SLF BKG
67	10/21	1430		x		VOA, Petr. Hydro	9090 ~~9086~~	SLF BKGS	2	1				1				SLF BKG
68	10/21	1530		x			9086	SLF DNW	7	1	3	1	2		7.34	684	70.0	SLF DN
69	10/21	1530		x		VOA, Pet. Hydro	9091	SLF DNS	2	1				1				SLF DN
70	10/21	1550		x		VOA, Pet Hydro	9092	SLF SEEPS	2	1				1				

Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Ship Via:
Paul R Kopsick	1900 10/21/86	Fed. Express				
Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	
Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	BL/Airbill Number: / Date:
Fed Express	10-22-86 / 0900	William H. Howard				

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CHAIN-OF-CUSTODY RECORD

Project No: DF4000
Project Name: Richards Gebaum AFB
Project Manager: PAUL KOPSICK
Samplers (Signatures): Paul R Kopsick
Field Team Leader: PAUL Kopsick

STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP	SAMPLE TYPE GRAB	SAMPLE TYPE AIR	SAMPLE INFORMATION / EXPECTED COMPOUNDS (Concentration)*	STATION LOCATION	NUMBER OF CONTAINERS	2 40mL VOA	1 Liter Poly	1 Liter Amber	½ Gal Amber			REMARKS		
															pH	Cond	Temp
DF4071	10/21	1550		X		VOA, RtHydro, TDS, Ext., PPmetals, Anions, Phenols	SLFSEEPW 9087	7	1	3	1	2			8.00	567	674
72	10/21	1730		X		VOA Field Blank	9095	1	1								

Relinquished By (Signature)	Date/Time	Received By (Signature)	Relinquished By (Signature)	Date/Time	Received By (Signature)	Ship Via
Paul R Kopsick	10/21/86 1900	Tel Express				
Relinquished By (Signature)	Date/Time	Received By (Signature)	Relinquished By (Signature)	Date/Time	Received By (Signature)	BL/Airbill Number / Date
Relinquished By (Signature)	Date/Time	Received For Laboratory By (Signature)	Relinquished By (Signature)	Date/Time	Received For Laboratory By (Signature)	
Tel Express	10/22/0700	[illegible]				

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CHAIN-OF-CUSTODY RECORD

Project No.: DF4000
Project Name: Richards-Gebaur AFB
Project Manager: PAUL KOPSKK
Samplers: (Signatures) Michael Muhlebach, Joe Chandler, Mike Meyer
Field Team Leader: Joe Chandler

STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP	GRAB	AIR	SAMPLE INFORMATION / EXPECTED COMPOUNDS (Concentration)*	STATION LOCATION	NUMBER OF CONTAINERS	40ML VIALS (SET)	8oz JAR					REMARKS	EQE #'s
DF40A9	10/24	1050		X		VOA, Petroleum Hydrocarbons	POL TANK # 955 3	2	1	1					DEPTH = 1.0'	9343
80	10/24	1100		X			POL TANK # 955 3	2	1	1					" = 2' 10"	9344
81	10/24	1130		X			POL TANK # 955 3	2	1	1					" = 6.0'	9345
82	10/24	1330		X			POL TANK # 957 3	2	1	1					" = 1.0'	9346
83	10/24	1345		X			POL TANK # 957 3	2	1	1					" = 2' 8"	9347
84	10/24	1415		X			POL TANK # 957 3	2	1	1					" = 6.0'	9348
85	10/24	1450		X			POL TANK # 954 3	2	1	1					" = 1.0'	9349
86	10/24	1500		X			POL TANK # 954 3	2	1	1					" = 3.0'	9350
87	10/24	1515		X			POL TANK # 954 3	2	1	1					" = 5.0'	9351
88	10/24	1555		X			Bldg 955 drain 3	2	1	1					Cutout @ Bld. 952	9353
B20	10/24	1515		X		87 DUP	POL TANK # 934 (5)	2	1	1					Duplicate (5ft.)	9352

Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Ship Via:
Joe Chandler	1830 10/28/86					Fed. Ex
Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	
Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	BL/Airbill Number: / Date:
Fed Express	10-29-86/0930					

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CHAIN-OF-CUSTODY RECORD

Project No	Project Name	Project Manager
DF4000	Richards Gebaun AFB	PAUL KOPSICK

Samplers (Signatures): Paul R Kopsick, Joe Chandler, Michael Mukalowski

Field Team Leader: PAUL KOPSICK

STATION NUMBER	DATE	TIME	SAMPLE TYPE: COMP	SAMPLE TYPE: GRAB	SAMPLE TYPE: AIR	SAMPLE INFORMATION / EXPECTED COMPOUNDS (Concentration)*	STATION LOCATION		NUMBER OF CONTAINERS	2 40mL Vials	1 Liter Poly	1 Liter Amber	1/2 Gal Amber	8 oz JAR	REMARKS: PH	COND	TEMP	
73	10/23	1050		x		VOA, TDS, Phenol, Pet Hydro, Anions, Extr., PP metals	NELF culvert	RM 8	7	1	3	1	2		7.92	618	62.0	9230
74	10/23	1100		x			NELF Downstream	8	7	1	3	1	2		7.87	341	61.4	9231
75	10/23	1110		x			NELF Upstream	8	7	1	3	1	2		8.01	374	61.0	9232
76	10/23	1200		x			SLF SEEP 2	8	7	1	3	1	2		7.94	540	66.4	9233
77	10/23	1210		x		VOA, Pet. Hydro	SLF SEEP 2	3	2	1				1				9256
78	10/23	1620		x		VOA BLANK		RM 1	1	1								9234
																		~~9234~~
								Rcvd										
								RM										
DF4063	10/23	1030		x		Phenols	NELF M1	1	1				1		Replaces Broken jar of 10/21			9235

Relinquished By (Signature)	Date/Time	Received By (Signature)	Relinquished By (Signature)	Date/Time	Received By (Signature)	Ship Via
Paul R Kopsick	1700 10/23	FED EXP				Fed Exp
						BL/Airbill Number / Date
	1930 10/24/86	Received For Laboratory By (Signature) R. Marsh			Received For Laboratory By (Signature)	

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CHAIN-OF-CUSTODY RECORD

Project No.: DF4000
Project Name: Richards Gebaur AFB
Project Manager: Paul Kopsick
Samplers: (Signatures) Paul Kopsick, Michael Mikulowski
Field Team Leader: Paul Kopsick

STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP	SAMPLE TYPE GRAB	SAMPLE TYPE AIR	SAMPLE INFORMATION / EXPECTED COMPOUNDS (Concentration)*	STATION LOCATION	NUMBER OF CONTAINERS	2-40ml VOA Vials	1-8 oz Jar					REMARKS
DF4027	10/15	1420		X		VOA, Petroleum Hydrocarbons 8894	NB Boring 1 S-1	3	2	1					3.5-4.5' (all positive OVA reading)
DF4028		1430		X		8895	NB 1 S-2	3	2	1					7-8'
DF4029		1435		X		8896	NB 1 S-3	3	2	1					12-12.4'
DF4030		1510		X		8897	NB Boring 2 S-1	3	2	1					2-3'
DF4031		1515		X		8898	NB 2 S-2	3	2	1					5-6'
DF4032		1520		X		8899	NB 2 S-3	3	2	1					11-12'
DF4033		1600		X		8901	NB Boring 3 S-1	3	2	1					2-3'
DF4034		1605		X		8902	NB 3 S-2	3	2	1					5-6'
DF4035		1610		X		8903	NB 3 S-3	3	2	1					11-12'
DF4022		1520		X		8900 DUPLICATE	NB Boring 2-S-3	3	2	1					11-12'

Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Ship Via:
Paul Kopsick	10/15 1700hr	Joseph Chandler	Joseph Chandler	10/15 1745	Fed. Express	Federal Exp
Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	BL/Airbill Number:
						Date: 10/15/86
Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	
Fed Express	10-16-86 0900	William H. Howard				

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CHAIN-OF-CUSTODY RECORD

Project No: DF 4000
Project Name: RICHARDS - GEBAUR AFB
Project Manager: PAUL KOPSICK
Samplers (Signatures): [signature]
Field Team Leader: Joe Chandler

STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP	SAMPLE TYPE GRAB	SAMPLE TYPE AIR	SAMPLE INFORMATION / EXPECTED COMPOUNDS (Concentration)*	STATION LOCATION	NUMBER OF CONTAINERS	40 ml VOA VIALS (SET)	8 oz JAR					REMARKS
DF 4089	11/4/86	1130		X		VOA, PETROLEUM HYDROCARBONS	BLDG #953 DRAIN	2	1	1					

Relinquished By (Signature): [signature] — Date/Time: 1330 — Received By (Signature): Fed Express
Relinquished By (Signature): — Date/Time: — Received By (Signature): —
Relinquished By (Signature): Fed Express — Date/Time: 11-5-86 0900 — Received For Laboratory By (Signature): [signature]
Relinquished By (Signature): — Date/Time: — Received By (Signature): —
Relinquished By (Signature): — Date/Time: — Received By (Signature): —
Relinquished By (Signature): — Date/Time: — Received For Laboratory By (Signature): —

Ship Via: Federal Express
BL/Airbill Number:
Date:

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CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project No.: DF4100
Project Name: RICHARDS-GEBAUR AFB IRP
Project Manager: PAUL KOPSICK
Samplers: (Signatures) [signature] MARK NAPO
Field Team Leader: PAUL KOPSICK

STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP	GRAB	AIR	SAMPLE INFORMATION / EXPECTED COMPOUNDS (Concentration)*	STATION LOCATION	NUMBER OF CONTAINERS	1L Amber	1L Poly	1L Amber	500 ml Poly	40 ml VOA	REMARKS
DF4001	10/9/86	1200	X			VOA, CVG 8765	North Burn Area -S1	3	2			1		Burn pit 100 E
4002		1210	X			VOA, CVG 8766	-S2	3	2			1		Burn pit 200 E
4003		1215	X			VOA, CVG 8767	-S3	3	2			1		North of Fence
4004		1230	X			VOA, CVG 8768	-S4	3	2			1		SE Line 200-300' E
4005		1245	X			VOA, CVG 8769	-S5	3	2			1		SW corner of fence
4006		1245		W		VOA, ~~CVG~~ 8770 ~~8770~~ KB3	see fol W-136 -W1	5	2		1			pH 8.50 1100 um 60.5°C
4007		1430		X		VOA, CVG, Lead 8770	Old Sanitary Area -S1	3	2			1		corner of fence
4008		1430		X		VOA, CVG, Lead 8771	-S2	3	2			1		corner of fence + 25'
4009		1450		X		VOA, CVG, Lead 8772	-S3	3	2			1		corner of fence + 50'
4010		1515	X			VOA, CVG, Lead 8773	-S4	3	2			1		outside corner of fence 100'
4011		1530	X			VOA, CVG, Lead 8774	-S5	3	2			1		outside corner of fence 100-200'
4012		1545	X			VOA, CVG, LEAD 8775	-S6	3	2			1		outside corner of fence 200-300'
4013		1430		W		VOA, CVG, Lead, TDS 8777	-W1	5	2	2	1			pH 8.31 3600 um 60.6°C
														corner of fence

Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Ship Via:
[signature]	10/9/86 20:00 hrs	Fed Express				Fed Ex
Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received By: (Signature)	BL/Airbill Number:
Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	Relinquished By: (Signature)	Date/Time:	Received For Laboratory By: (Signature)	Date:
Fed Express	10-10-86/0900	[signature]				10/9/86

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NTRATION RANGE on back of form.

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International Specialists in the Environment

CHAIN-OF-CUSTODY RECORD

Project No	Project Name	Project Manager
DF4000	Richards-Gebaur AFB IRP	Paul Kopsick

Samplers (Signatures)	Field Team Leader
Paul Kopsick, Bill Kwoka, Mike Michalowski	Paul Kopsick

STATION NUMBER	DATE	TIME	SAMPLE TYPE COMP	GRAB	AIR	SAMPLE INFORMATION / EXPECTED COMPOUNDS (Concentration)*		STATION LOCATION	NUMBER OF CONTAINERS	40 ml VOA vials (x2)	1 liter poly	1 liter Amber	1/2 gal Amber	8 oz Jar	REMARKS
DF4014	10/10	1120	X			VOA, O+G	8795	North Burn Area S-6	2	1				1	West Drainage
DF4015		1315	X			Pesticides, Arsenic, Mercury	8796	Herbicide Burial S1	2					2	300' South of Road
DF4016		1320	X				8797	-S-2	2					2	25' East of DF4015
DF4017		1330	X				8798	-S-3	2					2	25 East of DF4016
DF4018		1340	X				8799	-S-4	2					2	100' South of Road
DF4019		1445	X			VOA, EP Tox. (Metals), O&G	8800	Haz.Waste Storage S-1	2	1				1	Background Soil
DF4020		1505	X				8801	S-2	2	1				1	Gate of Compound
DF4021		1445	X				8802	S-3	2	1				1	Fence corner 0-26'
DF4022		1500	X				8803	S-4	2	1				1	26-60'
DF4023		1500	X				8804	S-5	2	1				1	60-120'
DF4024		1455	X				8805	S-6	2	1				1	Opposite corner + 25'
DF4025		1515		W		VOA, TDS, O&G, PPMetals, Barium, ~~Mercury~~	8806	cancelled per P Kopsick 10/15 KAD W-1	4	1	2	1			Opposite corner + 25' 8.27 pH 3070 µm 66°F
DF4026		1600		W			8808	Field Blank	1	1	~~2~~	~~2~~			HWSA
DF4027		1315		W		Herb. Pesticides, TDS, Arsenic, Mercury	8807	Herbicide Burial W-1	3		2		1		Pond in Field 6.9 pH 1505 µm 62.7°F

Relinquished By (Signature)	Date/Time	Received By (Signature)	Relinquished By (Signature)	Date/Time	Received By (Signature)	Ship Via
Paul Kopsick	10/10/86 7000					Federal Express
Relinquished By (Signature)	Date/Time	Received By (Signature)	Relinquished By (Signature)	Date/Time	Received By (Signature)	
Relinquished By (Signature)	Date/Time	Received For Laboratory By (Signature)	Relinquished By (Signature)	Date/Time	Received For Laboratory By (Signature)	BL/Airbill Number / Date 10/10/86

Distribution Original Accompanies Shipment, Copy to Coordinator Field Files
*See CONCENTRATION RANGE on back of form

234055

15 134

F 11

Provided on the following pages are sample receipt logs for the appropriate sample numbers as documentation of proper sample management and documentation procedures.

PACKAGE RECEIPT LOG

ITEM NO	CLIENT NAME and/or JOB NO	DATE RECEIVED	RECEIVED FROM (e.g., carrier)	CARRIER I D NO or INITIALS	SHIPPING INVOICE NO (Place in file)	PACKAGE DESCRIPTION (e.g., 1 cooler, 1 jar, etc.)	PACKAGE SECURED Yes	PACKAGE SECURED No	MANNER PACKAGE SECURED: Custody Seal	Fiberglass Tape	Other	Deficiencies	(Explain and footnote if necessary. File deficiency report.)	PACKAGE DISPOSITION: Sample Logged Yes	Sample Logged No	Temporary Secure Storage Area	ASC Custody Seal Affixed Yes	ASC Custody Seal Affixed No	CUSTOD INITIA
4337	PVS Chemical	10 9 86	L. Roedl	LR	none	1-Cardboard Box		✓						✓				✓	LHH
4338	Edgetrock Apartments	10-9-86	A Dennis	AD	none	1-Plastic Bag		✓						✓				✓	LHH
4339	Town of Amherst	10-9-86	Client	[illegible]	none	1-Plastic Bucket		✓						✓				✓	LHH
4340	Seller Thwaite Assoc	10-9-86	Client	[illegible]	none	1-Cooler		✓						✓				✓	[illegible]
4341	Sterling Environmental	10-9-86	Client	[illegible]	none	3-16 oz wm poly		✓						✓				✓	[illegible]
4342	Richards-Gebaver AFB	10 10 86	Fed Express	JM	Airbill # 1533064816	1-Cooler	✓		✓	✓				✓				✓	LHH
4343	C.P.C. - Tonawanda	10-10-86	Client	[illegible]	none	1-Cardboard Box		✓						✓				✓	LHH
4344	New York Air Brake	10-10-86	U S Air	[illegible]	Flight Ticket # 40 34-97	1-Cooler	✓			✓				✓				✓	LHH
4345	Richards-Gebaver AFB	10-11-86	FED EXPRESS	DM	Airbill # 1533064906	1-Cooler	✓		✓						✓	H.O	✓		LHH
4346	US EPA	10-13-86	Fed Express	JM	Airbill # 7205 9521	1-Cooler	✓		✓	✓				✓				✓	LHH
4347	John J Glass	10 13 86	Client	[illegible]	none	1-125ml poly		✓						✓				✓	LHH
4348	Richards-Gebaver AFB	10 13 86	Sameday Air	LHH	See Item # 4345	1-Cooler	✓		✓	✓				✓				✓	LHH
4349	Frontier Insulation	10-13-86	Client	[illegible]	none	2-mailers	✓				✓		Sealed envelope	✓				✓	LHH
4350	FMC - Middleport	10-13-86	Client	KAS	none	3-1L glass		✓						✓				✓	LHH
4351	D.P. Zio Construction	10 13 86	Client	[illegible]	none	2-125ml poly		✓						✓				✓	[illegible]
4352	Now Management Inc	10-13-86	Client	B.A.C.	none	1-glass bottle		✓						✓				✓	[illegible]
4353	Springville Central School	10-13-86	W. Hall	WH	none	2 PLASTIC		✓						✓				✓	[illegible]
4354	VFTA	10-14-86	Client	[illegible]	none	1-8oz Jar		✓						✓				✓	LHH

EXPLANATIONS

HAS 11/11

15 136

SAMPLE RECEIPT LOG

PACKAGE RECEIPT LOG ITEM NO.	ANALYTICAL SERVICES CENTER SAMPLE I.D. NO. Prime Sample I.D. No	Individual Sample Container No.	Lab Generated Sub sample No.	Additional Suffix No.	JOB NO.	DATE LOGGED	CLIENT SAMPLE I.D. (e.g., Well No., Boring No.)	PACKING LIST or CHAIN OF CUSTODY RECORD Yes	No*	SAMPLE CONTAINER TYPE 40 mL VOA	½ gal Amber	1L Poly	500 mL Poly	16 oz. Jar	8 oz. Jar	4 oz. Jar	1L Amber	250 mL Poly	1 mL Vial	Other**	SAMPLE SECURED ON RECEIPT Yes	No	MANNER SAMPLE SECURED Custody Seal	Fiberglass Tape	Other**	SUBSAMPLES REMARKS (If Subsamples Generated, Indicate Page Reference. If None, Make No Entry)	New Sub samples Yes	No	Deliverer's Initials (Footnote if not generator)	CUSTODY SEAL AFFIXED Yes	No*	LABEL WITH NO AND DATE AFFIXED Yes	No	REMARKS (e.g., leaks, breakage, discrepancies with packing list. File discrepancy report if necessary.)	SECURE STORAGE AREA	CUSTODIAN'S INITIALS	DISPOSITION Court	Consumed	Contaminated	Lost	Destroyed	Returned to Client	
4348	8801	02			U-4291	10-13-86	DF-4020	✓		✓												✓						✓			✓		✓				E	WHH					✓		DEC
(cont)	⊥	03					⊥	✓							✓							✓					175	✓			✓		✓				A-2						✓		
	8802	01					DF-4021	✓		✓												✓						✓			✓		✓				F						✓		
	⊥	02					⊥	✓														✓						✓			✓		✓				E						✓		
		03						✓							✓							✓					175	✓			✓		✓				A-2						✓		
	8803	01					DF-4022	✓		✓												✓						✓			✓		✓				E						✓		
	⊥	02					⊥	✓														✓						✓			✓		✓				E						✓		
		03						✓							✓							✓					175	✓			✓		✓				A-2						✓		
	8804	01					DF-4023	✓		✓												✓						✓			✓		✓				E						✓		
	⊥	02					⊥	✓														✓						✓			✓		✓				E						✓		
		03						✓							✓							✓					175	✓			✓		✓				A-2						✓		
	8805	01					DF-4024	✓		✓												✓						✓			✓		✓				E						✓		
	⊥	02					⊥	✓														✓						✓			✓		✓				E						✓		
		03						✓							✓							✓					175	✓			✓		✓				A-2						✓		
	8806	01			U-4182		DF-4025	✓		✓												✓						✓			✓		✓				F						✓		DEC
		02						✓		✓												✓						✓			✓		✓				E						✓		
		03						✓				✓										✓						✓			✓		✓				A-33						✓		
		04						✓									✓					✓						✓			✓		✓								✓					
		05						✓				✓										✓						✓			✓		✓													
	8807	01					DF-4027	✓			✓											✓						✓			✓		✓													
	⊥	02					⊥	✓				✓										✓						✓			✓		✓													
		03						✓				✓										✓						✓			✓		✓													
	8808	01					DF-4026 Field Blank	✓		✓												✓						✓			✓		✓				E						✓		
	⊥	02					⊥	✓		✓												✓						✓			✓		✓				E	WHH					✓		
4349	8809	01			U-4293	10-13-86	JP-L #1	✓				Air	Cask	Tite								✓						✓			✓		✓				G	WHH					✓		DEC
	8810	01					JP-L #2	✓														✓						✓			✓		✓										✓		
	8811	01					JP-L #3	✓														✓						✓			✓		✓										✓		
	8812	01			U-4284		LCC #1	✓														✓						✓			✓		✓										✓		
	8813	01					LCC #2	✓														✓						✓			✓		✓										✓		
	8814	01					LCC #3	✓														✓						✓			✓		✓					WHH					✓		
4356	8815	01			U-4295	10-13-86	OF-8038 Oathall										✓				✓							✓			✓		✓				A-26	WHH					✓		(1
	8816	01					Jedda Creek					1L glass								✓								✓			✓		✓										✓		
	8817	01					Blank										✓											✓			✓		✓					WHH					✓		
4331	8818	01			U-4296	10-13-86	Klein Rd.	✓				125ml poly								✓		✓						✓			✓		✓				A-2	WHH					✓		10

* If no, process discrepancy/deficiency report ** If other, footnote explanation

EXPLANATIONS

15 137

SAMPLE RECEIPT LOG

PACKAGE RECEIPT LOG ITEM NO	ANALYTICAL SERVICES CENTER SAMPLE I D NO: Prime Sample I D No	Individual Sample Container No	Lab Generated Sub sample No	Additional Suffix No	JOB NO	DATE LOGGED	CLIENT SAMPLE I D (e g Well No Boring No)	PACKING LIST or CHAIN OF CUSTODY RECORD Yes	No*	SAMPLE CONTAINER TYPE: 40 mL VOA	½ gal Amber	1L Poly	500 mL Poly	16 oz Jar	8 oz Jar	4 oz Jar	1L Amber	250 mL Poly	1 mL Vial	Other**	SAMPLE SECURED ON RECEIPT Yes	No	MANNER SAMPLE SECURED: Custody Seal	Fiberglass Tape	Other**	SUBSAMPLES: REMARKS (If Subsamples Generated, Indicate Page Reference If None Make No Entry)	New Subsamples Yes	No	Deliverer s Initials (Footnote if not generator)	CUSTODY SEAL AFFIXED Yes	No*	LABEL WITH NO AND DATE AFFIXED Yes	No	REMARKS (e g leaks breakage discrepancies with packing list File discrepancy report if necessary)	SECURE STORAGE AREA	CUSTODIAN S INITIALS	DISPOSITION: Court	Consumed	Contaminated	Lost	Destroyed	Returned to Client	Date
4246	8788	01			U-4290	10-13-86	AG 267	✓								✓						✓					✓			✓		✓		✓			A54	WHH							1-1
	⊥	02					- ⊥	✓								✓						✓					✓			✓		✓		✓											
		03						✓								✓						✓					1945			✓		✓		✓											
	8789	01					AG-411	✓								✓						✓					✓			✓		✓		✓											
		02						✓								✓						✓					✓			✓		✓		✓											
	⊥	03					- ⊥	✓								✓						✓					1945			✓		✓		✓											
	8790	01					AG 412	✓								✓						✓					✓			✓		✓		✓											
		02						✓								✓						✓					✓			✓		✓		✓											
	⊥	03					- ⊥	✓								✓						✓					1945			✓		✓		✓											
	8791	01					AG 413	✓								✓						✓					✓			✓		✓		✓											
		02						✓								✓						✓					✓			✓		✓		✓											
	⊥	03					- ⊥	✓								✓						✓					1945,1...			✓		✓		✓											
	8792	01					AG 414	✓								✓						✓					✓			✓		✓		✓											
		02						✓								✓						✓					✓			✓		✓		✓											
	⊥	03					- ⊥	✓								✓						✓					1945			✓		✓		✓											
	8793	01					AG 415	✓								✓						✓					✓			✓		✓		✓											
		02						✓								✓						✓					✓			✓		✓		✓											
	⊥	03					- ⊥	✓								✓						✓					1...			✓		✓		✓											
4247	8794	01			*U	10-13-86	Kitchen Cold Trap		✓	12.5 mL			Poly							✓		✓								✓		✓			H-2	WHH					✓		10-13-86
4248	8795	01			U-4291	10-13-86	DF-4014	✓														✓								✓		✓			E	WHH					✓		DEC 1 6 1
	⊥	02					⊥	✓														✓								✓		✓			E									
		03						✓														✓								✓		✓			A-2									
	8796	01					DF-4015	✓														✓					1...			✓		✓												
	⊥	02					⊥	✓														✓					1...			✓		✓												
	8797	01					DF-4016	✓														✓								✓		✓												
	⊥	02					⊥	✓														✓								✓		✓												
	8798	01					DF-4017	✓														✓								✓		✓												
	⊥	02					DF-4018	✓														✓					1...			✓		✓												
	8799	01					DF-4018	✓														✓								✓		✓												
	⊥	02					⊥	✓														✓					1...			✓		✓												
	8800	01					DF-4019	✓														✓								✓		✓			E									
		02						✓														✓								✓		✓			E									
	⊥	03					⊥	✓														✓								✓		✓			A 2									
	8801	01					DF 4020	✓														✓					1...			✓		✓			F	L.DH								

If no prior discrepancy report, leave blank * Enter footnote explanation

EXPLANATIONS *U = Not ..., Jar ... contained, Sample ..., 1 ...

15 132

APPENDIX F

AF 103 ENGINEERING PERMIT

SSGT MAY 375 15 140

CIVIL ENGINEER CONSTRUCTION PERMIT

DATE 6 AUG 71

Clearance is requested to proceed with the work at SOUTH OF WEATHER STATION FAC 847 on Work Order No N/A, Contract No. N/A involving excavation or disturbance of facilities as indicated. The requested clearance ☐ has ☒ has not been staked.

1. FACILITY/WORK INVOLVED

X	A. EXCAVATION		B. PAVEMENTS		C. DRAINAGE DITCHES		D. RAILROAD TRACKS		E. OTHER

F. OVERHEAD LINES				G. SURFACE LINES			
	UTILITY		COMMUNICATION		UTILITY		COMMUNICATION

2. METHOD OF EXCAVATION

	A. HAND		B. POWER SHOVEL		C. DITCHER	D. OTHER (Specify)	BACK HOE

3. SCOPE OF WORK (Depth, width, length, location, and sketch as applicable, road closure; discontinuance of service, other disturbance)

10 FT WIDE X 10' X 6 FT DEEP

4. DATE CLEARANCE REQUIRED	5. TERMINATION DATE OF CLEARANCE
9 AUG 71	9 AUG 71

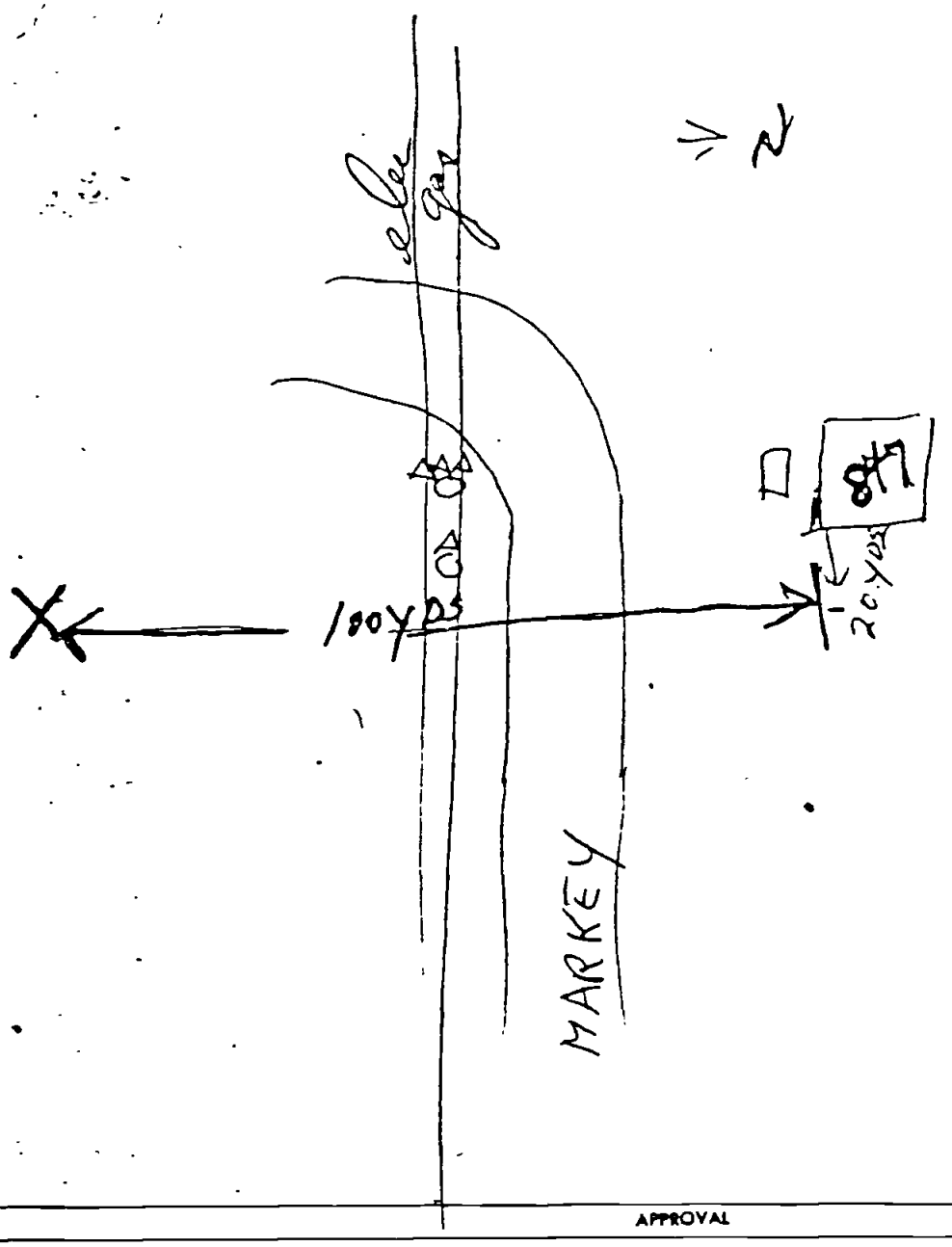
6. REQUESTING ORGANIZATION	7. PHONE NO.	8. SIGNATURE (Requesting official)
1840 CES	3255	Larry Lyles

CLEARANCE REVIEW

	ORGANIZATION		REMARKS	SIGNATURE (Commenter's)
9. BASE CIVIL ENGINEER	A. ELECTRICAL DISTRIBUTION	X	as shown on drawings	[illegible]
	B. STEAM DISTRIBUTION	X	No steam	[illegible]
	C. WATER DISTRIBUTION	X	as shown	[illegible]
	D. SEWER LINES	X	as shown	[illegible]
	E. POL DISTRIBUTION	X	no POL	[illegible]
	F. PAVEMENTS, GROUNDS, RAILROADS	X		
	G. ENGINEERING AND CONSTRUCTION			
	H. FIRE DEPARTMENT			
	I. OTHER gas		as shown	[illegible]
10 BASE COMMUNICATIONS		X	No Buried Cable	[illegible]
11. BASE PROVOST MARSHAL				
12. OTHER (Specify)				
13 OTHER (Specify)				

AF FORM MAY 67 103 PREVIOUS EDITION WILL BE USED UNTIL STOCK IS EXHAUSTED.

14 REMARKS



APPROVAL

15. COMMENTS

LOCATION OF HERBSIDE BURIED ON BASE AUG 71.

16 RECOMMENDATIONS

17. REQUESTED CLEARANCE

☐ APPROVED ☐ DISAPPROVED

18. DATE

19. SIGNATURE OF CHIEF PROGRAMS

* U.S. GOVERNMENT PRINTING OFFICE 1964 OF—700-846—100-522

APPENDIX G

NORTHEAST LANDFILL TRENCH LOCATIONS (1985)

recycled paper

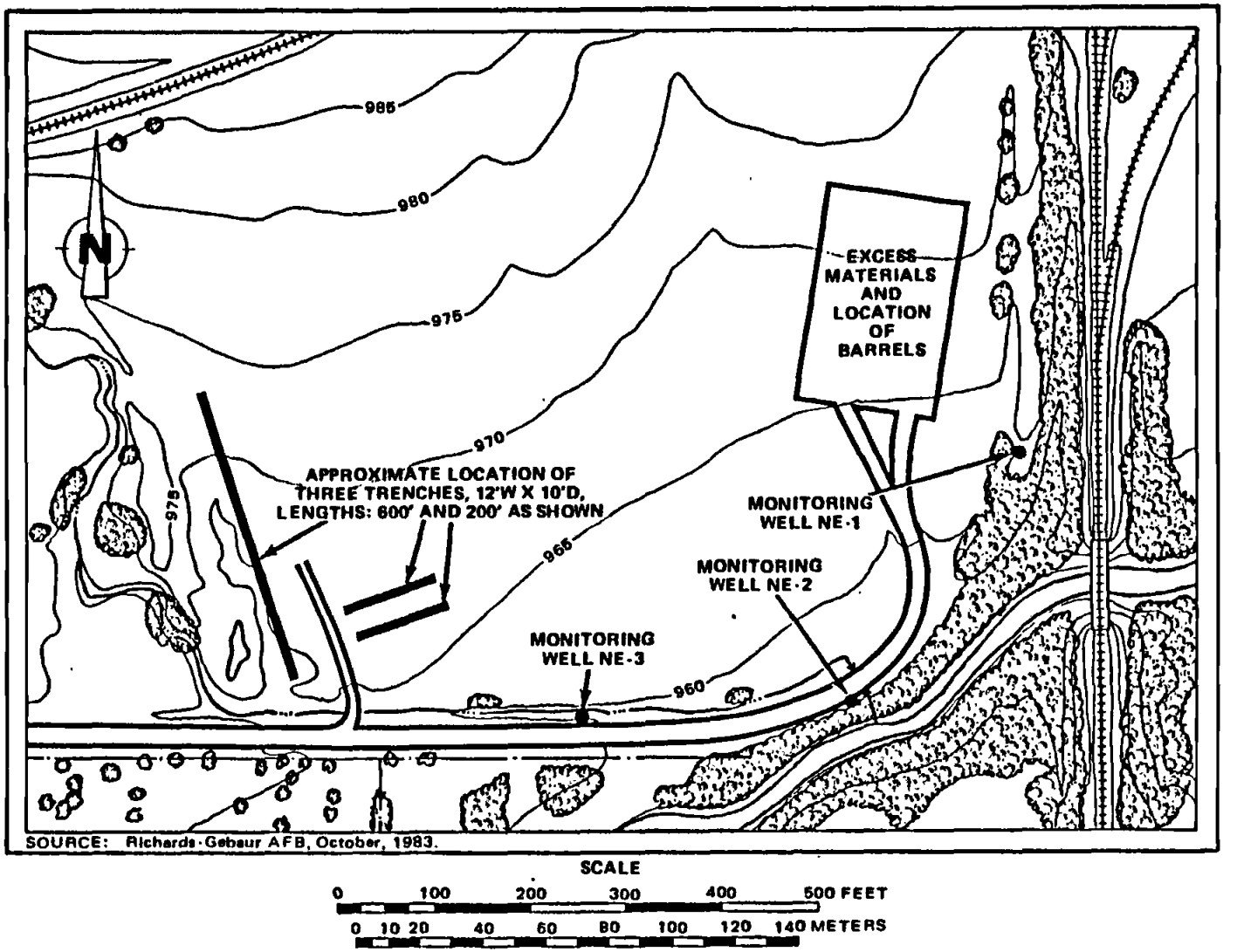


Figure 2–2 POSSIBLE LOCATIONS OF TRENCHES AT NORTHEAST LANDFILL

APPENDIX H

ANALYTICAL DATA

recycled pape

Table H-1

SAMPLE IDENTIFICATION CROSS REFERENCE

Lab Number	Field Number	Description	Page
South Landfill (Site 1)			
8972	DF4047	Boring #7; 1.0 - 2.0 feet	H-178
8973	DF4048	Boring #7; 4.0 - 5.0 feet	H-178
8974	DF4049	Boring #7; 6.0 - 7.0 feet	H-178
9090	DF4067	Scope Creek - Background at Markey and Bates	H-12
9091	DF4069	Scope Creek - Downstream of South Landfill	H-12
9092	DF4070	Scope Creek - Seep 1 east of South Landfill	H-12
9236	DF4077	Scope Creek - Seep 2 northeast of South Landfill	H-113
9085	DF4066	Scope Creek - Background	H-83
9086	DF4068	Scope Creek - Downstream from South Landfill	H-83
9087	DF4071	Seep 1 adjacent to Scope Creek	H-83
9233	DF4076	Seep 2 adjacent to Scope Creek	H-122
Northeast Landfill (Site 2)			
8963	DF4036	Boring #4, 1.0 - 2.0 feet	H-178
8964	DF4037	Boring #4, 6.0 - 7.0 feet	H-178
8965	DF4038	Boring #4, 8.0 - 8.5 feet	H-178
8975	DF4050	Boring #8, 7.0 - 7.9 feet	H-179
8976	DF4051	Boring #9, 4.0 - 5.0 feet	H-179
8977	DF4052	Boring #9, 6.0 - 7.0 feet	H-179
8978	DF4052*	Boring #9, 6.0 - 7.0 feet	H-179
8979	DF4053	Boring #9, 9.0 - 10.0 feet	H-179
8980	DF4054	Boring #10, 1.0 - 2.0 feet	H-179
8981	DF4055	Boring #10, 4.0 - 5.0 feet	H-179
8982	DF4056	Boring #10, 7.0 - 8.0 feet	H-179
9230	DF4073	Tributary draining Northeast Landfill	H-122
9231	DF4074	Scope Creek - Downstream from Northeast Landfill	H-122
9232	DF4075	Scope Creek - Upstream from Northeast Landfill	H-122
9082	DF4063	Phase II Stage 2 well #1	H-83
9083	DF4064	Phase II Stage 2 well #2	H-83
9084	DF4065	Phase II Stage 2 well #3	H-83
9081	DF4062	Perimeter well at entrance gate (MW #4)	H-83
9080	DF4061	Background well north of Northeast Landfill (MW #5)	H-83
North Burn Area (Site 6)			
8765	DF4001	North Burn - 100 feet east of eastern fence center	H-30
8766	DF4002	North Burn - 200 feet east of eastern fence center	H-30
8767	DF4003	North Burn - 100 feet north of northern fence drainage	H-30
8768	DF4004	North Burn - Southeast corner fence, 200-300 feet	H-30
8769	DF4005	North Burn - 25 feet south of southwestern corner of fence	H-30
8795	DF4014	North Burn - 100 feet northwest of northwest corner of fence	H-160
8894	DF4027	Boring #1, 3.5 - 4.5 feet	H-67
8895	DF4028	Boring #1, 7.0 - 8.0 feet	H-67
8896	DF4029	Boring #1, 12.0 - 12.4 feet	H-67
8897	DF4030	Boring #2, 2.0 - 3.0 feet	H-67

Table H-1 (Cont.)

Lab Number	Field Number	Description	Page
North Burn Area (Site 6) (Cont.)			
8898	DF4031	Boring #2, 5.0 - 6.0 feet	H-67
8899, 8900	DF4032*	Boring #2, 11.0 - 12.0 feet	H-67
8901	DF4033	Boring #3, 2.0 - 3.0 feet	H-67
8902	DF4034	Boring #3, 5.0 - 6.0 feet	H-67
8903	DF4035	Boring #3, 11.0 - 12.0 feet	H-67
8776	DF4006	Local impoundment by east fence line	H-45
9077	DF4058	Northeast corner monitoring well (1-NBA-NEMW)	H-83
9076	DF4057	Northwest corner monitoring well (2-NBA-NWMW)	H-83
9078	DF4059	Southeast corner monitoring well (3-NBA-SWMW)	H-83
Herbicide Burial Pit Area (Site 8)			
8796	DF4015	Herbicide Burial Area - 300 feet south of Markey	H-160
8797	DF4016	Herbicide Burial Area - 25 feet east of DF4015	H-160
8798	DF4017	Herbicide Burial Area - 25 feet east of DF4016	H-160
8799	DF4018	Herbicide Burial Area - 100 feet south of Markey	H-160
8807	DF4027	Local impoundment - Small pond	H-55
Oil Saturated (Site 9)			
8770	DF4007	Oil-Saturated Area - Southwest corner of Motor Pool	H-30
8771	DF4008	Oil-Saturated Area - Southwest corner +25 feet	H-30
8772	DF4009	Oil-Saturated Area - Southwest corner +50 feet	H-30
8773	DF4010	Oil-Saturated Area - Outside southwest corner, 0-100 feet	H-30
8774	DF4011	Oil-Saturated Area - Outside southwest corner, 100-200 feet	H-30
8775	DF4012	Oil Saturated Area - Outside southwest corner, 200-300 feet	H-30
8966	DF4039	Boring #5, 3.0 - 4.0 feet	H-178
8967	DF4040	Boring #5, 8.0 - 9.0 feet	H-178
8968	DF4041	Boring #5, 15.5 - 16.5 feet	H-178
8777	DF4013	Drainage ditch - Lateral to stain area	H-45
Hazardous Waste Drum Storage Area (Site 10)			
8800	DF4019	Hazardous Waste Drum Storage Area - Background from athletic field	H-160
8801	DF4020	Hazardous Waste Drum Storage Area - North of gate to compound	H-160
8802	DF4021	Hazardous Waste Drum Storage Area - West corner of fence, 0-26 feet	H-160
8803	DF4022	Hazardous Waste Drum Storage Area - West corner of fence, 26-60 feet	H-160
8804	DF4023	Hazardous Waste Drum Storage Area - West corner of fence, 60-120 feet	H-160
8805	DF4024	Hazardous Waste Drum Storage Area - South corner +25 feet	H-160
8806	DF4025	Drainage ditch - Downgradient	H-55
8969	DF4042	Boring #6, 0.5 - 1.5 feet	H-178
8870	DF4043	Boring #6, 9.0 - 10.5 feet	H-178
8971	DF4044	Boring #6, 4.5 - 5.5 feet	H-178

Table H-1 (Cont.)

Lab Number	Field Number	Description	Page
POL Storage Yard (Site 12)			
9353	DF4088	Building 951 drain	H-144
8983	DF4045	Drainage ditch - Upstream	H-3
8984	DF4046	Drainage ditch - Downstream	H-3
9079	DF4060	Downgradient Monitoring Well (4-POL-DMW)	H-83
9343	DF4079	Hand Boring #1, Tank 955, 1.0 foot	H-144
9344	DF4080	Hand Boring #1, Tank 955, 2.10 feet	H-144
9345	DF4081	Hand Boring #1, Tank 955, 6.0 feet	H-144
9346	DF4082	Hand Boring #2, Tank 957, 1.0 foot	H-144
9347	DF4083	Hand Boring #2, Tank 957, 2.8 feet	H-144
9348	DF4084	Hand Boring #2, Tank 957, 6.0 feet	H-144
9349	DF4085	Hand Boring #3, Tank 954, 1.0 foot	H-144
9350	DF4086	Hand Boring #3, Tank 954, 3.0 feet	H-144
9351, 9352	DF4087*	Hand Boring #3, Tank 954, 6.0 feet	H-144
9596	DF4089	Outside Building 953, 3.0 feet	H-21

*Duplicate sample

MEMORANDUM

TO: Paul Kopsick

FROM: Gary Hahn GH/KS

DATE: November 14, 1986

SUBJECT: Richards-Gebauer AFB Report

REF: U-4311

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on two samples received at the Analytical Services Center on October 18, 1986. Analysis was performed according to the procedures set forth in "Methods for the Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March 1983 and "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater," EPA-600/4-82-057, July 1982.

All samples on which this report is based will be retained by E & E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00 per sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

GH/mba

Enclosure

SAMPLE IDENTIFICATION
CROSS-REFERENCE

U-4311

Laboratory Number 86-	Field Number	Field Location
8983	DF-4045	Pol Tanks upstream
8984	DF-4046	Pol Tanks downstream

SAMPLE TRACKING OF ANALYSES
REQUIRING HOLDING TIMES

U-4311.1

Job	Sample Number	Sample Date	VOA(14) Dead	VOA(14) Anal	Pet HC(28) Dead	Pet HC(28) Anal
U-4311	8983	10/17	10/31	10/20,22	11/14	11/10
	8984	10/17	10/31	10/20,22	11/14	11/10

VOA Confirmation Date

DEAD: Date sample holding time expires.
EXTR: Date sample was extracted.
ANAL: Date sample was analyzed.

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in ug/L)

U-4311.2

Compound	E & E Lab. No. 86-	Blank	8983	8984		
	Sample Identity	10/20/86	DF-4045	DF-4046		
chlorobenzene		<0.20	<0.20	<0.20		
1,2-dichlorobenzene		<0.40	<0.40	<0.40		
1,3-dichlorobenzene		<0.40	<0.40	<0.40		
1,4-dichlorobenzene		<0.30	<0.30	<0.30		
benzene		<0.20	<0.20	<0.20		
total xylenes		<1.0	<1.0	<1.0		
toluene		<0.20	<0.20	<0.20		
ethylbenzene		<0.20	<0.20	<0.20		

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in ug/L)

U-4311.3

Compound	E & E Lab. No. 86-	Blank	8983	8984			
	Sample Identity	10/22/86	DF-4045	DF-4046			
carbon tetrachloride		<0.12	<0.12	<0.12			
1,2-dichloroethane		<0.03	<0.03	<0.03			
1,1,1-trichloroethane		<0.03	<0.03	<0.03			
1,1-dichloroethane		<0.07	<0.07	<0.07			
1,1,2-trichloroethane		<0.02	<0.02	<0.02			
1,1,2,2-tetrachloroethane		<0.03	<0.03	<0.03			
chloroethane		<0.52	<0.52	<0.52			
2-chloroethylvinyl ether		<0.13	<0.13	<0.13			
chloroform		<0.05	<0.05	<0.05			
1,1-dichloroethene		<0.13	<0.13	<0.13			
trans-1,2-dichloroethene		<0.10	<0.10	<0.10			
1,2-dichloropropane		<0.04	<0.04	<0.04			
trans-1,3-dichloropropene		<0.34	<0.34	<0.34			
cis-1,3-dichloropropene		<0.20	<0.20	<0.20			
methylene chloride		<0.25	<0.25	<0.25			
chloromethane		<0.08	<0.08	<0.08			
bromomethane		<1.18	<1.18	<1.18			
bromoform		<0.20	<0.20	<0.20			
bromodichloromethane		<0.10	<0.10	<0.10			
fluorotrichloromethane		<2.0	<2.0	<2.0			
dichlorodifluoromethane		<1.81	<1.81	<1.81			
chlorodibromomethane		<0.09	<0.09	<0.09			
tetrachloroethene		<0.03	<0.03	<0.03			
trichloroethene		<0.12	<0.12	<0.12			
vinyl chloride		<0.18	<0.18	<0.18			

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LABORATORY REPORT

FOR

RICHARDS-GEBAUER AIR FORCE BASE

U-4311.4

Job No.: U-4311			RE: DF-4000			
Sample Date: 10/17/86			P.O. No.:			
Date Received: 10/18/86			Sampled By: E & E, Inc.			
Sample Type: Water			Delivered By: Federal Express			
E & E Lab. No. 86-	8983	8984				
Customer No.	DF-4045	DF-4046				
Sample Identity						
	Results in: mg/L unless noted					
Petroleum Hydrocarbons	<0.1	<0.1				

Analytical References:

"Methods for the Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March 1983.

Supervising Analyst: [illegible]

Date: November 14, 1986

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

U-4311.5

Parameter	E & E Laboratory No. 86-8984	(ug/L)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
chlorobenzene		<0.20	<0.20	—
1,2-dichlorobenzene		<0.40	<0.40	—
1,3-dichlorobenzene		<0.40	<0.40	—
1,4-dichlorobenzene		<0.30	<0.30	—
benzene		<0.20	<0.20	—
total xylenes		<1.0	<1.0	—
toluene		<0.20	<0.20	—
ethyl benzene		<0.20	<0.20	—

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

U-4311.6

Compound	E & E Laboratory No. 86-	(ug/L) Original Analysis	(ug/L) Replicate Analysis	Relative Percent Difference (RPD)
carbon tetrachloride	8984	<0.12	<0.12	--
1,2-dichloroethane	8984	<0.03	<0.03	--
1,1,1-trichloroethane	8984	<0.03	<0.03	--
1,1-dichloroethane	8984	<0.07	<0.07	--
1,1,2-trichloroethane	8984	<0.02	<0.02	--
1,1,2,2-tetrachloroethane	8984	<0.03	<0.03	--
chloroethane	8984	<0.52	<0.52	--
2-chloroethylvinyl ether	8984	<0.13	<0.13	--
chloroform	8984	<0.05	<0.05	--
1,1-dichloroethene	8984	<0.13	<0.13	--
trans-1,2-dichloroethene	8984	<0.10	<0.10	--
1,2-dichloropropane	8984	<0.04	<0.04	--
trans-1,3-dichloropropene	8984	<0.34	<0.34	--
cis-1,3-dichloropropene	8984	<0.20	<0.20	--
methylene chloride	8984	<0.25	<0.25	--
chloromethane	8984	<0.08	<0.08	--
bromomethane	8984	<1.18	<1.18	--
bromoform	8984	<0.20	<0.20	--
bromodichloromethane	8984	<0.10	<0.10	--
fluorotrichloromethane	8984	<2.0	<2.0	--
dichlorodifluoromethane	8984	<1.81	<1.81	--
chlorodibromomethane	8984	<0.09	<0.09	--
tetrachloroethene	8984	<0.03	<0.03	--
trichloroethene	8984	<0.12	<0.12	--
vinyl chloride	8984	<0.18	<0.18	--

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MEMORANDUM

TO: Paul Kopsick

FROM: Gary Hahn GH/KB

DATE: November 18, 1986

SUBJECT: Richards-Gebauer AFB Report

REF: U-4327

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on three samples received at the Analytical Services Center on October 22, 1986. Analysis was performed according to the procedures set forth in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

All samples on which this report is based will be retained by E & E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00 per sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

GH/dr
Enclosure

CORRECTING WET WEIGHT TO DRY WEIGHT

To correct the wet weight sample result to dry weight, the result must be divided by the percent solids (expressed in decimal form).

FOR EXAMPLE:

A sample is 65% solids.

$$\frac{15 \text{ mg/kg as received}}{0.65 \text{ (Solids)}} = 23 \text{ mg/kg dry weight}$$

KS/lo

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SAMPLE IDENTIFICATION
CROSS-REFERENCE

U-4327

Laboratory Number 86-	Field Number	Field Location
9090	DF-4067	SLF BKGS
9091	DF-4069	SLF DNS
9092	DF-4070	SLF-SEEPS

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4327.1

Compound	E & E Lab. No. 86-	Blank	9090	9091	9092	
	Sample Identity	10/28/86	DF-4067	DF-4069	DF-4070	
chlorobenzene		<1.0	<1.0	<1.0	<1.0	
1,2-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	
1,3-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	
1,4-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	
benzene		<1.0	<1.0	<1.0	<1.0	
total xylenes		<1.0	<1.0	<1.0	<1.0	
toluene		<1.0	<1.0	<1.0	<1.0	
ethylbenzene		<1.0	<1.0	<1.0	<1.0	

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ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in mg/kg as received)

U-4327.2

Compound	E & E Lab. No. 86-	Blank	9090	9091	9092		
	Sample Identity	10/22/86	DF-4067	DF-4069	DF-4070		
carbon tetrachloride		<1.0	<1.0	<1.0	<1.0		
1,2-dichloroethane		<1.0	<1.0	<1.0	<1.0		
1,1,1-trichloroethane		<1.0	<1.0	<1.0	<1.0		
1,1-dichloroethane		<1.0	<1.0	<1.0	<1.0		
1,1,2-trichloroethane		<1.0	<1.0	<1.0	<1.0		
1,1,2,2-tetrachloroethane		<1.0	<1.0	<1.0	<1.0		
chloroethane		<1.0	<1.0	<1.0	<1.0		
2-chloroethylvinyl ether		<1.0	<1.0	<1.0	<1.0		
chloroform		<1.0	<1.0	<1.0	<1.0		
1,1-dichloroethene		<1.0	<1.0	<1.0	<1.0		
trans-1,2-dichloroethene		<1.0	<1.0	<1.0	<1.0		
1,2-dichloropropane		<1.0	<1.0	<1.0	<1.0		
trans-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0		
cis-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0		
methylene chloride		<1.0	<1.0	<1.0	<1.0		
chloromethane		<1.0	<1.0	<1.0	<1.0		
bromomethane		<1.0	<1.0	<1.0	<1.0		
bromoform		<1.0	<1.0	<1.0	<1.0		
bromodichloromethane		<1.0	<1.0	<1.0	<1.0		
fluorotrichloromethane		<1.0	<1.0	<1.0	<1.0		
dichlorodifluoromethane		<1.0	<1.0	<1.0	<1.0		
chlorodibromomethane		<1.0	<1.0	<1.0	<1.0		
tetrachloroethene		<1.0	<1.0	<1.0	<1.0		
trichloroethene		<1.0	<1.0	<1.0	<1.0		
vinyl chloride		<1.0	<1.0	<1.0	<1.0		

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LABORATORY REPORT

FOR

RICHARDS-GEBAUER AIR FORCE BASE

U-4327.3

Job No.:	U-4327		RE:	DF-4000		
Sample Date:	10/21/86		P.O. No.:			
Date Received:	10/22/86		Sampled By:	E & E, Inc.		
Sample Type:	Soil		Delivered By:	Federal Express		
E & E Lab. No. 86-	9090	9091	9092			
Customer No.	DF-4067	DF-4069	DF-4070			
Sample Identity						
	Results in: mg/kg as received unless noted					
Petroleum Hydrocarbons	<1	<1	1.9			
Solids, %	68	73	66			

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst: [illegible]

Date: [illegible]

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

U-4327.4

Compound	E & E Laboratory No. 86-9092	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/kg)			
1,2-dichlorobenzene		<1.0	1.25	1.18	94
1,3-dichlorobenzene		<1.0	1.25	1.15	92
1,4-dichlorobenzene		<1.0	1.25	1.16	93
toluene		<1.0	1.25	1.23	98
ethyl benzene		<1.0	1.25	1.22	98

High spike recoveries for methylene chloride (186%) and bromodichloromethane (184%). The method used allows 162% and 172% recoveries, respectively, reflecting an inherent problem with these two compounds. Methylene chloride is an admitted problem with this method. The high recovery for bromodichloromethane is probably the result of column degradation and resultant response factor problems. Since bromodichloromethane was not detected in these samples, this out-of-control spike recovery should not affect data interpretations.

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4327.5

Parameter	E & E Laboratory No. 86-	(%)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
Solids	9245*	72	72	0

*This represents 10% QC. This is not one of your samples but was analyzed in the same batch as your samples.

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QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

U-4327.6

Parameter	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/kg)			
Petroleum Hydrocarbon	9091	<1	152	135	88.8

SAMPLE TRACKING OF ANALYSES
REQUIRING HOLDING TIMES

U-4327.7

Job	Sample Number	Sample Date	VOA(14)		Phenol (7/30)				BNA(7/40)				TDS(7)		Pet HC	
					Extraction		Analysis		Extraction		Analysis					
			Dead	Anal	Dead	Extr	Dead	Anal	Dead	Extr	Dead	Anal	Dead	Anal	Dead	Anal
U-4327	9090	10/21	11/4	10/22,28	--	--	--	--	--	--	--	--	--	--	11/18	11/12
	9091	10/21	11/4	10/22,28	--	--	--	--	--	--	--	--	--	--	11/18	11/12
	9092	10/21	11/4	10/22,28	--	--	--	--	--	--	--	--	--	--	11/18	11/12

	VOA Confirmation Date
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

DEAD: Date sample holding time expires.
EXTR: Date sample was extracted.
ANAL: Date sample was analyzed.

recycled paper

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MEMORANDUM

15 166

TO: Paul Kopsick

FROM: Gary Hahn JH/KRS

DATE: December 2, 1986

SUBJECT: Richards-Gebauer Air Force Base Report

REF: U-4419

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on one sample received at the Analytical Services Center on November 4, 1986. Analysis was performed according to the procedures set forth in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

All samples on which this report is based will be retained by E & E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00 per sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

GH/cp
Enclosure

SAMPLE IDENTIFICATION
CROSS-REFERENCE

U-4419

Laboratory Number 86-	Field Number	Field Location
9596	DF-4089	Bldg. #953 Drain

SAMPLE TRACKING OF ANALYSES
REQUIRING HOLDING TIMES

U-4419

Job	Sample Number	Sample Date	VOA(14)		Phenol (7/30)				BNA(7/40)				IDS(7)		Pet HC(28)	
					Extraction		Analysis		Extraction		Analysis					
			Dead	Anal	Dead	Extr	Dead	Anal	Dead	Extr	Dead	Anal	Dead	Anal	Dead	Anal
U-4419	9596	11/4	11/18	11/6	--	--	--	--	--	--	--	--	--	--	12/2	11/24

	VOA Confirmation Date
9596	11/7

DEAD: Date sample holding time expires.
EXTR: Date sample was extracted.
ANAL: Date sample was analyzed.

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4419.2

Compound	E & E Lab. No. 86-	Blank	9596*			
	Sample Identity	11/6/86	DF-4089			
chlorobenzene		<1.0	<1.0			
1,2-dichlorobenzene		<1.0	<1.0			
1,3-dichlorobenzene		<1.0	<1.0			
1,4-dichlorobenzene		<1.0	<1.0			
benzene		<1.0	1.25			
total xylenes		<1.0	2.25			
toluene		<1.0	<1.0			
ethylbenzene		<1.0	6.25			

*Analyzed by GC/MS - cyclohexanes and other aliphatics, propyl benzenes and higher aromatics present.

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in mg/kg as received)

U-4419.3

Compound	E & E Lab. No. 86-	Blank	9596				
	Sample Identity	11/6/86	DF-4089				
carbon tetrachloride		<1.0	<1.0				
1,2-dichloroethane		<1.0	<1.0				
1,1,1-trichloroethane		<1.0	<1.0				
1,1-dichloroethane		<1.0	<1.0				
1,1,2-trichloroethane		<1.0	<1.0				
1,1,2,2-tetrachloroethane		<1.0	<1.0				
chloroethane		<1.0	<1.0				
2-chloroethylvinyl ether		<1.0	<1.0				
chloroform		<1.0	<1.0				
1,1-dichloroethene		<1.0	<1.0				
trans-1,2-dichloroethene		<1.0	<1.0				
1,2-dichloropropane		<1.0	<1.0				
trans-1,3-dichloropropene		<1.0	<1.0				
cis-1,3-dichloropropene		<1.0	<1.0				
methylene chloride		<1.0	<1.0				
chloromethane		<1.0	<1.0				
bromomethane		<1.0	<1.0				
bromoform		<1.0	<1.0				
bromodichloromethane		<1.0	<1.0				
fluorotrichloromethane		<1.0	<1.0				
dichlorodifluoromethane		<1.0	<1.0				
chlorodibromomethane		<1.0	<1.0				
tetrachloroethene		<1.0	<1.0				
trichloroethene		<1.0	<1.0				
vinyl chloride		<1.0	<1.0				

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LABORATORY REPORT

FOR

RICHARDS-GEBAUER AIR FORCE BASE

U-4419.4

Job No.: U-4419			RE: DF-4000			
Sample Date: 11/4/86			P.O. No.:			
Date Received: 11/5/86			Sampled By: E & E, Inc.			
Sample Type: Soil			Delivered By: Federal Express			
E & E Lab. No. 86-	9596					
Customer No.	DF-4089					
Sample Identity						
	Results in: mg/kg as received unless noted					
Petroleum Hydrocarbons	100					
Solids, %	75					

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst: [illegible]

Date: December 23 1986

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4419.5

Parameter	E & E Laboratory No. 86-	(%)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
Solids	9716*	78	79	1.3

*This represents 10% QC. This is not one of your samples, but was analyzed in the same batch as your samples.

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

U-4419.6

Parameter	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/kg)			
Petroleum Hydrocarbon	9596	100	150	250	100

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MEMORANDUM

TO: Paul Kopsick

FROM: Gary Hahn GH/KOS

DATE: November 5, 1986

SUBJECT: Richards-Gebauer AFB Report

REF: U-4275

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on 11 samples received at the Analytical Services Center on October 10, 1986. Analysis was performed according to the procedures set forth in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

All samples on which this report is based will be retained by E & E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00 per sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

GH/dr
Enclosure

CORRECTING WET WEIGHT TO DRY WEIGHT

To correct the wet weight sample result to dry weight, the result must be divided by the percent solids (expressed in decimal form).

FOR EXAMPLE:

A sample is 65% solids.

$$\frac{\text{15 mg/kg as received}}{\text{0.65 (Solids)}} = \text{23 mg/kg dry weight}$$

KS/lo

SAMPLE IDENTIFICATION
CROSS-REFERENCE

U-4275

Laboratory Number 86-	Field Number	Field Location
8765	DF4001	North Burn Area-S1
8766	DF4002	North Burn Area-S2
8767	DF4003	North Burn Area-S3
8768	DF4004	North Burn Area-S4
8769	DF4005	North Burn Area-S5
8770	DF4007	Oil Saturated Area-S1
8771	DF4008	Oil Saturated Area-S2
8772	DF4009	Oil Saturated Area-S3
8773	DF4010	Oil Saturated Area-S4
8774	DF4011	Oil Saturated Area-S5
8775	DF4012	Oil Saturated Area-S6

SAMPLE TRACKING OF ANALYSES
REQUIRING HOLDING TIMES

U-4275.1

Job	Sample Number	Sample Date	VOA(14)		Pest/PCB(7/40)				BNA(7/40)				TDS(7)		PET HC(28)	
					Extraction		Analysis		Extraction		Analysis					
			Dead	Anal	Dead	Extr	Dead	Anal	Dead	Extr	Dead	Anal	Dead	Anal	Dead	Anal
U-4275	8765	10/9	10/23	10/10,15	--	--	--	--	--	--	--	--	--	--	11/6	10/27
	8766	10/9	10/23	10/10,15	--	--	--	--	--	--	--	--	--	--	11/6	10/27
	8767	10/9	10/23	10/10,15	--	--	--	--	--	--	--	--	--	--	11/6	10/27
	8768	10/9	10/23	10/10,15	--	--	--	--	--	--	--	--	--	--	11/6	10/28
	8769	10/9	10/23	10/10,15	--	--	--	--	--	--	--	--	--	--	11/6	10/28
	8770	10/9	10/23	10/13,15	--	--	--	--	--	--	--	--	--	--	11/6	10/28
	8771	10/9	10/23	10/13,15	--	--	--	--	--	--	--	--	--	--	11/6	10/28
	8772	10/9	10/23	10/13,15	--	--	--	--	--	--	--	--	--	--	11/6	10/28
	8773	10/9	10/23	10/13,15	--	--	--	--	--	--	--	--	--	--	11/6	10/28
	8774	10/9	10/23	10/13,17	--	--	--	--	--	--	--	--	--	--	11/6	10/28
	8775	10/9	10/23	10/13,17	--	--	--	--	--	--	--	--	--	--	11/6	10/28

	VOA Confirmation Date
____	____
____	____
____	____
____	____
____	____
____	____
____	____

DEAD: Date sample holding time expires.
EXTR: Date sample was extracted.
ANAL: Date sample was analyzed.

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ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4275.2

Compound	E & E Lab. No. 86-	Blank	8765	8766	8767	8768
	Sample Identity	10/10/86	DF 4001	DF 4002	DF 4003	DF 4004
chlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,4-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
benzene		<1.0	<1.0	<1.0	<1.0	<1.0
total xylenes		<1.0	<1.0	<1.0	<1.0	<1.0
toluene		<1.0	<1.0	<1.0	<1.0	<1.0
ethylbenzene		<1.0	<1.0	<1.0	<1.0	<1.0

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4275.3

Compound	E & E Lab. No. 86-	8769	8770	8771	8772	8773
	Sample Identity	DF 4005	DF 4007	DF 4008	DF 4009	DF 4010
chlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,4-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
benzene		<1.0	<1.0	<1.0	<1.0	<1.0
total xylenes		<1.0	<1.0	<1.0	<1.0	<1.0
toluene		<1.0	<1.0	<1.0	<1.0	<1.0
ethylbenzene		<1.0	<1.0	<1.0	<1.0	<1.0

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ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4275.4

Compound	E & E Lab. No. 86-	8774	8775	Blank		
	Sample Identity	DF-4011	DF-4012	10/13/86		
chlorobenzene		<1.0	<1.0	<1.0		
1,2-dichlorobenzene		<1.0	<1.0	<1.0		
1,3-dichlorobenzene		<1.0	<1.0	<1.0		
1,4-dichlorobenzene		<1.0	<1.0	<1.0		
benzene		<1.0	<1.0	<1.0		
total xylenes		<1.0	<1.0	<1.0		
toluene		<1.0	<1.0	<1.0		
ethylbenzene		<1.0	<1.0	<1.0		

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in mg/kg as received)

U-4275.5

Compound	E & E Lab. No. 86-	Blank	Blank	8765	8766	8767	8768
	Sample Identity	10/15/86	10/17/86	DF 4001	DF 4002	DF 4003	DF 4004
carbon tetrachloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-tetrachloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-chloroethylvinyl ether		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloropropane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
methylene chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromoform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromodichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
fluorotrichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
dichlorodifluoromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chlorodibromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
tetrachloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
vinyl chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in mg/kg as received)

U-4275.6

Compound	E & E Lab. No. 86-	8769	8770	8771	8772	8773	8774
	Sample Identity	DF 4005	DF 4007	DF 4008	DF 4009	DF 4010	DF 4011
carbon tetrachloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-tetrachloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-chloroethylvinyl ether		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloropropane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
methylene chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromoform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromodichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
fluorotrichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
dichlorodifluoromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chlorodibromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
tetrachloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
vinyl chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in mg/kg as received)

U-4275.7

Compound	E & E Lab. No. 86-	8775					
	Sample Identity	DF 4012					
carbon tetrachloride		<1.0					
1,2-dichloroethane		<1.0					
1,1,1-trichloroethane		<1.0					
1,1-dichloroethane		<1.0					
1,1,2-trichloroethane		<1.0					
1,1,2,2-tetrachloroethane		<1.0					
chloroethane		<1.0					
2-chloroethylvinyl ether		<1.0					
chloroform		<1.0					
1,1-dichloroethene		<1.0					
trans-1,2-dichloroethene		<1.0					
1,2-dichloropropane		<1.0					
trans-1,3-dichloropropene		<1.0					
cis-1,3-dichloropropene		<1.0					
methylene chloride		<1.0					
chloromethane		<1.0					
bromomethane		<1.0					
bromoform		<1.0					
bromodichloromethane		<1.0					
fluorotrichloromethane		<1.0					
dichlorodifluoromethane		<1.0					
chlorodibromomethane		<1.0					
tetrachloroethene		<1.0					
trichloroethene		<1.0					
vinyl chloride		<1.0					

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LABORATORY REPORT

FOR

RICHARDS-GEBAUER AIR FORCE BASE

U-4275.8

Job No.:	U-4275		RE:	DF-4000		
Sample Date:	10/9/86		P.O. No.:			
Date Received:	10/10/86		Sampled By:	E & E, Inc.		
Sample Type:	Soil		Delivered By:	Federal Express		
E & E Lab. No. 86-	8765	8766	8767	8768	8769	8770
Customer No. DF-	4001	4002	4003	4004	4005	4007
Sample Identity						
	Results in: mg/kg as received unless noted					
Petroleum Hydrocarbons	34	1.4	5.4	2.8	5.7	2000
Lead	NR	NR	NR	NR	NR	169
Solids, %	58	72	77	77	72	80

NR: Not requested.

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst: [illegible]

Date: November 1, 1986

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LABORATORY REPORT

FOR

RICHARDS-GEBAUER AIR FORCE BASE

U-4275.9

Job No.:	U-4275		RE:	DF-4000		
Sample Date:	10/9/86		P.O. No.:			
Date Received:	10/10/86		Sampled By:	E & E, Inc.		
Sample Type:	Soil		Delivered By:	Federal Express		
E & E Lab. No. 86-	8771	8772	8773	8774	8775	Blank*
Customer No. DF-	4008	4009	4010	4011	4012	
Sample Identity						
	Results in: mg/kg as received unless noted					
Petroleum Hydrocarbons	3800	670	<1	2	3	NA
Lead	117	343	14.1	14.8	18.5	<0.005
Solids, %	81	81	75	76	78	NA

* mg/L

NA: Not applicable.

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst: [illegible]

Date: November [illegible]

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4275.10

Parameter	E & E Laboratory No. 86-8774	(mg/kg)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
chlorobenzene		<1.0	<1.0	--
1,2-dichlorobenzene		<1.0	<1.0	--
1,3-dichlorobenzene		<1.0	<1.0	--
1,4-dichlorobenzene		<1.0	<1.0	--
benzene		<1.0	<1.0	--
total xylenes		<1.0	<1.0	--
toluene		<1.0	<1.0	--
ethyl benzene		<1.0	<1.0	--

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4275.11

Compound	E & E Laboratory No. 86-	(mg/kg)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
carbon tetrachloride	8774	<1.0	<1.0	--
1,2-dichloroethane	8774	<1.0	<1.0	--
1,1,1-trichloroethane	8774	<1.0	<1.0	--
1,1-dichloroethane	8774	<1.0	<1.0	--
1,1,2-trichloroethane	8774	<1.0	<1.0	--
1,1,2,2-tetrachloroethane	8774	<1.0	<1.0	--
chloroethane	8774	<1.0	<1.0	--
2-chloroethylvinyl ether	8774	<1.0	<1.0	--
chloroform	8774	<1.0	<1.0	--
1,1-dichloroethene	8774	<1.0	<1.0	--
trans-1,2-dichloroethene	8774	<1.0	<1.0	--
1,2-dichloropropane	8774	<1.0	<1.0	--
trans-1,3-dichloropropene	8774	<1.0	<1.0	--
cis-1,3-dichloropropene	8774	<1.0	<1.0	--
methylene chloride	8774	<1.0	<1.0	--
chloromethane	8774	<1.0	<1.0	--
bromomethane	8774	<1.0	<1.0	--
bromoform	8774	<1.0	<1.0	--
bromodichloromethane	8774	<1.0	<1.0	--
fluorotrichloromethane	8774	<1.0	<1.0	--
dichlorodifluoromethane	8774	<1.0	<1.0	--
chlorodibromomethane	8774	<1.0	<1.0	--
tetrachloroethene	8774	<1.0	<1.0	--
trichloroethene	8774	<1.0	<1.0	--
vinyl chloride	8774	<1.0	<1.0	--

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4275.12

Parameter	E & E Laboratory No. 86-	(mg/kg)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
Solids, %	8770	80	81	1.2
Lead	8775	18.5	23.2	22.5

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

U-4275.13

Parameter	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/kg)			
Petroleum Hydrocarbons	8768	2.8	170	160	92.5

MEMORANDUM

TO: Paul Kopsick

FROM: Gary Hahn GH/mba

DATE: November 3, 1986

SUBJECT: Richards-Gebauer AFB Report

REF: U-4276

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on two samples received at the Analytical Services Center on October 10, 1986. Analysis was performed according to the procedures set forth in "Methods for the Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March 1983 and "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater," EPA-600/4-82-057, July 1982.

All samples on which this report is based will be retained by E & E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00 per sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

GH/mba
Enclosure

SAMPLE IDENTIFICATION
CROSS-REFERENCE

U-4276

Laboratory Number 86-	Field Number	Field Location
8776	DF-4006	North Burn Area - W1
8777	DF-4013	Oil Saturated Area - W1

SAMPLE TRACKING OF ANALYSES
REQUIRING HOLDING TIMES

U-4276.1

Job	Sample Number	Sample Date	VOA(14)		Pest/PCB(7/40)				BNA(7/40)				TDS(7)		Pet HC(28)	
					Extraction		Analysis		Extraction		Analysis					
			Dead	Anal	Dead	Extr	Dead	Anal	Dead	Extr	Dead	Anal	Dead	Anal	Dead	Anal
U-4276	8776	10/9	10/23	10/10,16	--	--	--	--	--	--	--	--	--	--	11/6	10/21
	8777	10/9	10/23	10/10,16	--	--	--	--	--	--	--	--	10/16	10/14	11/6	10/21

	VOA Confirmation Date
____	____
____	____
____	____
____	____
____	____
____	____
____	____

DEAD: Date sample holding time expires.
EXTR: Date sample was extracted.
ANAL: Date sample was analyzed.

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in ug/L)

U-4276.2

Compound	E & E Lab. No. 86-	Blank	8776	8777		
	Sample Identity	10/10/86	DF-4006	DF-4013		
chlorobenzene		<0.20	<0.20	<0.20		
1,2-dichlorobenzene		<0.40	<0.40	<0.40		
1,3-dichlorobenzene		<0.40	<0.40	<0.40		
1,4-dichlorobenzene		<0.30	<0.30	<0.30		
benzene		<0.20	<0.20	<0.20		
total xylenes		<1.0	<1.0	<1.0		
toluene		<0.20	<0.20	<0.20		
ethylbenzene		<0.20	<0.20	<0.20		

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LABORATORY REPORT

FOR

RICHARDS-GEBAUR AIR FORCE BASE

U-4276.3

Job No.: U-4276			RE: DF-4000			
Sample Date: 10/9/86			P.O. No.:			
Date Received: 10/10/86			Sampled By: E & E, Inc.			
Sample Type: Water			Delivered By: Federal Express			
E & E Lab. No. 86-	8776	8777	Blank			
Customer No. DF-	4006	4013				
Sample Identity						
	Results in: mg/L unless noted					
Petroleum Hydrocarbons	*	<1	NA			
Total Dissolved Solids	NR	270	NA			
Lead	NR	<0.005	<0.005			

NR: Not requested
NA: Not applicable
*: Sample shipped in wrong bottle type, see U-4326 for results.

Analytical References:

"Methods for the Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March 1983.

Supervising Analyst: [illegible]
Date: November 3, 1986

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED WATER SAMPLES

U-4276.4

Parameter	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/L)			
Petroleum Hydrocarbons	DI Water	<1	8.3	6.5	78.3

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

U-4276.5

Parameter	E & E Laboratory No. 86-	(mg/L)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
Total Dissolved Solids	8777	270	260	3.8

QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

U-4276.6

Parameter	Concentrations in ug/L		Percent Difference
	Known	Determined	
Lead	53.0 53.0	54.2 51.2	2.3 3.4

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF WATER ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in ug/L)

U-4276.7

Compound	E & E Lab. No. 86-	Blank	8776	8777			
	Sample Identity	10/16/86	DF-4006	DF-4013			
carbon tetrachloride		<0.12	<0.12	<0.12			
1,2-dichloroethane		<0.03	<0.03	<0.03			
1,1,1-trichloroethane		<0.03	<0.03	<0.03			
1,1-dichloroethane		<0.07	<0.07	<0.07			
1,1,2-trichloroethane		<0.02	<0.02	<0.02			
1,1,2,2-tetrachloroethane		<0.03	<0.03	<0.03			
chloroethane		<0.52	<0.52	<0.52			
2-chloroethylvinyl ether		<0.13	<0.13	<0.13			
chloroform		<0.05	<0.05	<0.05			
1,1-dichloroethene		<0.13	<0.13	<0.13			
trans-1,2-dichloroethene		<0.10	<0.10	<0.10			
1,2-dichloropropane		<0.04	<0.04	<0.04			
trans-1,3-dichloropropene		<0.34	<0.34	<0.34			
cis-1,3-dichloropropene		<0.20	<0.20	<0.20			
methylene chloride		<0.25	<0.25	<0.25			
chloromethane		<0.08	<0.08	<0.08			
bromomethane		<1.18	<1.18	<1.18			
bromoform		<0.20	<0.20	<0.20			
bromodichloromethane		<0.10	<0.10	<0.10			
fluorotrichloromethane		<2.0	<2.0	<2.0			
dichlorodifluoromethane		<1.81	<1.81	<1.81			
chlorodibromomethane		<0.09	<0.09	<0.09			
tetrachloroethene		<0.03	<0.03	<0.03			
trichloroethene		<0.12	<0.12	<0.12			
vinyl chloride		<0.18	<0.18	<0.18			

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

U-4276.8

Compound	E & E Laboratory No. 86-	(ug/L) Original Analysis	(ug/L) Replicate Analysis	Relative Percent Difference (RPD)
carbon tetrachloride	8777	<0.12	<0.12	--
1,2-dichloroethane	8777	<0.03	<0.03	--
1,1,1-trichloroethane	8777	<0.03	<0.03	--
1,1-dichloroethane	8777	<0.07	<0.07	--
1,1,2-trichloroethane	8777	<0.02	<0.02	--
1,1,2,2-tetrachloroethane	8777	<0.03	<0.03	--
chloroethane	8777	<0.52	<0.52	--
2-chloroethylvinyl ether	8777	<0.13	<0.13	--
chloroform	8777	<0.05	<0.05	--
1,1-dichloroethene	8777	<0.13	<0.13	--
trans-1,2-dichloroethene	8777	<0.10	<0.10	--
1,2-dichloropropane	8777	<0.04	<0.04	--
trans-1,3-dichloropropene	8777	<0.34	<0.34	--
cis-1,3-dichloropropene	8777	<0.20	<0.20	--
methylene chloride	8777	<0.25	<0.25	--
chloromethane	8777	<0.08	<0.08	--
bromomethane	8777	<1.18	<1.18	--
bromoform	8777	<0.20	<0.20	--
bromodichloromethane	8777	<0.10	<0.10	--
fluorotrichloromethane	8777	<2.0	<2.0	--
dichlorodifluoromethane	8777	<1.81	<1.81	--
chlorodibromomethane	8777	<0.09	<0.09	--
tetrachloroethene	8777	<0.03	<0.03	--
trichloroethene	8777	<0.12	<0.12	--
vinyl chloride	8777	<0.18	<0.18	--

MEMORANDUM

TO: Paul Kopsick

FROM: Gary Hahn

DATE: November 3, 1986

SUBJECT: Richards-Gebauer AFB Report

REF: U-4282

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on three samples received at the Analytical Services Center on October 11, 1986. Analysis was performed according to the procedures set forth in "Methods for the Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March 1983 and "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater," EPA-600/4-82-057, July 1982.

All samples on which this report is based will be retained by E & E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00 per sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

GH/mba
Enclosure

SAMPLE IDENTIFICATION
CROSS-REFERENCE

U-4282

Laboratory Number 86-	Field Number	Field Location
8806	DF4025	Haz. Waste Storage W-1
8807	DF4027	Herb. Burial W-1
8808	DF4026	Field Blank

SAMPLE TRACKING OF ANALYSES
REQUIRING HOLDING TIMES

U-4282.1

Job	Sample Number	Sample Date	VOA(14)		Pest/PCB(7/40)				Herb(7/30)				TDS(7)		Pet HC(28)	
					Extraction		Analysis		Extraction		Analysis					
			Dead	Anal	Dead	Extr	Dead	Anal	Dead	Extr	Dead	Anal	Dead	Anal	Dead	Anal
U-4282	8806	10/10	10/24	10/14,16	--	--	--	--	--	--	--	--	10/17	10/15	11/7	10/21
	8808	10/10	10/24	10/14,16	--	--	--	--	--	--	--	--	--	--	--	--
	8807	10/10	--	--	10/17	10/17	11/26	10/27	10/17	10/15	11/14	10/15	10/17	10/15	--	--

DEAD: Date sample holding time expires.
EXTR: Date sample was extracted.
ANAL: Date sample was analyzed.

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ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in ug/L)

U-4282.2

Compound	E & E Lab. No. 86-	Blank	8806	8808		
	Sample Identity	10/14/86	DF-4025	DF-4026		
chlorobenzene		<0.20	<0.20	<0.20		
1,2-dichlorobenzene		<0.40	<0.40	<0.40		
1,3-dichlorobenzene		<0.40	<0.40	<0.40		
1,4-dichlorobenzene		<0.30	<0.30	<0.30		
benzene		<0.20	<0.20	<0.20		
total xylenes		<1.0	<1.0	<1.0		
toluene		<0.20	<0.20	<0.20		
ethylbenzene		<0.20	<0.20	<0.20		

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF WATER ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in ug/L)

U-4282.3

Compound	E & E Lab. No. 86-	Blank	8806	8808
	Sample Identity	10/16/86	DF-4025	DF-4026
carbon tetrachloride		<0.12	<0.12	<0.12
1,2-dichloroethane		<0.03	<0.03	<0.03
1,1,1-trichloroethane		<0.03	<0.03	<0.03
1,1-dichloroethane		<0.07	<0.07	<0.07
1,1,2-trichloroethane		<0.02	<0.02	<0.02
1,1,2,2-tetrachloroethane		<0.03	<0.03	<0.03
chloroethane		<0.52	<0.52	<0.52
2-chloroethylvinyl ether		<0.13	<0.13	<0.13
chloroform		<0.05	<0.05	<0.05
1,1-dichloroethene		<0.13	<0.13	<0.13
trans-1,2-dichloroethene		<0.10	<0.10	<0.10
1,2-dichloropropane		<0.04	<0.04	<0.04
trans-1,3-dichloropropene		<0.34	<0.34	<0.34
cis-1,3-dichloropropene		<0.20	<0.20	<0.20
methylene chloride		<0.25	<0.25	<0.25
chloromethane		<0.08	<0.08	<0.08
bromomethane		<1.18	<1.18	<1.18
bromoform		<0.20	<0.20	<0.20
bromodichloromethane		<0.10	<0.10	<0.10
fluorotrichloromethane		<2.0	<2.0	<2.0
dichlorodifluoromethane		<1.81	<1.81	<1.81
chlorodibromomethane		<0.09	<0.09	<0.09
tetrachloroethene		<0.03	<0.03	<0.03
trichloroethene		<0.12	<0.12	<0.12
vinyl chloride		<0.18	<0.18	<0.18

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSIS FOR
PRIORITY POLLUTANT PESTICIDES, PCBs AND HERBICIDES BY GC

(all results in ug/L)

U-4282.4

	E & E Lab. No. 86-	8807	Blank					
Compound	Sample Identity	DF4027	10/17/86					
Aldrin		<0.05	<0.05					
a-BHC		<0.05	<0.05					
b-BHC		<0.05	<0.05					
g-BHC		<0.05	<0.05					
d-BHC		<0.05	<0.05					
Chlordane		<0.50	<0.50					
4,4'-DDD		<0.10	<0.10					
4,4'-DDE		<0.10	<0.10					
4,4'-DDT		<0.10	<0.10					
Dieldrin		<0.10	<0.10					
Endosulfan I		<0.05	<0.05					
Endosulfan II		<0.10	<0.10					
Endosulfan sulfate		<0.10	<0.10					
Endrin		<0.10	<0.10					
Endrin aldehyde		<0.10	<0.10					
Heptachlor		<0.05	<0.05					
Heptachlor epoxide		<0.05	<0.05					
PCB - 1016		<0.50	<0.50					
PCB - 1221		<0.50	<0.50					
PCB - 1232		<0.50	<0.50					
PCB - 1242		<0.50	<0.50					
PCB - 1248		<0.50	<0.50					
PCB - 1254		<1.0	<1.0					
PCB - 1260		<1.0	<1.0					
Toxaphene		<1.0	<1.0					
2,4-D		<0.50	<0.50					
2,4,5-TP (Silvex)		<0.05	<0.05					
2,4,5-T		<0.05	<0.05					

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

U-4282.6

Parameter	E & E Laboratory No. 86-8808	(ug/L)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
chlorobenzene		<0.20	<0.20	--
1,2-dichlorobenzene		<0.40	<0.40	--
1,3-dichlorobenzene		<0.40	<0.40	--
1,4-dichlorobenzene		<0.30	<0.30	--
benzene		<0.20	<0.20	--
total xylenes		<1.0	<1.0	--
toluene		<0.20	<0.20	--
ethyl benzene		<0.20	<0.20	--

ecology and environment, inc.
International Specialists in the Environment

LABORATORY REPORT

FOR

RICHARDS - GEBAUER AIR FORCE BASE

U-4282.5

Job No.: U-4282			RE: DF-4000			
Sample Date: 10/10/86			P.O. No.:			
Date Received: 10/11/86			Sampled By: E & E, Inc.			
Sample Type: Water			Delivered By: Federal Express			
E & E Lab. No. 86-	8806	8807	Blank			
Customer No.	DF-4025	DF-4027				
Sample Identity						
	Results in: mg/L unless noted					
Total Dissolved Solids	180	110	NA			
Petroleum Hydro-Carbons	<1	NR	NA			
Antimony	<0.15	NR	<0.15			
Arsenic	<0.005	<0.005	<0.005			
Barium	0.085	NR	<0.05			
Beryllium	<0.005	NR	<0.005			
Cadmium	<0.01	NR	<0.01			
Chromium	<0.05	NR	<0.05			
Copper	<0.02	NR	<0.02			
Lead	0.005	NR	<0.005			
Mercury	<0.0002	<0.0002	NA			
Nickel	<0.1	NR	<0.1			
Selenium	<0.005	NR	<0.005			
Silver	<0.01	NR	<0.01			
Thallium	<0.005	NR	<0.005			
Zinc	<0.05	NR	<0.05			

NR: Not requested
NA: Not applicable

Analytical References:

"Methods for the Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March 1983.

H-60(a) Supervising Analyst: [illegible]

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED WATER SAMPLES

U-4282.7

Compound	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(ug/L)			
1,2-dichloroethane	8808	<0.03	10.0	14.0	140
1,1-dichloroethane	8808	<0.07	10.0	13.3	133
chloroethane	8808	<0.52	10.0	10.6	106
methylene chloride	8808	<0.25	10.0	18.6	186
chloromethane	8808	<0.08	10.0	11.2	112
bromomethane	8808	<1.18	10.0	12.8	128
bromodichloromethane	8808	<0.10	10.0	18.4	184
trichloroethene	8808	<0.12	10.0	11.1	111

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED WATER SAMPLES

U-4282.8

Parameter	E & E Laboratory No. 86-DI Spike	Original Value	Amount Added	Amount Determined	Percent Recovery
		(ug/L)			
2,4-D		<0.50	10	9.4	94
Silvex		<0.05	10	7.2	72

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED WATER SAMPLES

U-4282.9

Parameter	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/L)			
Petroleum Hydrocarbons	DI Water	<1	8.3	6.5	78.3

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

U-4282.10

Parameter	E & E Laboratory No. 86-	(mg/L)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
Total Dissolved Solids	8807	110	110	0

QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

U-4282.11

Parameter	Concentrations in ug/L		Percent Difference
	Known	Determined	
Antimony	990	1007	1.7
Arsenic	20.0	18.7	6.5
Beryllium	960	950	1.0
Barium	119600	117900	1.4
Cadmium	940	903	3.9
Chromium	1030	989	4.0
Copper	1030	1010	1.9
Lead	53.0	54.2	2.3
Mercury	4.4	4.5	2.3
Nickel	1020	1004	1.6
Selenium	10.9	11.3	3.7
Silver	6000	6290	4.8
Thallium	25.0	23.2	7.2
Zinc	1010	1015	0.5

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MEMORANDUM

TO: Paul Kopsick

FROM: Gary Hahn JH/KD

DATE: November 6, 1986

SUBJECT: Richards - Gebauer AFB Report

REF: U-4299

CC: ~~Lab File~~, QA/QC File

Attached is the laboratory report of the analysis conducted on 10 samples received at the Analytical Services Center on October 16, 1986. Analysis was performed according to the procedures set forth in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

All samples on which this report is based will be retained by E & E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00 per sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

GH/mba
Enclosure

SAMPLE IDENTIFICATION
CROSS-REFERENCE

U-4299

Laboratory Number 86-	Field Number	Field Location
8894	DF-4027	NB Boring 1 S-1
8895	DF-4028	NB Boring 1 S-2
8896	DF-4029	NB Boring 1 S-3
8897	DF-4030	NB Boring 2 S-1
8898	DF-4031	NB Boring 2 S-2
8899	DF-4032	NB Boring 2 S-3
8900	DF-4032D	NB Boring 2 S-3
8901	DF-4033	NB Boring 3 S-1
8902	DF-4034	NB Boring 3 S-2
8903	DF-4035	NB Boring 3 S-3

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SAMPLE TRACKING OF ANALYSES
REQUIRING HOLDING TIMES

U-4299.1

Job	Sample Number	Sample Date	VOA(14) Dead	VOA(14) Anal	Pet HC(28) Dead	Pet HC(28) Anal
U-4299	8894	10/15	10/29	10/17	11/12	10/29
	8895	10/15	10/29	10/17	11/12	10/29
	8896	10/15	10/29	10/17	11/12	10/29
	8897	10/15	10/29	10/17	11/12	10/29
	8898	10/15	10/29	10/17	11/12	10/29
	8899	10/15	10/29	10/17,20	11/12	10/29
	8900	10/15	10/29	10/17,20	11/12	10/29
	8901	10/15	10/29	10/17,21	11/12	10/29
	8902	10/15	10/29	10/17,21	11/12	10/29
	8903	10/15	10/29	10/17,21	11/12	10/29

	VOA Confirmation Date
8896	10/24

DEAD: Date sample holding time expires.
EXTR: Date sample was extracted.
ANAL: Date sample was analyzed.

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4299.2

Compound	E & E Lab. No. 86-	Blank	8894	8895	8896	8897
	Sample Identity	10/17/86	DF-4027	DF-4028	DF-4029	DF-4030
chlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,4-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
benzene		<1.0	<1.0	<1.0	<1.0	<1.0
total xylenes		<1.0	<1.0	<1.0	<1.0	<1.0
toluene		<1.0	<1.0	<1.0	<1.0	<1.0
ethylbenzene		<1.0	<1.0	<1.0	<1.0	<1.0

recycled pape

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4299.3

Compound	E & E Lab. No. 86-	8898	8899	8900	8901	8902
	Sample Identity	DF-4031	DF-4032	DF-4032D	DF-4033	DF-4034
chlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,4-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
benzene		<1.0	<1.0	<1.0	<1.0	<1.0
total xylenes		<1.0	<1.0	<1.0	<1.0	<1.0
toluene		<1.0	<1.0	<1.0	<1.0	<1.0
ethylbenzene		<1.0	<1.0	<1.0	<1.0	<1.0

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4299.4

Compound	E & E Lab. No. 86-	8903				
	Sample Identity	DF-4035				
chlorobenzene		<1.0				
1,2-dichlorobenzene		<1.0				
1,3-dichlorobenzene		<1.0				
1,4-dichlorobenzene		<1.0				
benzene		<1.0				
total xylenes		<1.0				
toluene		<1.0				
ethylbenzene		<1.0				

recycled paper

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in mg/kg as received)

U-4299.5

Compound	E & E Lab. No. 86-	Blank	Blank	Blank	8894	8895	8896†
	Sample Identity	10/17/86	10/20/86	10/21/86	DF-4027	DF-4028	DF-4029
carbon tetrachloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-tetrachloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-chloroethylvinyl ether		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloropropane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
methylene chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromoform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromodichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
fluorotrichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
dichlorodifluoromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chlorodibromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
tetrachloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
vinyl chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

†Sample confirmed - results negative.

15 2-0

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in mg/kg as received)

U-4299.6

Compound	E & E Lab. No. 86-	8897	8898	8899	8900	8901	8902
	Sample Identity	DF-4030	DF-4031	DF-4032	DF-4032D	DF-4033	DF-4034
carbon tetrachloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-tetrachloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-chloroethylvinyl ether		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloropropane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
methylene chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromoform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromodichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
fluorotrichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
dichlorodifluoromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chlorodibromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
tetrachloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
vinyl chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

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ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in mg/kg as received)

U-4299.7

Compound	E & E Lab. No. 86-	8903					
	Sample Identity	DF-4035					
carbon tetrachloride		<1.0					
1,2-dichloroethane		<1.0					
1,1,1-trichloroethane		<1.0					
1,1-dichloroethane		<1.0					
1,1,2-trichloroethane		<1.0					
1,1,2,2-tetrachloroethane		<1.0					
chloroethane		<1.0					
2-chloroethylvinyl ether		<1.0					
chloroform		<1.0					
1,1-dichloroethene		<1.0					
trans-1,2-dichloroethene		<1.0					
1,2-dichloropropane		<1.0					
trans-1,3-dichloropropene		<1.0					
cis-1,3-dichloropropene		<1.0					
methylene chloride		<1.0					
chloromethane		<1.0					
bromomethane		<1.0					
bromoform		<1.0					
bromodichloromethane		<1.0					
fluorotrichloromethane		<1.0					
dichlorodifluoromethane		<1.0					
chlorodibromomethane		<1.0					
tetrachloroethene		<1.0					
trichloroethene		<1.0					
vinyl chloride		<1.0					

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LABORATORY REPORT

FOR

RICHARDS - GEBAUER AIR FORCE BASE

U-4299.8

Job No.: U-4299			RE: DF-4000			
Sample Date: 10/15/86			P.O. No.:			
Date Received: 10/16/86			Sampled By: E & E, Inc.			
Sample Type: Soil			Delivered By: Federal Express			
E & E Lab. No. 86-	8894	8895	8896	8897	8898	8899
Customer No.	DF-4027	DF-4028	DF-4029	DF-4030	DF-4031	DF-4032
Sample Identity						
	Results in: mg/kg as received unless noted					
Petroleum Hydrocarbons	<1	3.8	3.8	1.9	1.6	2.0
Solids, %	80	78	67	81	81	65

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst: Gary Hahn / db

Date: November 7, 1986

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LABORATORY REPORT

FOR

RICHARD - GEBAUER AIR FORCE BASE

U-4299.9

Job No.: U-4299			RE: DF-4000			
Sample Date: 10/15/86			P.O. No.:			
Date Received: 10/16/86			Sampled By: E & E, Inc.			
Sample Type: Soil			Delivered By: Federal Express			
E & E Lab. No. 86-	8900	8901	8902	8903		
Customer No.	DF-4032D	DF-4033	DF4034	DF-4035		
Sample Identity						
	Results in: mg/kg as received unless noted					
Petroleum Hydrocarbons	1.4	<1	<1	<1		
Solids, %	64	78	84	79		

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst: [illegible]

Date: November 7, 1986

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

U-4299.10

Compound	E & E Laboratory No. 86-8903	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/kg)			
1,2-dichlorobenzene		<1.0	1.25	1.17	94
1,3-dichlorobenzene		<1.0	1.25	1.14	91
1,4-dichlorobenzene		<1.0	1.25	1.15	92
toluene		<1.0	1.25	1.13	90
ethyl benzene		<1.0	1.25	1.03	82

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QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4299.11

Parameter	E & E Laboratory No. 86-8899	(mg/kg)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
chlorobenzene		<1.0	<1.0	--
1,2-dichlorobenzene		<1.0	<1.0	--
1,3-dichlorobenzene		<1.0	<1.0	--
1,4-dichlorobenzene		<1.0	<1.0	--
benzene		<1.0	<1.0	--
total xylenes		<1.0	<1.0	--
toluene		<1.0	<1.0	--
ethyl benzene		<1.0	<1.0	--

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4299.12

Compound	E & E Laboratory No. 86-	(mg/kg) Original Analysis	(mg/kg) Replicate Analysis	Relative Percent Difference (RPD)
carbon tetrachloride	8898	<1.0	<1.0	--
1,2-dichloroethane	8898	<1.0	<1.0	--
1,1,1-trichloroethane	8898	<1.0	<1.0	--
1,1-dichloroethane	8898	<1.0	<1.0	--
1,1,2-trichloroethane	8898	<1.0	<1.0	--
1,1,2,2-tetrachloroethane	8898	<1.0	<1.0	--
chloroethane	8898	<1.0	<1.0	--
2-chloroethylvinyl ether	8898	<1.0	<1.0	--
chloroform	8898	<1.0	<1.0	--
1,1-dichloroethene	8898	<1.0	<1.0	--
trans-1,2-dichloroethene	8898	<1.0	<1.0	--
1,2-dichloropropane	8898	<1.0	<1.0	--
trans-1,3-dichloropropene	8898	<1.0	<1.0	--
cis-1,3-dichloropropene	8898	<1.0	<1.0	--
methylene chloride	8898	<1.0	<1.0	--
chloromethane	8898	<1.0	<1.0	--
bromomethane	8898	<1.0	<1.0	--
bromoform	8898	<1.0	<1.0	--
bromodichloromethane	8898	<1.0	<1.0	--
fluorotrichloromethane	8898	<1.0	<1.0	--
dichlorodifluoromethane	8898	<1.0	<1.0	--
chlorodibromomethane	8898	<1.0	<1.0	--
tetrachloroethene	8898	<1.0	<1.0	--
trichloroethene	8898	<1.0	<1.0	--
vinyl chloride	8898	<1.0	<1.0	--

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QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

U-4299.13

Parameter	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/kg)			
Petroleum Hydrocarbon	8897	1.9	170	180	105

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QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4299.14

Parameter	E & E Laboratory No. 86-	Original Analysis	Replicate Analysis	Relative Percent Difference (RPD)
Petroleum Hydrocarbons, mg/kg	8903	<1	<1	--
Solids, %	8903	79	80	1.2

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MEMORANDUM

TO: Paul Kopsick

FROM: Gary Hahn GH/KS

DATE: November 21, 1986

SUBJECT: Richards-Gebauer AFB Report

REF: U-4326

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on 15 samples received at the Analytical Services Center on October 22, 1986. Analysis was performed according to the procedures set forth in "Methods for the Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March 1983; and "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater," EPA-600/4-82-057, July 1982.

All samples on which this report is based will be retained by E & E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00 per sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

GH/mba

Enclosure

SAMPLE IDENTIFICATION
CROSS-REFERENCE

U-4326

Laboratory Number 86-	Field Number	Field Location
9076	DF-4057	North Burn - NWMW
9077	DF-4058	North Burn - NEMW
9078	DF-4059	North Burn - SEMW
9079	DF-4060	POL Monitoring Well
9080	DF-4061	Northeast LF Bkg Well
9081	DF-4062	Northeast LF Gate Well
9082	DF-4063	Northeast LF PII Well 1
9083	DF-4064	Northeast LF PII Well 2
9084	DF-4065	Northeast LF PII Well 3
9085	DF-4066	South LF
9086	DF-4068	SLF DNW
9087	DF-4071	SLF SEE PW
9088	DF-4006	North Burn Area - W1
9089	DF-4072	Field Blank
9095	DF-4072	VOA Field Blank

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SAMPLE TRACKING OF ANALYSES
REQUIRING HOLDING TIMES

U-4326

Job	Sample Number	Sample Date	VOA(14)		Phenol (7/40)				BNA(7/40)				TDS(7)		Pet HC	
					Extraction		Analysis		Extraction		Analysis					
			Dead	Anal	Dead	Extr	Dead	Anal	Dead	Extr	Dead	Anal	Dead	Anal	Dead	Anal
U-4326	9076	10/21	11/4	10/25,27	--	--	--	--	--	--	--	--	--	--	--	--
	9077	10/21	11/4	10/25,27	--	--	--	--	--	--	--	--	--	--	--	--
	9078	10/21	11/4	10/25,27	--	--	--	--	--	--	--	--	--	--	--	--
	9079	10/21	11/4	10/25,28	--	--	--	--	--	--	--	--	10/28	10/24	11/18	11/10
	9080	10/21	11/4	10/25,28	10/28	10/27	11/19	10/30	10/28	10/23	12/2	10/24	10/28	10/24	11/18	11/10
	9081	10/21	11/4	10/25,28	10/28	10/27	11/19	10/30	10/28	10/23	12/2	10/28	10/28	10/24	11/18	11/10
	9082	10/21	11/4	10/25,28	10/28	10/27	11/19	10/30	10/28	10/23	12/2	10/24	10/28	10/24	11/18	11/10
	9083	10/21	11/4	10/25,28	10/28	10/27	11/19	10/30	10/28	10/23	12/2	10/24	10/28	10/24	11/18	11/10
	9084	10/21	11/4	10/25,28	10/28	10/27	11/19	10/30	10/28	10/23	12/2	10/24	10/28	10/24	11/18	11/10
	9085	10/21	11/4	10/25,28	10/28	10/27	11/19	10/30	10/28	10/23	12/2	10/28	10/28	10/24	11/18	11/10
	9086	10/21	11/4	10/25,28	10/28	10/27	11/19	10/30	10/28	10/23	12/2	10/28	10/28	10/24	11/18	11/10
	9087	10/21	11/4	10/25,28	10/28	10/27	11/19	10/30	10/28	10/23	12/2	10/28	10/28	10/24	11/18	11/10
	9095	10/21	11/4	10/25,28	--	--	--	--	--	--	--	--	--	--	--	--
	9088	10/21	--	--	--	--	--	--	--	--	--	--	--	--	11/18	11/10
	9089	10/21	--	--	--	--	--	--	--	--	--	--	--	--	11/18	11/10

	VOA Confirmation Date		Phenol Confirmation Date
9076	10/29	9080	11/18
9077	10/29		
9078	10/29		
9082	10/29		
9084	10/29		

DEAD: Date sample holding time expires.
EXTR: Date sample was extracted.
ANAL: Date sample was analyzed.

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in ug/L)

U-4326.1

Compound	E & E Lab. No. 86-	Blank	9076	9077	9078	9079
	Sample Identity	10-23-86	DF-4057	DF-4058	DF-4059	DF-4060
chlorobenzene		<0.20	<0.20	<0.20	<0.20	<0.20
1,2-dichlorobenzene		<0.40	<0.40	<0.40	<0.40	<0.40
1,3-dichlorobenzene		<0.40	<0.40	<0.40	<0.40	<0.40
1,4-dichlorobenzene		<0.30	<0.30	<0.30	<0.30	<0.30
benzene		<0.20	<0.20	<0.20	<0.20	<0.20
total xylenes		<1.0	<1.0	<1.0	<1.0	<1.0
toluene		<0.20	<0.20	<0.20	<0.20	<0.20
ethylbenzene		<0.20	<0.20	<0.20	<0.20	<0.20

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ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in ug/L)

U-4326.2

Compound	E & E Lab. No. 86-	9080	9081	9082	9083	9084
	Sample Identity	DF-4061	DF-4062	DF-4063	DF-4064	DF-4065
chlorobenzene		<0.20	<0.20	<0.20	<0.20	<0.20
1,2-dichlorobenzene		<0.40	<0.40	<0.40	<0.40	<0.40
1,3-dichlorobenzene		<0.40	<0.40	<0.40	<0.40	<0.40
1,4-dichlorobenzene		<0.30	<0.30	<0.30	<0.30	<0.30
benzene		<0.20	<0.20	<0.20	<0.20	<0.20
total xylenes		<1.0	<1.0	<1.0	<1.0	<1.0
toluene		<0.20	<0.20	<0.20	<0.20	<0.20
ethylbenzene		<0.20	<0.20	<0.20	<0.20	<0.20

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in ug/L)

U-4326.3

Compound	E & E Lab. No. 86-	9085	9086	9087	9095	
	Sample Identity	DF-4066	DF-4068	DF-4071	DF-4072	
chlorobenzene		<0.20	<0.20	<0.20	<0.20	
1,2-dichlorobenzene		<0.40	<0.40	<0.40	<0.40	
1,3-dichlorobenzene		<0.40	<0.40	<0.40	<0.40	
1,4-dichlorobenzene		<0.30	<0.30	<0.30	<0.30	
benzene		<0.20	<0.20	<0.20	<0.20	
total xylenes		<1.0	<1.0	<1.0	<1.0	
toluene		<0.20	<0.20	<0.20	<0.20	
ethylbenzene		<0.20	<0.20	<0.20	<0.20	

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ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF WATER ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in ug/L)

U-4326.4

Compound	E & E Lab. No. 86-	Blank	Blank	9076*	9077*	9078*	9079
	Sample Identity	10/27/86	10/28/86	DF-4057	DF-4058	DF-4059	DF-4060
carbon tetrachloride		<0.12	<0.12	<0.12	<0.60	<0.12	<0.12
1,2-dichloroethane		<0.03	<0.03	<0.03	<0.15	<0.03	<0.03
1,1,1-trichloroethane		<0.03	<0.03	<0.03	<0.15	<0.03	<0.03
1,1-dichloroethane		<0.07	<0.07	<0.07	<0.35	<0.07	<0.07
1,1,2-trichloroethane		<0.02	<0.02	<0.02	<0.10	<0.02	<0.02
1,1,2,2-tetrachloroethane		<0.03	<0.03	<0.03	<0.15	<0.03	<0.03
chloroethane		<0.52	<0.52	<0.52	<2.6	<0.52	<0.52
2-chloroethylvinyl ether		<0.13	<0.13	<0.13	<0.65	<0.13	<0.13
chloroform		<0.05	<0.05	0.50	<0.25	0.61	<0.05
1,1-dichloroethene		<0.13	<0.13	<0.13	<0.65	<0.13	<0.13
trans-1,2-dichloroethene		<0.10	<0.10	<0.10	<0.50	<0.10	<0.10
1,2-dichloropropane		<0.04	<0.04	<0.04	<0.20	<0.04	<0.04
trans-1,3-dichloropropene		<0.34	<0.34	<0.34	<1.7	<0.34	<0.34
cis-1,3-dichloropropene		<0.20	<0.20	<0.20	<1.0	<0.20	<0.20
methylene chloride		<0.25	<0.25	<0.25	37	<0.25	<0.25
chloromethane		<0.08	<0.08	<0.08	<0.40	<0.08	<0.08
bromomethane		<1.18	<1.18	<1.18	<5.9	<1.18	<1.18
bromoform		<0.20	<0.20	<0.20	<1.0	<0.20	<0.20
bromodichloromethane		<0.10	<0.10	<0.10	<0.50	<0.10	<0.10
fluorotrichloromethane		<2.0	<2.0	<2.0	<10	<2.0	<2.0
dichlorodifluoromethane		<1.81	<1.81	<1.81	<9.0	<1.81	<1.81
chlorodibromomethane		<0.09	<0.09	<0.09	<0.45	<0.09	<0.09
tetrachloroethene		<0.03	<0.03	0.71	<0.15	0.41	<0.03
trichloroethene		<0.12	<0.12	<0.12	<0.60	<0.12	<0.12
vinyl chloride		<0.18	<0.18	<0.18	<0.90	<0.18	<0.18

*Sample confirmed - results positive

15 235

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF WATER ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in ug/L)

U-4326.5

Compound	E & E Lab. No. 86-	9080	9081	9082**	9083	9084**	9085
	Sample Identity	DF-4061	DF-4062	DF-4063	DF-4064	DF-4065	DF-4066
carbon tetrachloride		<0.12	<0.12	<0.12	<0.12	<0.12	<0.12
1,2-dichloroethane		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
1,1,1-trichloroethane		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
1,1-dichloroethane		<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1,2-trichloroethane		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,2,2-tetrachloroethane		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
chloroethane		<0.52	<0.52	<0.52	<0.52	<0.52	<0.52
2-chloroethylvinyl ether		<0.13	<0.13	<0.13	<0.13	<0.13	<0.13
chloroform		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,1-dichloroethene		<0.13	<0.13	<0.13	<0.13	<0.13	<0.13
trans-1,2-dichloroethene		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
1,2-dichloropropane		<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
trans-1,3-dichloropropene		<0.34	<0.34	<0.34	<0.34	<0.34	<0.34
cis-1,3-dichloropropene		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
methylene chloride		<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
chloromethane		<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
bromomethane		<1.18	<1.18	<1.18	<1.18	<1.18	<1.18
bromoform		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
bromodichloromethane		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
fluorotrichloromethane		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dichlorodifluoromethane		<1.81	<1.81	<1.81	<1.81	<1.81	<1.81
chlorodibromomethane		<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
tetrachloroethene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
trichloroethene		<0.12	<0.12	<0.12	<0.12	<0.12	<0.12
vinyl chloride		<0.18	<0.18	<0.18	<0.18	<0.18	<0.18

**Sample confirmed - results negative.

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ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF WATER ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in ug/L)

U-4326.6

Compound	E & E Lab. No. 86-	9086	9087	9095			
	Sample Identity	DF-4068	DF-4071	DF-4072			
carbon tetrachloride		<0.12	<0.12	<0.12			
1,2-dichloroethane		<0.03	<0.03	<0.03			
1,1,1-trichloroethane		<0.03	<0.03	<0.03			
1,1-dichloroethane		<0.07	<0.07	<0.07			
1,1,2-trichloroethane		<0.02	<0.02	<0.02			
1,1,2,2-tetrachloroethane		<0.03	<0.03	<0.03			
chloroethane		<0.52	<0.52	<0.52			
2-chloroethylvinyl ether		<0.13	<0.13	<0.13			
chloroform		<0.05	<0.05	<0.05			
1,1-dichloroethene		<0.13	<0.13	<0.13			
trans-1,2-dichloroethene		<0.10	<0.10	<0.10			
1,2-dichloropropane		<0.04	<0.04	<0.04			
trans-1,3-dichloropropene		<0.34	<0.34	<0.34			
cis-1,3-dichloropropene		<0.20	<0.20	<0.20			
methylene chloride		<0.25	<0.25	<0.25			
chloromethane		<0.08	<0.08	<0.08			
bromomethane		<1.18	<1.18	<1.18			
bromoform		<0.20	<0.20	<0.20			
bromodichloromethane		<0.10	<0.10	<0.10			
fluorotrichloromethane		<2.0	<2.0	<2.0			
dichlorodifluoromethane		<1.81	<1.81	<1.81			
chlorodibromomethane		<0.09	<0.09	<0.09			
tetrachloroethene		<0.03	<0.03	<0.03			
trichloroethene		<0.12	<0.12	<0.12			
vinyl chloride		<0.18	<0.18	<0.18			

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
ACID EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/L)

U-4326.7

Compound	E & E Lab. No. 86-	9080	9081	9082	9083	9084
	Sample Identity	DF-4061	DF-4062	DF-4063	DF-4064	DF-4065
phenol		<10	<10	<10	<10	<10
2-chlorophenol		<10	<10	<10	<10	<10
2-nitrophenol		<10	<10	<10	<10	<10
2,4-dimethylphenol		<10	<10	<10	<10	<10
2,4-dichlorophenol		<10	<10	<10	<10	<10
4-chloro-3-methylphenol		<10	<10	<10	<10	<10
2,4,6-trichlorophenol		<10	<10	<10	<10	<10
2,4-dinitrophenol		<30	<30	<30	<30	<30
4-nitrophenol		<10	<10	<10	<10	<10
4,6-dinitro-2-methylphenol		<30	<30	<30	<30	<30
pentachlorophenol		<30	<30	<30	<30	<30

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ANALYTICAL SERVICES CENTER

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
ACID EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/L)

U-4326.8

Compound	E & E Lab. No. 86-	9085	9086	9087	Method Blank	
	Sample Identity	DF-4066	DF-4068	DF-4071		
phenol		<10	<10	<10	<10	
2-chlorophenol		<10	<10	<10	<10	
2-nitrophenol		<10	<10	<10	<10	
2,4-dimethylphenol		<10	<10	<10	<10	
2,4-dichlorophenol		<10	<10	<10	<10	
4-chloro-3-methylphenol		<10	<10	<10	<10	
2,4,6-trichlorophenol		<10	<10	<10	<10	
2,4-dinitrophenol		<30	<30	<30	<30	
4-nitrophenol		<10	<10	<10	<10	
4,6-dinitro-2-methylphenol		<30	<30	<30	<30	
pentachlorophenol		<30	<30	<30	<30	

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
BASE/NEUTRAL EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/L)

U-4326.9

Compound	E & E Lab. No. 86-	9080	9081	9082	9083	9084
	Sample Identity	DF-4061	DF-4062	DF-4063	DF-4064	DF-4065
bis(2-chloroethyl)ether		<10	<10	<10	<10	<10
1,3-dichlorobenzene		<10	<10	<10	<10	<10
1,4-dichlorobenzene		<10	<10	<10	<10	<10
1,2-dichlorobenzene		<10	<10	<10	<10	<10
bis(2-chloroisopropyl)ether		<10	<10	<10	<10	<10
N-nitrosodipropylamine		<10	<10	<10	<10	<10
hexachloroethane		<10	<10	<10	<10	<10
nitrobenzene		<10	<10	<10	<10	<10
isophorone		<10	<10	<10	<10	<10
bis(2-chloroethoxy)methane		<10	<10	<10	<10	<10
1,2,4-trichlorobenzene		<10	<10	<10	<10	<10
naphthalene		<10	<10	<10	<10	<10
hexachlorobutadiene		<10	<10	<10	<10	<10
hexachlorocyclopentadiene		<10	<10	<10	<10	<10
2-chloronaphthalene		<10	<10	<10	<10	<10
dimethyl phthalate		<10	<10	<10	<10	<10
acenaphthylene		<10	<10	<10	<10	<10
fluorene		<10	<10	<10	<10	<10
acenaphthene		<10	<10	<10	<10	<10
2,4-dinitrotoluene		<10	<10	<10	<10	<10
2,6-dinitrotoluene		<10	<10	<10	<10	<10
diethylphthalate		<10	<10	<10	<10	<10
4-chlorophenyl phenyl ether		<10	<10	<10	<10	<10
N-nitrosodiphenylamine		<10	<10	<10	<10	<10
4-bromophenyl phenyl ether		<10	<10	<10	<10	<10
hexachlorobenzene		<10	<10	<10	<10	<10
phenanthrene		<10	<10	<10	<10	<10
anthracene		<10	<10	<10	<10	<10
di-n-butyl phthalate		12	<10*	<10*	<10*	11
fluoranthene		<10	<10	<10	<10	<10
benzidine		<50	<50	<50	<50	<50
pyrene		<10	<10	<10	<10	<10
butyl benzyl phthalate		<10	<10	<10	<10	<10
3,3'-dichlorobenzidine		<30	<30	<30	<30	<30
benzo(a)anthracene		<10	<10	<10	<10	<10
bis(2-ethylhexyl)phthalate		<10	<10	<10	<10	<10
chrysene		<10	<10	<10	<10	<10
di-n-octyl phthalate		<10	<10	<10	<10	<10
benzo(b)fluoranthene		<10	<10	<10	<10	<10
benzo(k)fluoranthene		<10	<10	<10	<10	<10
benzo(a)pyrene		<10	<10	<10	<10	<10
indeno(1,2,3-cd)pyrene		<10	<10	<10	<10	<10
dibenzo(a,h)anthracene		<10	<10	<10	<10	<10
benzo(ghi)perylene		<10	<10	<10	<10	<10

*Compound present below measurable detection limit.

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ANALYTICAL SERVICES CENTER

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
BASE/NEUTRAL EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/L)

U-4326.10

Compound	E & E Lab. No. 86-	9085	9086	9087	Method Blank	
	Sample Identity	DF-4066	DF-4068	DF-4071		
bis(2-chloroethyl)ether		<10	<10	<10	<10	
1,3-dichlorobenzene		<10	<10	<10	<10	
1,4-dichlorobenzene		<10	<10	<10	<10	
1,2-dichlorobenzene		<10	<10	<10	<10	
bis(2-chloroisopropyl)ether		<10	<10	<10	<10	
N-nitrosodipropylamine		<10	<10	<10	<10	
hexachloroethane		<10	<10	<10	<10	
nitrobenzene		<10	<10	<10	<10	
isophorone		<10	<10	<10	<10	
bis(2-chloroethoxy)methane		<10	<10	<10	<10	
1,2,4-trichlorobenzene		<10	<10	<10	<10	
naphthalene		<10	<10	<10	<10	
hexachlorobutadiene		<10	<10	<10	<10	
hexachlorocyclopentadiene		<10	<10	<10	<10	
2-chloronaphthalene		<10	<10	<10	<10	
dimethyl phthalate		<10	<10	<10	<10	
acenaphthylene		<10	<10	<10	<10	
fluorene		<10	<10	<10	<10	
acenaphthene		<10	<10	<10	<10	
2,4-dinitrotoluene		<10	<10	<10	<10	
2,6-dinitrotoluene		<10	<10	<10	<10	
diethylphthalate		<10	<10	<10	<10	
4-chlorophenyl phenyl ether		<10	<10	<10	<10	
N-nitrosodiphenylamine		<10	<10	<10	<10	
4-bromophenyl phenyl ether		<10	<10	<10	<10	
hexachlorobenzene		<10	<10	<10	<10	
phenanthrene		<10	<10	<10	<10	
anthracene		<10	<10	<10	<10	
di-n-butyl phthalate		10	<10*	10	<10*	
fluoranthene		<10	<10	<10	<10	
benzidine		<50	<50	<50	<50	
pyrene		<10	<10	<10	<10	
butyl benzyl phthalate		<10	<10	<10	<10	
3,3'-dichlorobenzidine		<30	<30	<30	<30	
benzo(a)anthracene		<10	<10	<10	<10	
bis(2-ethylhexyl)phthalate		<10	<10	<10	<10	
chrysene		<10	<10	<10	<10	
di-n-octyl phthalate		<10	<10	<10	<10	
benzo(b)fluoranthene		<10	<10	<10	<10	
benzo(k)fluoranthene		<10	<10	<10	<10	
benzo(a)pyrene		<10	<10	<10	<10	
indeno(1,2,3-cd)pyrene		<10	<10	<10	<10	
dibenzo(a,h)anthracene		<10	<10	<10	<10	
benzo(ghi)perylene		<10	<10	<10	<10	

*Compound present below measurable detection limit.

ECOLOGY AND ENVIRONMENT'S, INC.
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RESULTS OF WATER ANALYSIS FOR
PHENOLS BY GC

(all results in ug/L)

U-4326.11

Compound	E & E Lab. No. 86-	Blank	9080*	9081	9082	9083
	Sample Identity	10/27/86	DF-4061	DF-4062	DF-4063	DF-4064
phenol		<0.14	<5.0	<5.0	<5.0	<5.0
2-chlorophenol		<0.31	<5.0	<5.0	<5.0	<5.0
2-nitrophenol		<0.45	<5.0	<5.0	<5.0	<5.0
2,4-dimethylphenol		<0.32	<5.0	<5.0	<5.0	<5.0
2,4-dichlorophenol		<0.39	<5.0	<5.0	<5.0	<5.0
4-chloro-3-methylphenol		<0.36	<5.0	<5.0	<5.0	<5.0
2,4,6-trichlorophenol		<0.64	<5.0	<5.0	<5.0	<5.0
2,4-dinitrophenol		<13	<13	<13	<13	<13
4-nitrophenol		<2.8	<5.0	<5.0	<5.0	<5.0
4,6-dinitro-2-methylphenol		<16	<16	<16	<16	<16
pentachlorophenol		<7.4	<7.4	<7.4	<7.4	<7.4

*Sample confirmed - results negative.

NOTE: Elevated detection limits due to matrix interferences.

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ANALYTICAL SERVICES CENTER

RESULTS OF WATER ANALYSIS FOR
PHENOLS BY GC

(all results in ug/L)

U-4326.12

Compound	E & E Lab. No. 86-	9084	9085	9086	9087	
	Sample Identity	DF-4065	DF-4066	DF-4068	DF-4071	
phenol		<5.0	<5.0	<5.0	<5.0	
2-chlorophenol		<5.0	<5.0	<5.0	<5.0	
2-nitrophenol		<5.0	<5.0	<5.0	<5.0	
2,4-dimethylphenol		<5.0	<5.0	<5.0	<5.0	
2,4-dichlorophenol		<5.0	<5.0	<5.0	<5.0	
4-chloro-3-methylphenol		<5.0	<5.0	<5.0	<5.0	
2,4,6-trichlorophenol		<5.0	<5.0	<5.0	<5.0	
2,4-dinitrophenol		<13	<13	<13	<13	
4-nitrophenol		<5.0	<5.0	<5.0	<5.0	
4,6-dinitro-2-methylphenol		<16	<16	<16	<16	
pentachlorophenol		<7.4	<7.4	<7.4	<7.4	

NOTE: Elevated detection limits due to matrix interferences.

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LABORATORY REPORT

FOR

RICHARDS-GEBAUER AIR FORCE BASE

U-4326.13

Job No.: U-4326			RE: DF-4000			
Sample Date: 10/21/86			P.O. No.:			
Date Received: 10/22/86			Sampled By: E & E, Inc.			
Sample Type: Water			Delivered By: Federal Express			
E & E Lab. No. 86-	9079	9080	9081	9082	9083	9084
Customer No.	DF-4060	DF-4061	DF-4062	DF-4063	DF-4064	DF-4065
Sample Identity						
	Results in: mg/L unless noted					
Petroleum Hydrocarbons	<1	<1	<1	<1	<1	<1
Total Dissolved Solids	540	380	940	430	650	510

Analytical References:

"Methods for the Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March 1983.

Supervising Analyst: [illegible]

Date: November 25, 1986

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LABORATORY REPORT

FOR

RICHARDS-GEBAUER AIR FORCE BASE

U-4326.14

Job No.:	U-4326		RE:	DF-4000		
Sample Date:	10/21/86		P.O. No.:			
Date Received:	10/22/86		Sampled By:	E & E, Inc.		
Sample Type:	Water		Delivered By:	Federal Express		
E & E Lab. No. 86-	9085	9086	9087	9088	9089	
Customer No.	DF-4066	DF-4068	DF-4071	DF-4006	DF-4072	
Sample Identity						
	Results in: mg/L unless noted					
Petroleum Hydrocarbons	<1	<1	<1	<1	<1	
Total Dissolved Solids	290	390	400	NR	NR	

NR: Not requested.

Analytical References:

"Methods for the Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March 1983.

Supervising Analyst: [illegible]

Date: November 25, 1986

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSES
FOR PRIORITY POLLUTANT METALS

(all results in mg/L)

U-4326.15

	E & E Lab. No. 86-	9080	9081	9082	9083	9084
	Sample Identity	DF-4061	DF-4062	DF-4063	DF-4064	DF-4065
Antimony		<0.15	<0.15	<0.15	<0.15	<0.15
Arsenic		<0.005	<0.005	<0.005	<0.005	<0.005
Beryllium		<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium		<0.01	<0.01	<0.01	<0.01	<0.01
Chromium		<0.05	<0.05	<0.05	<0.05	<0.05
Copper		<0.02	<0.02	<0.02	<0.02	<0.02
Lead		0.008	0.005	0.005	0.008	<0.005
Mercury		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Nickel		<0.1	<0.1	<0.1	<0.1	<0.1
Selenium		<0.005	<0.005	<0.005	<0.005	<0.005
Silver		<0.04	<0.04	<0.04	<0.04	<0.04
Thallium		<0.005	<0.005	<0.005	<0.005	<0.005
Zinc		<0.05	<0.05	0.062	<0.05	<0.05

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ANALYTICAL SERVICES CENTER

RESULTS OF WATER ANALYSES
FOR PRIORITY POLLUTANT METALS

(all results in mg/L)

U-4326.16

	E & E Lab. No. 86-	9085	9086	9087	Blank	
	Sample Identity	DF-4066	DF-4068	DF-4071		
Antimony		<0.15	<0.15	<0.15	<0.15	
Arsenic		<0.005	<0.005	<0.005	<0.005	
Beryllium		<0.01	<0.01	<0.01	<0.01	
Cadmium		<0.01	<0.01	<0.01	<0.01	
Chromium		<0.05	<0.05	<0.05	<0.05	
Copper		<0.02	<0.02	<0.02	<0.02	
Lead		0.006	<0.005	<0.005	<0.005	
Mercury		<0.0002	<0.0002	<0.0002	NA	
Nickel		<0.1	<0.1	<0.1	<0.1	
Selenium		<0.005	<0.005	<0.005	<0.005	
Silver		<0.04	<0.04	<0.04	<0.04	
Thallium		<0.005	<0.005	<0.005	<0.005	
Zinc		<0.05	<0.05	<0.05	<0.05	

NA: Not applicable.

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED WATER SAMPLES

U-4326.17

Compound	E & E Laboratory No. 86-9085	Original Value	Amount Added	Amount Determined	Percent Recovery
		(ug/L)			
1,2-dichlorobenzene		<0.40	10	8.9	89
1,3-dichlorobenzene		<0.40	10	8.6	86
1,4-dichlorobenzene		<0.30	10	8.7	87
benzene		<0.20	10	8.3	83
toluene		<0.20	10	8.6	86
ethyl benzene		<0.20	10	8.6	86

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QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED WATER SAMPLES

U-4326.18

Compound	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(ug/L)			
1,2-dichloroethane	9083	<0.03	10.0	9.42	94.2
1,1-dichloroethane	9083	<0.07	10.0	10.6	106
chloroethane	9083	<0.52	10.0	8.57	85.7
methylene chloride	9083	<0.25	10.0	8.36	83.6
chloromethane	9083	<0.08	10.0	12.8	128
bromomethane	9083	<1.18	10.0	11.8	118
bromodichloromethane	9083	<0.10	10.0	9.75	97.5
trichloroethene	9083	<0.12	10.0	8.94	89.4

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY OF SURROGATE SPIKES

U-4326.19

Compound	E & E Laboratory No. 86-	Amount Added (ug/L)	Amount Determined (ug/L)	Percent Recovery
Nitrobenzene-D5	9080	100	97	97
	9081	100	92	92
	9082	100	77	77
	9083	100	88	88
	9084	100	89	89
	9085	100	83	83
	9086	100	58	58
	9087	100	49	49
2-Fluorobiphenyl	9080	100	80	80
	9081	100	91	91
	9082	100	76	76
	9083	100	88	88
	9084	100	85	85
	9085	100	88	88
	9086	100	71	71
	9087	100	68	68
Terphenyl-D14	9080	100	89	89
	9081	100	98	98
	9082	100	71	71
	9083	100	115	115
	9084	100	82	82
	9085	100	98	98
	9086	100	90	90
	9087	100	96	96

These recoveries are acceptable to EPA Contract Lab Program (CLP) guidelines.

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY OF SURROGATE SPIKES

U-4326.20

Compound	E & E Laboratory No. 86-	Amount Added (ug/L)	Amount Determined (ug/L)	Percent Recovery
Phenol-D5	9080	200	76	38
	9081	200	66	33
	9082	200	58	29
	9083	200	34	17
	9084	200	51	25.5
	9085	200	62	31
	9086	200	47	23.5
	9087	200	74	37
2-Fluorophenol	9080	200	102	51
	9081	200	116	58
	9082	200	98	49
	9083	200	76	38
	9084	200	80	40
	9085	200	108	54
	9086	200	72	36
	9087	200	98	49
2,4,6-Tribromophenol	9080	200	211	106
	9081	200	127	63.5
	9082	200	136	68
	9083	200	63	31.5
	9084	200	116	58
	9085	200	120	60
	9086	200	119	59.5
	9087	200	135	67.5

These recoveries are acceptable to EPA Contract Lab Program (CLP) guidelines.

QUALITY CONTROL FOR ACCURACY:
PERCENT RECOVERY--EPA QUALITY ASSURANCE MATERIALS

U-4326.21

Compound	True Value (ug/L)	Amount Determined (ug/L)	Percent Recovery
2-chlorophenol	100	66	66
2-nitrophenol	100	70	70
phenol	100	30	30
2,4-dimethylphenol	100	65	65
2,4-dichlorophenol	100	75	75
2,4,6-trichlorophenol	100	82	82
4-chloro-3-methylphenol	100	76	76
2-methyl-4,6-dinitrophenol	100	81	81
pentachlorophenol	100	66	66
4-nitrophenol	100	<10*	<10*

*Compound present below measurable detection limits.

These results are acceptable to EPA Guidelines.

QUALITY CONTROL FOR SPIKED
PHENOL ANALYSIS

U-4326.22

Compound	E & E Lab. No. 86-9087	(ug/L)			% Recovery
		Original Analysis	Amount Spiked	Amount Determined	
phenol		<5.0	40	11	28
2-chlorophenol		<5.0	40	23	58
2-nitrophenol		<5.0	40	25	63
2,4-dimethylphenol		<5.0	40	23	58
2,4-dichlorophenol		<5.0	40	25	63
4-chloro-3-methylphenol		<5.0	40	24	60*
2,4,6-trichlorophenol		<5.0	40	31	78
2,4-dinitrophenol		<13	40	28	70
4-nitrophenol		<5.0	40	14	35
4,6-dinitro-2-methylphenol		<16	40	30	75
pentachlorophenol		<7.4	40	32	80

*This recovery is outside the laboratory control limit (67%). Since all spiking compounds are in the same solution, the sample matrix is assumed to be the cause. Results on Page H-105 demonstrate E & E ability to generate acceptable data.

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED WATER SAMPLES

U-4326.23

Parameter	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/L)			
Petroleum Hydrocarbon	DI Water	--	8.7	6.8	78.2
Lead	9087	<0.005	0.05	0.05	100
Thallium	9087	<0.005	0.05	0.029	58.0*
Arsenic	9087	<0.005	0.04	0.034	85
Mercury	9086	<0.0002	0.004	0.004	100

*Outside control limits (75-125%). Sample matrix is suspected as the cause.

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

U-4326.24

Parameter	E & E Laboratory No. 86-	(mg/L)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
Total Dissolved Solids	9087	400	400	0
Antimony	9087	<0.15	<0.15	--
Arsenic	9087	<0.005	<0.005	--
Beryllium	9087	<0.01	<0.01	--
Cadmium	9087	<0.01	<0.01	--
Chromium	9087	<0.05	<0.05	--
Copper	9087	<0.02	<0.02	--
Lead	9087	<0.005	<0.005	--
Mercury	9086	<0.0002	<0.0002	--
Nickel	9087	<0.1	<0.1	--
Selenium	9087	<0.005	<0.025	--
Silver	9087	<0.04	<0.04	--
Thallium	9087	<0.005	<0.1	--
Zinc	9087	<0.05	<0.05	--

NUS CORPORATION

Laboratory Services Division
5350 Campbells Run Road
Pittsburgh, PA 15205

REMIT TO:
Park West Two
Cliff Mine Road
Pittsburgh, PA 15275
412-788-1080

15 256

LAB ANALYSIS REPORT

CLIENT NAME: ECOLOGY & ENVIRONMENT, INC.
ADDRESS: 4285 GENESEE STREET
BUFFALO, NY 14225

NUS CLIENT NO: 879792
VENDOR NO: 95536109
WORK ORDER NO: 55830
DATE RECEIVED: 10/29/86

REPORT DATE: 11/13/86

ATTENTION: MS. KATHY SYRACUSE

SAMPLE IDENTIFICATION		NUS SAMPLE NO	RESULTS	UNITS
9080	10/21	16101698		
W340 ION CHROMATOGRAPHY SCAN				
W850 Flouride (F) by IC			1.0	mg/l
W852 Chloride (Cl) by IC			4.3	mg/l
W854 Nitrite (NO2) by IC			< 0.10	mg/l
W856 Phosphate (PO4) by IC			< 0.20	mg/l
W858 Nitrate (NO3) by IC			2.2	mg/l
W860 Bromide (Br) by IC			< 0.1	mg/l
W862 Sulfate (SO4) by IC			61	mg/l
9081	10/21	16101699		
W340 ION CHROMATOGRAPHY SCAN				
W850 Flouride (F) by IC			2.7	mg/l
W852 Chloride (Cl) by IC			47	mg/l
W854 Nitrite (NO2) by IC			< 1.0	mg/l
W856 Phosphate (PO4) by IC			< 0.20	mg/l
W858 Nitrate (NO3) by IC			< 1.0	mg/l
W860 Bromide (Br) by IC			0.25	mg/l
W862 Sulfate (SO4) by IC			200	mg/l
9082	10/21	16101700		
W340 ION CHROMATOGRAPHY SCAN				
W850 Flouride (F) by IC			0.79	mg/l
W852 Chloride (Cl) by IC			22	mg/l
W854 Nitrite (NO2) by IC			< 1.0	mg/l
W856 Phosphate (PO4) by IC			< 0.20	mg/l
W858 Nitrate (NO3) by IC			6.7	mg/l
W860 Bromide (Br) by IC			< 0.1	mg/l
W862 Sulfate (SO4) by IC			110	mg/l
9083	10/21	16101701		
W340 ION CHROMATOGRAPHY SCAN				
W850 Flouride (F) by IC			3.2	mg/l

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CLIENT ORIGINAL

NUS CORPORATION

Laboratory Services Division
5350 Campbells Run Road
Pittsburgh, PA 15205

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Pittsburgh, PA 15275
412-788-1080

15 257

LAB ANALYSIS REPORT

CLIENT NAME: ECOLOGY & ENVIRONMENT, INC.
ADDRESS: 4285 GENESEE STREET
BUFFALO, NY 14225
ATTENTION: MS. KATHY SYRACUSE

REPORT DATE: 11/13/86

NUS CLIENT NO: 070902
VENDOR NO: 05536100
WORK ORDER NO: 55830
DATE RECEIVED: 10/29/86

SAMPLE IDENTIFICATION			NUS SAMPLE NO	RESULTS	UNITS
9083		10/21	16101701 - CONTINUED		
W852	Chloride (Cl) by IC			22	mg/l
W854	Nitrite (NO2) by IC			< 1.0	mg/l
W856	Phosphate (PO4) by IC			< 0.20	mg/l
W858	Nitrate (NO3) by IC			0.24	mg/l
W860	Bromide (Br) by IC			0.20	mg/l
W862	Sulfate (SO4) by IC			60	mg/l
9084		10/21	16101702		
W340	ION CHROMATOGRAPHY SCAN				
W850	Flouride (F) by IC			1.2	mg/l
W852	Chloride (Cl) by IC			41	mg/l
W854	Nitrite (NO2) by IC			< 0.40	mg/l
W856	Phosphate (PO4) by IC			< 0.20	mg/l
W858	Nitrate (NO3) by IC			0.60	mg/l
W860	Bromide (Br) by IC			0.24	mg/l
W862	Sulfate (SO4) by IC			71	mg/l
9085		10/21	16101703		
W340	ION CHROMATOGRAPHY SCAN				
W850	Flouride (F) by IC			0.64	mg/l
W852	Chloride (Cl) by IC			4.6	mg/l
W854	Nitrite (NO2) by IC			< 0.10	mg/l
W856	Phosphate (PO4) by IC			< 0.20	mg/l
W858	Nitrate (NO3) by IC			< 0.10	mg/l
W860	Bromide (Br) by IC			< 0.10	mg/l
W862	Sulfate (SO4) by IC			36	mg/l
9086		10/21	16101704		
W340	ION CHROMATOGRAPHY SCAN				
W850	Flouride (F) by IC			0.75	mg/l
W852	Chloride (Cl) by IC			29	mg/l
W854	Nitrite (NO2) by IC			< 1.0	mg/l
W856	Phosphate (PO4) by IC			< 0.20	mg/l

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NUS CORPORATION

Laboratory Services Division
5350 Campbells Run Road
Pittsburgh, PA 15205

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Cliff Mine Road
Pittsburgh, PA 15275
412-788-1080

15 258

LAB ANALYSIS REPORT

CLIENT NAME: ECOLOGY & ENVIRONMENT, INC.
ADDRESS: 4285 GENESEE STREET
BUFFALO, NY 14225

ATTENTION: MS. KATHY SYRACUSE

REPORT DATE: 11/13/86

NUS CLIENT NO: 890202
VENDOR NO: 05536100
WORK ORDER NO: 55830
DATE RECEIVED: 10/27/86

SAMPLE IDENTIFICATION			NUS SAMPLE NO	RESULTS	UNITS
9086		10/21	16101704 - CONTINUED		
W858	Nitrate (NO3) by IC			2.4	mg/l
W860	Bromide (Br) by IC			< 0.1	mg/l
W862	Sulfate (SO4) by IC			35	mg/l
9087		10/21	16101705		
W340	ION CHROMATOGRAPHY SCAN				
W850	Flouride (F) by IC			0.74	mg/l
W852	Chloride (Cl) by IC			32	mg/l
W854	Nitrite (NO2) by IC			< 1.0	mg/l
W856	Phosphate (PO4) by IC			< 0.20	mg/l
W858	Nitrate (NO3) by IC			2.7	mg/l
W860	Bromide (Br) by IC			< 0.1	mg/l
W862	Sulfate (SO4) by IC			28	mg/l

COMMENTS: P.O.NO: 24401

Reviewed and Approved by: JMC

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CLIENT ORIGINAL

MEMORANDUM

TO: Paul Kopsick

FROM: Gary Hahn GH/dr

DATE: December 1, 1986

SUBJECT: Richards-Gebauer AFB Report

REF: U-4351

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on one sample received at the Analytical Services Center on October 24, 1986. Analysis was performed according to the procedures set forth in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

All samples on which this report is based will be retained by E & E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00 per sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

GH/dr
Enclosure

SAMPLE IDENTIFICATION
CROSS-REFERENCE

U-4351

Laboratory Number 86-	Field Number	Field Location
9236	DF-4077	SLFSEEP2

ecology and environment, inc.
International Specialists in the Environment

15 261

LABORATORY REPORT

FOR

RICHARDS-GEBAUER AIR FORCE BASE

U-4351.1

Job No.:	U-4351		RE:	DF-4000		
Sample Date:	10/23/86		P.O. No.:			
Date Received:	10/24/86		Sampled By:	E & E, Inc.		
Sample Type:	Soil		Delivered By:	Federal Express		
E & E Lab. No. 86-	9236					
Customer No.	DF-4077					
Sample Identity						
	Results in: mg/kg as received unless noted					
Petroleum Hydrocarbons	16					
Solids, %	65					

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst: Mary Hahn/kos

Date: December 8, 1986

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4351.2

Parameter	E & E Laboratory No. 86-9236	(mg/kg)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
chlorobenzene		<1.0	<1.0	--
1,2-dichlorobenzene		<1.0	<1.0	--
1,3-dichlorobenzene		<1.0	<1.0	--
1,4-dichlorobenzene		<1.0	<1.0	--
benzene		<1.0	<1.0	--
total xylenes		<1.0	<1.0	--
toluene		<1.0	<1.0	--
ethyl benzene		<1.0	<1.0	--

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

U-4351.3

Parameter	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/kg)			
Petroleum Hydrocarbons	9236	16	160	180	102

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4351.4

Parameter	E & E Laboratory No. 86-	(%)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
Solids	9245*	72	72	0

*This represents 10% QC. This is not one of your samples, but was analyzed in the same batch as your samples.

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SAMPLE TRACKING OF ANALYSES
REQUIRING HOLDING TIMES

U-4351.5

Job	Sample Number	Sample Date	VOA(14)		Phenol (7/30)				BNA(7/40)				TDS(7)		Pet HC(28)	
					Extraction		Analysis		Extraction		Analysis					
			Dead	Anal	Dead	Extr	Dead	Anal	Dead	Extr	Dead	Anal	Dead	Anal	Dead	Anal
U-4351	9236	10/23	11/6	10/28, 11/4	--	--	--	--	--	--	--	--	--	--	11/20	11/19

VOA Confirmation Date
____
____
____
____
____
____
____

DEAD: Date sample holding time expires.
EXTR: Date sample was extracted.
ANAL: Date sample was analyzed.

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4351.6

Compound	E & E Lab. No. 86-	Blank	9236			
	Sample Identity	10/28/86	DF-4077			
chlorobenzene		<1.0	<1.0			
1,2-dichlorobenzene		<1.0	<1.0			
1,3-dichlorobenzene		<1.0	<1.0			
1,4-dichlorobenzene		<1.0	<1.0			
benzene		<1.0	<1.0			
total xylenes		<1.0	<1.0			
toluene		<1.0	<1.0			
ethylbenzene		<1.0	<1.0			

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in mg/kg as received)

U-4351.7

Compound	E & E Lab. No. 86-	Blank	9236				
	Sample Identity	11/4/86	DF-4077				
carbon tetrachloride		<1.0	<1.0				
1,2-dichloroethane		<1.0	<1.0				
1,1,1-trichloroethane		<1.0	<1.0				
1,1-dichloroethane		<1.0	<1.0				
1,1,2-trichloroethane		<1.0	<1.0				
1,1,2,2-tetrachloroethane		<1.0	<1.0				
chloroethane		<1.0	<1.0				
2-chloroethylvinyl ether		<1.0	<1.0				
chloroform		<1.0	<1.0				
1,1-dichloroethene		<1.0	<1.0				
trans-1,2-dichloroethene		<1.0	<1.0				
1,2-dichloropropane		<1.0	<1.0				
trans-1,3-dichloropropene		<1.0	<1.0				
cis-1,3-dichloropropene		<1.0	<1.0				
methylene chloride		<1.0	<1.0				
chloromethane		<1.0	<1.0				
bromomethane		<1.0	<1.0				
bromoform		<1.0	<1.0				
bromodichloromethane		<1.0	<1.0				
fluorotrichloromethane		<1.0	<1.0				
dichlorodifluoromethane		<1.0	<1.0				
chlorodibromomethane		<1.0	<1.0				
tetrachloroethene		<1.0	<1.0				
trichloroethene		<1.0	<1.0				
vinyl chloride		<1.0	<1.0				

M E M O R A N D U M

TO: Paul Kopsick

FROM: Gary Hahn GH/kos

DATE: December 1, 1986

SUBJECT: Richards - Gebauer AFB Report

REF: U-4350

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on five samples received at the Analytical Services Center on October 24, 1986. Analysis was performed according to the procedures set forth in "Methods for the Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March 1983 and "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater," EPA-600/4-82-057, July 1982.

All samples on which this report is based will be retained by E & E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00 per sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

GH/mba

Enclosure

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SAMPLE IDENTIFICATION
CROSS-REFERENCE

U-4350

Laboratory Number 86-	Field Number	Field Location
9230	DF-4073	NELF culvert
9231	DF-4074	NELF downstream
9232	DF-4075	NELF upstream
9233	DF-4076	SLF SEEP 2
9234	DF-4078	VOA blank

SAMPLE TRACKING OF ANALYSES
REQUIRING HOLDING TIMES

U-4350.1

Job	Sample Number	Sample Date	VOA(14)		Phenol (7/30)				BNA(7/40)				IDS(7)		Pet HC(28)	
					Extraction		Analysis		Extraction		Analysis					
			Dead	Anal	Dead	Extr	Dead	Anal	Dead	Extr	Dead	Anal	Dead	Anal	Dead	Anal
U-4350	9230	10/23	11/4	10/27,29	10/30	10/29	11/28	10/31	10/30	10/28	12/7	11/3	10/30	10/28	11/20	11/18
	9231	10/23	11/4	10/27,29	10/30	10/29	11/28	10/31	10/30	10/28	12/7	11/3	10/30	10/28	11/20	11/18
	9232	10/23	11/4	10/27,29	10/30	10/29	11/28	11/3	10/30	10/30	12/9	11/3	10/30	10/28	11/20	11/18
	9233	10/23	11/4	10/27,29	10/30	10/29	11/28	11/3	10/30	10/30	12/9	11/3	10/30	10/28	11/20	11/18
	9234	10/23	11/4	10/27,29	--	--	--	--	--	--	--	--	--	--	--	--

	VOA Confirmation Date
____	____
____	____
____	____
____	____
____	____
____	____
____	____

DEAD: Date sample holding time expires.
EXTR: Date sample was extracted.
ANAL: Date sample was analyzed.

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in ug/L)

U-4350.2

Compound	E & E Lab. No. 86-	Blank	9230	9231	9232	9233
	Sample Identity	10/27/86	DF-4073	DF-4074	DF-4075	DF-4076
chlorobenzene		<0.20	<0.20	<0.20	<0.20	<0.20
1,2-dichlorobenzene		<0.40	<0.40	<0.40	<0.40	<0.40
1,3-dichlorobenzene		<0.40	<0.40	<0.40	<0.40	<0.40
1,4-dichlorobenzene		<0.30	<0.30	<0.30	<0.30	<0.30
benzene		<0.20	<0.20	<0.20	<0.20	<0.20
total xylenes		<1.0	<1.0	<1.0	<1.0	<1.0
toluene		<0.20	<0.20	<0.20	<0.20	<0.20
ethylbenzene		<0.20	<0.20	<0.20	<0.20	<0.20

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in ug/L)

U-4350.3

Compound	E & E Lab. No. 86-	9234				
	Sample Identity	DF-4078				
chlorobenzene		<0.20				
1,2-dichlorobenzene		<0.40				
1,3-dichlorobenzene		<0.40				
1,4-dichlorobenzene		<0.30				
benzene		<0.20				
total xylenes		<1.0				
toluene		<0.20				
ethylbenzene		<0.20				

recycled paper

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF WATER ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in ug/L)

U-4350.4

Compound	E & E Lab. No. 86-	Blank	9230	9231	9232	9233	9234
	Sample Identity	10/29/86	DF-4073	DF-4074	DF4075	DF-4076	DF-4078
carbon tetrachloride		<0.12	<0.12	<0.12	<0.12	<0.12	<0.12
1,2-dichloroethane		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
1,1,1-trichloroethane		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
1,1-dichloroethane		<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
1,1,2-trichloroethane		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
1,1,2,2-tetrachloroethane		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
chloroethane		<0.52	<0.52	<0.52	<0.52	<0.52	<0.52
2-chloroethylvinyl ether		<0.13	<0.13	<0.13	<0.13	<0.13	<0.13
chloroform		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,1-dichloroethene		<0.13	<0.13	<0.13	<0.13	<0.13	<0.13
trans-1,2-dichloroethene		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
1,2-dichloropropane		<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
trans-1,3-dichloropropene		<0.34	<0.34	<0.34	<0.34	<0.34	<0.34
cis-1,3-dichloropropene		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
methylene chloride		0.78	<0.25	<0.25	<0.25	<0.25	<0.25
chloromethane		<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
bromomethane		<1.18	<1.18	<1.18	<1.18	<1.18	<1.18
bromoform		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
bromodichloromethane		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
fluorotrichloromethane		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
dichlorodifluoromethane		<1.81	<1.81	<1.81	<1.81	<1.81	<1.81
chlorodibromomethane		<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
tetrachloroethene		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
trichloroethene		<0.12	<0.12	<0.12	<0.12	<0.12	<0.12
vinyl chloride		<0.18	<0.18	<0.18	<0.18	<0.18	<0.18

NOTE: Due to low level artifacts present in the methanol used for internal standard preparation, all samples have been blank subtracted. The actual value of the blank has been reported.

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
ACID EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/L)

U-4350.5

Compound	E & E Lab. No. 86-	9230	9231	9232	9233	Method Blank
	Sample Identity	DF-4073	DF-4074	DF-4075	DF-4076	
phenol		<10	<10	<10	<10	<10
2-chlorophenol		<10	<10	<10	<10	<10
2-nitrophenol		<10	<10	<10	<10	<10
2,4-dimethylphenol		<10	<10	<10	<10	<10
2,4-dichlorophenol		<10	<10	<10	<10	<10
4-chloro-3-methylphenol		<10	<10	<10	<10	<10
2,4,6-trichlorophenol		<10	<10	<10	<10	<10
2,4-dinitrophenol		<30	<30	<30	<30	<30
4-nitrophenol		<10	<10	<10	<10	<10
4,6-dinitro-2-methylphenol		<30	<30	<30	<30	<30
pentachlorophenol		<30	<30	<30	<30	<30

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ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
BASE/NEUTRAL EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/L)

U-4350.6

Compound	E & E Lab. No. 86-	9230	9231	9232	9233	Method Blank
	Sample Identity	DF-4073	DF-4074	DF-4075	DF-4076	
bis(2-chloroethyl)ether		<10	<10	<10	<10	<10
1,3-dichlorobenzene		<10	<10	<10	<10	<10
1,4-dichlorobenzene		<10	<10	<10	<10	<10
1,2-dichlorobenzene		<10	<10	<10	<10	<10
bis(2-chloroisopropyl)ether		<10	<10	<10	<10	<10
N-nitrosodipropylamine		<10	<10	<10	<10	<10
hexachloroethane		<10	<10	<10	<10	<10
nitrobenzene		<10	<10	<10	<10	<10
isophorone		<10	<10	<10	<10	<10
bis(2-chloroethoxy)methane		<10	<10	<10	<10	<10
1,2,4-trichlorobenzene		<10	<10	<10	<10	<10
naphthalene		<10	<10	<10	<10	<10
hexachlorobutadiene		<10	<10	<10	<10	<10
hexachlorocyclopentadiene		<10	<10	<10	<10	<10
2-chloronaphthalene		<10	<10	<10	<10	<10
dimethyl phthalate		<10	<10	<10	<10	<10
acenaphthylene		<10	<10	<10	<10	<10
fluorene		<10	<10	<10	<10	<10
acenaphthene		<10	<10	<10	<10	<10
2,4-dinitrotoluene		<10	<10	<10	<10	<10
2,6-dinitrotoluene		<10	<10	<10	<10	<10
diethylphthalate		<10	<10	<10	<10	<10
4-chlorophenyl phenyl ether		<10	<10	<10	<10	<10
N-nitrosodiphenylamine		<10	<10	<10	<10	<10
4-bromophenyl phenyl ether		<10	<10	<10	<10	<10
hexachlorobenzene		<10	<10	<10	<10	<10
phenanthrene		<10	<10	<10	<10	<10
anthracene		<10	<10	<10	<10	<10
di-n-butyl phthalate		17	14	14	16	13
fluoranthene		<10	<10	<10	<10	<10
benzidine		<50	<50	<50	<50	<50
pyrene		<10	<10	<10	<10	<10
butyl benzyl phthalate		<10	<10	<10	<10	<10
3,3'-dichlorobenzidine		<30	<30	<30	<30	<30
benzo(a)anthracene		<10	<10	<10	<10	<10
bis(2-ethylhexyl)phthalate		<10	<10	<10	<10	<10
chrysene		<10	<10	<10	<10	<10
di-n-octyl phthalate		<10	<10	<10	<10	<10
benzo(b)fluoranthene		<10	<10	<10	<10	<10
benzo(k)fluoranthene		<10	<10	<10	<10	<10
benzo(a)pyrene		<10	<10	<10	<10	<10
indeno(1,2,3-cd)pyrene		<10	<10	<10	<10	<10
dibenzo(a,h)anthracene		<10	<10	<10	<10	<10
benzo(ghi)perylene		<10	<10	<10	<10	<10

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSIS FOR
PHENOLS BY GC

(all results in ug/L)

U-4350.7

Compound	E & E Lab. No. 86-	Blank	9230	9231	9232	9233
	Sample Identity	10/29/86	DF-4073	DF-4074	DF-4075	DF-4076
phenol		<5.0	<5.0	<5.0	<5.0	<5.0
2-chlorophenol		<5.0	<5.0	<5.0	<5.0	<5.0
2-nitrophenol		<5.0	<5.0	<5.0	<5.0	<5.0
2,4-dimethylphenol		<5.0	<5.0	<5.0	<5.0	<5.0
2,4-dichlorophenol		<5.0	<5.0	<5.0	<5.0	<5.0
4-chloro-3-methylphenol		<5.0	<5.0	<5.0	<5.0	<5.0
2,4,6-trichlorophenol		<5.0	<5.0	<5.0	<5.0	<5.0
2,4-dinitrophenol		<13	<13	<13	<13	<13
4-nitrophenol		<5.0	<5.0	<5.0	<5.0	<5.0
4,6-dinitro-2-methylphenol		<16	<16	<16	<16	<16
pentachlorophenol		<7.4	<7.4	<7.4	<7.4	<7.4

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ecology and environment, inc.
International Specialists in the Environment

LABORATORY REPORT

FOR

RICHARDS GEBAUER AIR FORCE BASE

U-4350.8

Job No.: U-4350			RE: DF-4000			
Sample Date: 10/23/86			P.O. No.:			
Date Received: 10/24/86			Sampled By: E & E, Inc.			
Sample Type: Water			Delivered By: Federal Express			
E & E Lab. No. 86-	9230	9231	9232	9233		
Customer No.	DF-4073	DF-4074	DF-4075	DF-4076		
Sample Identity						
	Results in: mg/L unless noted					
Petroleum Hydrocarbons	<1	<1	<1	<1		
Total Dissolved Solids	470	250	260	380		

Analytical References:

"Methods for the Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March 1983.

Supervising Analyst: [signature]

Date: December 9, 1986

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF WATER ANALYSES
FOR PRIORITY POLLUTANT METALS

(all results in mg/L)

U-4350.9

	E & E Lab. No. 86-	9230	9231	9232	9233	Blank
	Sample Identity	DF-4073	DF-4074	DF-4075	DF-4076	
Antimony		<0.15	<0.15	<0.15	<0.15	<0.15
Arsenic		<0.005	<0.005	<0.005	<0.005	<0.005
Beryllium		<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium		<0.01	<0.01	<0.01	<0.01	<0.01
Chromium		<0.05	<0.05	<0.05	<0.05	<0.05
Copper		<0.02	<0.02	<0.02	<0.02	<0.02
Lead		<0.005	<0.005	<0.005	<0.005	<0.005
Mercury		<0.0002	<0.0002	<0.0002	<0.0002	NA
Nickel		<0.1	<0.1	<0.1	<0.1	<0.1
Selenium		<0.005	<0.005	<0.005	<0.005	<0.005
Silver		<0.04	<0.04	<0.04	<0.04	<0.04
Thallium		<0.005	<0.005	<0.005	<0.005	<0.005
Zinc		<0.05	<0.05	<0.05	<0.05	<0.05

NA: Not applicable.

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QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

U-4350.10

Parameter	E & E Laboratory No. 86-9234	(ug/L)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
chlorobenzene		<0.20	<0.20	--
1,2-dichlorobenzene		<0.40	<0.40	--
1,3-dichlorobenzene		<0.40	<0.40	--
1,4-dichlorobenzene		<0.30	<0.30	--
benzene		<0.20	<0.20	--
total xylenes		<1.0	<1.0	--
toluene		<0.20	<0.20	--
ethyl benzene		<0.20	<0.20	--

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED WATER SAMPLES

U-4350.11

Compound	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(ug/L)			
1,2-dichloroethane	9234	<0.03	10.0	8.95	89.5
1,1-dichloroethane	9234	<0.07	10.0	9.45	94.5
chloroethane	9234	<0.52	10.0	8.56	85.6
methylene chloride	9234	<0.25	10.0	10.7	107
chloromethane	9234	<0.08	10.0	10.1	101
bromodichloromethane	9234	<0.10	10.0	8.80	88.0
trichloroethene	9234	<0.12	10.0	9.12	91.2

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QUALITY CONTROL FOR ACCURACY: PERCENT
RECOVERY OF SURROGATE SPIKES

U-4350.12

Compound	E & E Laboratory No. 86-	Amount Added (ug/L)	Amount Determined (ug/L)	Percent Recovery
nitrobenzene-D5	9230	100	103	103
	9231	100	94	94
	9232	100	88	88
	9233	100	101	101
2-fluorobiphenyl	9230	100	84	84
	9231	100	77	77
	9232	100	76	76
	9233	100	82	82
terphenyl-D14	9230	100	96	96
	9231	100	114	114
	9232	100	140	140
	9233	100	127	127
phenol-D5	9230	200	61	30.5
	9231	200	76	38
	9232	200	39	19.5
	9233	200	53	26.5
2-fluorophenol	9320	200	98	49
	9231	200	133	66.5
	9232	200	78	39
	9233	200	116	58
2,4,6-tribromphenol	9230	200	173	86.5
	9231	200	147	73.5
	9232	200	107	53.5
	9233	200	119	59.5

These recoveries are acceptable to EPA Contract Lab Program (CLP) guidelines.

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

U-4350.13

Compound	E & E Lab. No. 86-9233	ug/L		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
bis(2-chloroethyl)ether		<10	<10	--
1,3-dichlorobenzene		<10	<10	--
1,4-dichlorobenzene		<10	<10	--
1,2-dichlorobenzene		<10	<10	--
bis(2-chloroisopropyl)ether		<10	<10	--
N-nitrosodipropylamine		<10	<10	--
hexachloroethane		<10	<10	--
nitrobenzene		<10	<10	--
isophorone		<10	<10	--
bis(2-chloroethoxy)methane		<10	<10	--
1,2,4-trichlorobenzene		<10	<10	--
naphthalene		<10	<10	--
hexachlorobutadiene		<10	<10	--
hexachlorocyclopentadiene		<10	<10	--
2-chloronaphthalene		<10	<10	--
dimethyl phthalate		<10	<10	--
acenaphthylene		<10	<10	--
fluorene		<10	<10	--
acenaphthene		<10	<10	--
2,4-dinitrotoluene		<10	<10	--
2,6-dinitrotoluene		<10	<10	--
diethylphthalate		<10	<10	--
4-chlorophenyl phenyl ether		<10	<10	--
N-nitrosodiphenylamine		<10	<10	--
4-bromophenyl phenyl ether		<10	<10	--
hexachlorobenzene		<10	<10	--
phenanthrene		<10	<10	--
anthracene		<10	<10	--
di-n-butyl phthalate		16	11	37
fluoranthene		<10	<10	--
benzidine		<50	<50	--
pyrene		<10	<10	--
butyl benzyl phthalate		<10	<10	--
3,3'-dichlorobenzidine		<30	<30	--
benzo(a)anthracene		<10	<10	--
bis(2-ethylhexyl)phthalate		<10	<10	--
chrysene		<10	<10	--
di-n-octyl phthalate		<10	<10	--
benzo(b)fluoranthene		<10	<10	--
benzo(k)fluoranthene		<10	<10	--
benzo(a)pyrene		<10	<10	--
indeno(1,2,3-c,d)pyrene		<10	<10	--
dibenzo(a,h)anthracene		<10	<10	--
benzo(g,h,i)perylene		<10	<10	--

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QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

U-4350.14

Compound	E & E Lab. No. 86-9233	ug/L		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
phenol		<10	<10	--
2-chlorophenol		<10	<10	--
2-nitrophenol		<10	<10	--
2,4-dimethylphenol		<10	<10	--
2,4-dichlorophenol		<10	<10	--
4-chloro-3-methylphenol		<10	<10	--
2,4,6-trichlorophenol		<10	<10	--
2,4-dinitrophenol		<30	<30	--
4-nitrophenol		<10	<10	--
4,6-dinitro-2-methylphenol		<30	<30	--
pentachlorophenol		<30	<30	--

QUALITY CONTROL FOR ACCURACY:
PERCENT RECOVERY OF WATER MATRIX SPIKE
(Sample #9231)

U-4350.15

Compound	(ug/L)			Percent Recovery	EPA QC Limits (advisory)
	Original Result	Amount Added	Amount Determined		
1,2,4-Trichlorobenzene	<10	100	74	74	39 - 98
Acenaphthene	<10	100	87	87	46 - 118
2,4-Dinitrotoluene	<10	100	113	113	24 - 96
Pyrene	<10	100	128	128	26 - 127
N-Nitrosodi-n-propylamine	<10	100	96	96	41 - 116
1,4-Dichlorobenzene	<10	100	66	66	36 - 97
Pentachlorophenol	<30	200	131	66	9 - 103
Phenol	<10	200	90	45	12 - 89
2-Chlorophenol	<10	200	174	87	27 - 123
4-Chloro-3-methylphenol	<10	200	172	86	23 - 97
4-Nitrophenol	<10	200	70	35	10 - 80

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QUALITY CONTROL FOR PRECISION
RESULTS OF REPLICATE ANALYSIS

U-4350.16

Compound	E & E Lab. No. 86-9231	ug/L		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
2,4,6-trichlorophenol		<5.0	<5.0	--
4-chloro-3-methylphenol		<5.0	<5.0	--
2-chlorophenol		<5.0	<5.0	--
2,4-dichlorophenol		<5.0	<5.0	--
2,4-dimethylphenol		<5.0	<5.0	--
2-nitrophenol		<5.0	<5.0	--
4-nitrophenol		<5.0	<5.0	--
2,4-dinitrophenol		<13	<13	--
4,6-dinitro-2-methylphenol		<16	<16	--
pentachlorophenol		<7.4	<7.4	--
phenol		<5.0	<5.0	--

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED WATER SAMPLES

U-4350.17

Parameter	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/L)			
Antimony	9230	<0.15	0.50	0.475	95.0
Arsenic	9230	<0.005	0.02	0.02	100
Beryllium	9230	<0.01	0.051	0.046	90.2
Cadmium	9230	<0.01	0.05	0.042	84.0
Chromium	9230	<0.05	0.199	0.176	88.4
Copper	9230	<0.02	0.249	0.222	89.1
Lead	9230	<0.005	0.02	0.018	90.0
Nickel	9230	<0.1	0.40	0.357	89.2
Selenium	9230	<0.005	0.01	0.007	70.0
Silver	9230	<0.04	0.05	0.044	88.0
Thallium	9230	<0.005	0.05	0.027	54.0
Zinc	9230	<0.05	0.199	0.191	96.0
Petroleum Hydrocarbons	DI Water	--	8.2	7.3	89.0

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

U-4350.18

Parameter	E & E Laboratory No. 86-	(mg/L) Original Analysis	(mg/L) Replicate Analysis	Relative Percent Difference (RPD)
Total Dissolved Solids	9167*	170	170	0
Antimony	9232	<0.15	<0.15	--
Arsenic	9232	<0.005	<0.005	--
Beryllium	9232	<0.01	<0.01	--
Cadmium	9232	<0.01	<0.01	--
Chromium	9232	<0.05	<0.05	--
Copper	9232	<0.02	<0.02	--
Lead	9232	<0.005	<0.005	--
Nickel	9232	<0.1	<0.1	--
Selenium	9232	<0.005	<0.005	--
Silver	9232	<0.04	<0.04	--
Thallium	9232	<0.005	<0.005	--
Zinc	9232	<0.05	<0.05	--

*This represents 10% QC. This is not one of your samples but was analyzed in the same batch as your samples.

NUS CORPORATION

Laboratory Services Division
5350 Campbells Run Road
Pittsburgh, PA 15205

REMIT TO:
Park West Two
Cliff Mine Road
Pittsburgh, PA 15275
412-788-1080

15 284

LAB ANALYSIS REPORT

CLIENT NAME: ECOLOGY & ENVIRONMENT, INC.
ADDRESS: 4285 GENESEE STREET
BUFFALO, NY 14225

REPORT DATE: 11/13/86

ATTENTION: MS. KATHY SYRACUSE

NUS CLIENT NO: 890702
VENDOR NO: 05536100
WORK ORDER NO: 55830
DATE RECEIVED: 11/04/86

SAMPLE IDENTIFICATION		NUS SAMPLE NO	RESULTS	UNITS
9230	10/23	16110172		
W340 ION CHROMATOGRAPHY SCAN				
W850 Flouride (F) by IC			0.81	mg/l
W852 Chloride (Cl) by IC			54	mg/l
W854 Nitrite (NO2) by IC			< 1.0	mg/l
W856 Phosphate (PO4) by IC			< 0.20	mg/l
W858 Nitrate (NO3) by IC			0.15	mg/l
W860 Bromide (Br) by IC			0.15	mg/l
W862 Sulfate (SO4) by IC			64	mg/l
9231	10/23	16110173		
W340 ION CHROMATOGRAPHY SCAN				
W850 Flouride (F) by IC			0.49	mg/l
W852 Chloride (Cl) by IC			16	mg/l
W854 Nitrite (NO2) by IC			< 2.0	mg/l
W856 Phosphate (PO4) by IC			< 0.20	mg/l
W858 Nitrate (NO3) by IC			2.7	mg/l
W860 Bromide (Br) by IC			0.16	mg/l
W862 Sulfate (SO4) by IC			20	mg/l
9232	10/23	16110174		
W340 ION CHROMATOGRAPHY SCAN				
W850 Flouride (F) by IC			0.53	mg/l
W852 Chloride (Cl) by IC			16	mg/l
W854 Nitrite (NO2) by IC			< 2.0	mg/l
W856 Phosphate (PO4) by IC			< 0.20	mg/l
W858 Nitrate (NO3) by IC			2.5	mg/l
W860 Bromide (Br) by IC			0.11	mg/l
W862 Sulfate (SO4) by IC			25	mg/l
9233	10/23	16110175		
W340 ION CHROMATOGRAPHY SCAN				
W850 Flouride (F) by IC			0.65	mg/l

NUS CORPORATION

Laboratory Services Division
5350 Campbells Run Road
Pittsburgh, PA 15205
412-788-1080

REMIT TO:
Park West Two
Cliff Mine Road
Pittsburgh, PA 152/-

15 289

LAB ANALYSIS REPORT

CLIENT NAME: ECOLOGY & ENVIRONMENT, INC.
ADDRESS: 4285 GENESEE STREET
BUFFALO, NY 14225
ATTENTION: MS. KATHY SYRACUSE

REPORT DATE: 11/13/86

NUS CLIENT NO: 870702
VENDOR NO: 05536100
WORK ORDER NO: 55830
DATE RECEIVED: 11/04/86

SAMPLE IDENTIFICATION			NUS SAMPLE NO	RESULTS	UNITS
9233		10/23	16110175 - CONTINUED		
W852	Chloride (Cl) by IC			5.2	mg/l
W854	Nitrite (NO2) by IC			< 1.0	mg/l
W856	Phosphate (PO4) by IC			< 0.20	mg/l
W858	Nitrate (NO3) by IC			< 0.1	mg/l
W860	Bromide (Br) by IC			0.24	mg/l
W862	Sulfate (SO4) by IC			18	mg/l

COMMENTS: P.O.# 24422

Reviewed and Approved by: JMC

A Halliburton Company

CLIENT ORIGINAL

M E M O R A N D U M

TO: Paul Kopsick

FROM: Gary Hahn GH/KB

DATE: December 1, 1986

SUBJECT: Richards - Gebauer Air Force Base Report

REF: U-4374

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on 11 samples received at the Analytical Services Center on October 29, 1986. Analysis was performed according to the procedures set forth in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

All samples on which this report is based will be retained by E & E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00 per sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

GH/mba

Enclosure

recycled paper

SAMPLE IDENTIFICATION
CROSS-REFERENCE

U-4374

Laboratory Number 86-	Field Number	Field Location
9343	DF-4079	Pol Tank #955 1.0'
9344	DF-4080	Pol Tank #955 2'10"
9345	DF-4081	Pol Tank #955 6.0'
9346	DF-4082	Pol Tank #957 1.0'
9347	DF-4083	Pol Tank #957 2'8"
9348	DF-4084	Pol Tank #957 6.0'
9349	DF-4085	Pol Tank #954 1.0'
9350	DF-4086	Pol Tank #954 3.0'
9351	DF-4087	Pol Tank #954 5.0'
9352	DF-4087 Dup	Pol Tank #954 5.0'
9353	DF-4088	Bldg 951 Drain

SAMPLE TRACKING OF ANALYSES
REQUIRING HOLDING TIMES

U-4374.1

Job	Sample Number	Sample Date	VOA(14)		Phenol (7/30)				BNA(7/40)				TDS(7)		Pet HC(28)	
					Extraction		Analysis		Extraction		Analysis					
			Dead	Anal	Dead	Extr	Dead	Anal	Dead	Extr	Dead	Anal	Dead	Anal	Dead	Anal
U-4374	9343	10/28	11/11	11/4	--	--	--	--	--	--	--	--	--	--	11/25	11/21
	9344	10/28	11/11	11/4	--	--	--	--	--	--	--	--	--	--	11/25	11/21
	9345	10/28	11/11	11/4	--	--	--	--	--	--	--	--	--	--	11/25	11/21
	9346	10/28	11/11	11/4	--	--	--	--	--	--	--	--	--	--	11/25	11/21
	9347	10/28	11/11	11/4	--	--	--	--	--	--	--	--	--	--	11/25	11/21
	9348	10/28	11/11	11/4	--	--	--	--	--	--	--	--	--	--	11/25	11/21
	9349	10/28	11/11	11/4	--	--	--	--	--	--	--	--	--	--	11/25	11/21
	9350	10/28	11/11	11/4,5	--	--	--	--	--	--	--	--	--	--	11/25	11/21
	9351	10/28	11/11	11/4,6	--	--	--	--	--	--	--	--	--	--	11/25	11/21
	9352	10/28	11/11	11/4,6	--	--	--	--	--	--	--	--	--	--	11/25	11/21
	9353	10/28	11/11	11/4,6	--	--	--	--	--	--	--	--	--	--	11/25	11/21

	VOA Confirmation Date
9353	11/5
____	____
____	____
____	____
____	____
____	____
____	____

DEAD: Date sample holding time expires.
EXTR: Date sample was extracted.
ANAL: Date sample was analyzed.

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4374.2

Compound	E & E Lab. No. 86-	Blank	Blank	9343	9344	9345
	Sample Identity	11/4/86	11/5/86	DF-4079	DF-4080	DF-4081
chlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,4-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
benzene		<1.0	<1.0	<1.0	<1.0	<1.0
total xylenes		<1.0	<1.0	<1.0	<1.0	<1.0
toluene		<1.0	<1.0	<1.0	<1.0	<1.0
ethylbenzene		<1.0	<1.0	<1.0	<1.0	<1.0

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4374.3

Compound	E & E Lab. No. 86-	9346	9347	9348	9349	9350
	Sample Identity	DF-4082	DF-4083	DF-4084	DF-4085	DF-4086
chlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,4-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
benzene		<1.0	<1.0	<1.0	<1.0	<1.0
total xylenes		<1.0	<1.0	<1.0	<1.0	<1.0
toluene		<1.0	<1.0	<1.0	<1.0	<1.0
ethylbenzene		<1.0	<1.0	<1.0	<1.0	<1.0

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4374.4

Compound	E & E Lab. No. 86-	9351	9352	9353*		
	Sample Identity	DF-4087	DF-4087 Dup	DF-4088		
chlorobenzene		<1.0	<1.0	<1.0		
1,2-dichlorobenzene		<1.0	<1.0	<1.0		
1,3-dichlorobenzene		<1.0	<1.0	<3.0		
1,4-dichlorobenzene		<1.0	<1.0	<1.0		
benzene		<1.0	<1.0	<1.0		
total xylenes		<1.0	<1.0	<2.0		
toluene		<1.0	<1.0	<1.0		
ethylbenzene		<1.0	<1.0	<1.0		

*Detection limit elevated because of matrix interferences.

NOTE: Sample 9353 confirmed - results negative.

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in mg/kg as received)

U-4374.5

Compound	E & E Lab. No. 86-	Blank	Blank	Blank	9343	9344	9345
	Sample Identity	11/4/86	11/5/86	11/6/86	DF-4079	DF-4080	DF-4081
carbon tetrachloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-tetrachloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-chloroethylvinyl ether		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloropropane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
methylene chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromoform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromodichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
fluorotrichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
dichlorodifluoromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chlorodibromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
tetrachloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
vinyl chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in mg/kg as received)

U-4374.6

Compound	E & E Lab. No. 86-	9346	9347	9348	9349	9350	9351
	Sample Identity	DF-4082	DF-4083	DF-4084	DF-4085	DF-4086	DF-4087
carbon tetrachloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-tetrachloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-chloroethylvinyl ether		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloropropane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
methylene chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromoform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromodichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
fluorotrichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
dichlorodifluoromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chlorodibromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
tetrachloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
vinyl chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in mg/kg as received)

U-4374.7

Compound	E & E Lab. No. 86-	9352	9353				
	Sample Identity	DF-4087 Dup	DF-4088				
carbon tetrachloride		<1.0	<1.0				
1,2-dichloroethane		<1.0	<1.0				
1,1,1-trichloroethane		<1.0	<1.0				
1,1-dichloroethane		<1.0	<1.0				
1,1,2-trichloroethane		<1.0	<1.0				
1,1,2,2-tetrachloroethane		<1.0	<1.0				
chloroethane		<1.0	<1.0				
2-chloroethylvinyl ether		<1.0	<1.0				
chloroform		<1.0	<1.0				
1,1-dichloroethene		<1.0	<1.0				
trans-1,2-dichloroethene		<1.0	<1.0				
1,2-dichloropropane		<1.0	<1.0				
trans-1,3-dichloropropene		<1.0	<1.0				
cis-1,3-dichloropropene		<1.0	<1.0				
methylene chloride		<1.0	<1.0				
chloromethane		<1.0	<1.0				
bromomethane		<1.0	<1.0				
bromoform		<1.0	<1.0				
bromodichloromethane		<1.0	<1.0				
fluorotrichloromethane		<1.0	<1.0				
dichlorodifluoromethane		<1.0	<1.0				
chlorodibromomethane		<1.0	<1.0				
tetrachloroethene		<1.0	<1.0				
trichloroethene		<1.0	<1.0				
vinyl chloride		<1.0	<1.0				

ecology and environment, inc.
International Specialists in the Environment

15 299

LABORATORY REPORT

FOR

RICHARDS - GEBAUER AIR FORCE BASE

U-4374.8

Job No.: U-4374			RE: DF-4000			
Sample Date: 10/28/86			P.O. No.:			
Date Received: 10/29/86			Sampled By: E & E, Inc.			
Sample Type: Soil			Delivered By: Federal Express			
E & E Lab. No. 86-	9343	9344	9345	9346	9347	9348
Customer No.	DF-4079	DF-4080	DF-4081	DF-4082	DF-4083	DF-4084
Sample Identity						
	Results in: mg/kg as received unless noted					
Petroleum Hydrocarbons	93	390	6.9	67	270	44

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst: [signature]

Date: December 2, 1986

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LABORATORY REPORT

FOR

RICHARDS - GEBAUER AIR FORCE BASE

U-4374.9

Job No.:	U-4374		RE:	DF-4000		
Sample Date:	10/28/86		P.O. No.:			
Date Received:	10/29/86		Sampled By:	E & E, Inc.		
Sample Type:	Soil		Delivered By:	Federal Express		
E & E Lab. No. 86-	9349	9350	9351	9352	9353	
Customer No.	DF-4085	DF-4086	DF-4087	DF-4087 Dup	DF-4088	
Sample Identity						
	Results in: mg/kg as received unless noted					
Petroleum Hydrocarbons	9.9	1500	11	28	2800	

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst: [illegible]

Date: December 2, 1986

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4374.10

Parameter	E & E Laboratory No. 86-9347	(mg/kg)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
chlorobenzene		<1.0	<1.0	—
1,2-dichlorobenzene		<1.0	<1.0	—
1,3-dichlorobenzene		<1.0	<1.0	—
1,4-dichlorobenzene		<1.0	<1.0	—
benzene		<1.0	<1.0	—
total xylenes		<1.0	<1.0	—
toluene		<1.0	<1.0	—
ethyl benzene		<1.0	<1.0	—

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4374.11

Compound	E & E Laboratory No. 86-	(mg/kg)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
carbon tetrachloride	9347	<1.0	<1.0	--
1,2-dichloroethane	9347	<1.0	<1.0	--
1,1,1-trichloroethane	9347	<1.0	<1.0	--
1,1-dichloroethane	9347	<1.0	<1.0	--
1,1,2-trichloroethane	9347	<1.0	<1.0	--
1,1,2,2-tetrachloroethane	9347	<1.0	<1.0	--
chloroethane	9347	<1.0	<1.0	--
2-chloroethylvinyl ether	9347	<1.0	<1.0	--
chloroform	9347	<1.0	<1.0	--
1,1-dichloroethene	9347	<1.0	<1.0	--
trans-1,2-dichloroethene	9347	<1.0	<1.0	--
1,2-dichloropropane	9347	<1.0	<1.0	--
trans-1,3-dichloropropene	9347	<1.0	<1.0	--
cis-1,3-dichloropropene	9347	<1.0	<1.0	--
methylene chloride	9347	<1.0	<1.0	--
chloromethane	9347	<1.0	<1.0	--
bromomethane	9347	<1.0	<1.0	--
bromoform	9347	<1.0	<1.0	--
bromodichloromethane	9347	<1.0	<1.0	--
fluorotrichloromethane	9347	<1.0	<1.0	--
dichlorodifluoromethane	9347	<1.0	<1.0	--
chlorodibromomethane	9347	<1.0	<1.0	--
tetrachloroethene	9347	<1.0	<1.0	--
trichloroethene	9347	<1.0	<1.0	--
vinyl chloride	9347	<1.0	<1.0	--

recycled paper

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

U-4374.12

Compound	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/kg)			
1,2-dichloroethane	9353	<1.0	1.75	1.49	85.1
1,1-dichloroethane	9353	<1.0	1.75	1.33	76.0
chloroethane	9353	<1.0	1.75	1.35	77.1
methylene chloride	9353	<1.0	1.75	1.60	91.4
chloromethane	9353	<1.0	1.75	1.39	79.4
bromomethane	9353	<1.0	1.75	1.31	74.9
bromodichloromethane	9353	<1.0	1.75	1.98	113
trichloroethene	9353	<1.0	1.75	1.73	98.9

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

U-4374.13

Parameter	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/kg)			
Petroleum Hydrocarbons	9351	11	160	200	118

recycled paper

MEMORANDUM

TO: Paul Kopsick

FROM: Gary Hahn GH/KB

DATE: November 13, 1986

SUBJECT: Richards - Gebauer AFB Report

REF: U-4281

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on 11 samples received at the Analytical Services Center on October 11, 1986. Analysis was performed according to the procedures set forth in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

All samples on which this report is based will be retained by E & E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00 per sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

GH/mba

Enclosure

CORRECTING WET WEIGHT TO DRY WEIGHT

To correct the wet weight sample result to dry weight, the result must be divided by the percent solids (expressed in decimal form).

FOR EXAMPLE:

A sample is 65% solids.

$$\frac{15 \text{ mg/kg as received}}{0.65 \text{ (Solids)}} = 23 \text{ mg/kg dry weight}$$

KS/lo

SAMPLE IDENTIFICATION
CROSS-REFERENCE

U-4281

Laboratory Number 86-	Field Number	Field Location
8795	DF-4014	North Burn Area S-6
8796	DF-4015	Herbicide Burial S1
8797	DF-4016	Herbicide Burial S2
8798	DF-4017	Herbicide Burial S3
8799	DF-4018	Herbicide Burial S4
8800	DF-4019	Haz. Waste Storage S1
8801	DF-4020	Haz. Waste Storage S2
8802	DF-4021	Haz. Waste Storage S3
8803	DF-4022	Haz. Waste Storage S4
8804	DF-4023	Haz. Waste Storage S5
8805	DF-4024	Haz. Waste Storage S6

SAMPLE TRACKING OF
ANALYSES REQUIRING HOLDING TIMES

U-4281.1

Job	Sample Number	Sample Date	VOA(14)		Herb(7/E+30)				Pest/PCB(7/E+40)				Pet HC (28)		TDS(7)	
					Extraction		Analysis		Extraction		Analysis					
			Dead	Anal	Dead	Extr	Dead	Anal	Dead	Extr	Dead	Anal	Dead	Anal	Dead	Anal
U-4281	8795	10/10	10/24	10/13,17	--	--	--	--	--	--	--	--	11/7	10/29	--	--
	8796	10/10	--	--	10/17	10/15	11/14	11/10	--	--	--	--	--	--	--	--
	8797	10/10	--	--	10/17	10/15	11/14	11/10	--	--	--	--	--	--	--	--
	8798	10/10	--	--	10/17	10/15	11/14	11/10	--	--	--	--	--	--	--	--
	8799	10/10	--	--	10/17	10/15	11/14	11/10	--	--	--	--	--	--	--	--
	8800	10/10	10/24	10/14,17	--	--	--	--	--	--	--	--	11/7	10/29	--	--
	8801	10/10	10/24	10/14,17	--	--	--	--	--	--	--	--	11/7	10/29	--	--
	8802	10/10	10/24	10/14,17	--	--	--	--	--	--	--	--	11/7	10/29	--	--
	8803	10/10	10/24	10/14,17	--	--	--	--	--	--	--	--	11/7	10/29	--	--
	8804	10/10	10/24	10/14,17	--	--	--	--	--	--	--	--	11/7	10/29	--	--
	8805	10/10	10/24	10/14,17	--	--	--	--	--	--	--	--	11/7	10/29	--	--

DEAD: Date sample holding time expires.
EXTR: Date sample was extracted.
ANAL: Date sample was analyzed.
( ): Holding time expires.
S+#: Holding time based on sample date.
E+#: Holding time based on sample extraction.

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4281.2

Compound	E & E Lab. No. 86-	Blank	8795	8800	8801	8802
	Sample Identity	10/13/86	DF-4014	DF-4019	DF-4020	DF-4021
chlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,4-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
benzene		<1.0	<1.0	<1.0	<1.0	<1.0
total xylenes		<1.0	<1.0	<1.0	<1.0	<1.0
toluene		<1.0	<1.0	<1.0	<1.0	<1.0
ethylbenzene		<1.0	<1.0	<1.0	<1.0	<1.0

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4281.3

Compound	E & E Lab. No. 86-	8803	8804	8805	Blank	
	Sample Identity	DF-4022	DF-4023	DF-4024	10/14/86	
chlorobenzene		<1.0	<1.0	<1.0	<1.0	
1,2-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	
1,3-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	
1,4-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	
benzene		<1.0	<1.0	<1.0	<1.0	
total xylenes		<1.0	<1.0	<1.0	<1.0	
toluene		<1.0	<1.0	<1.0	<1.0	
ethylbenzene		<1.0	<1.0	<1.0	<1.0	

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in mg/kg as received)

U-4281.4

Compound	E & E Lab. No. 86-	Blank	8795	8800	8801	8802	8803
	Sample Identity	10/17/86	DF-4014	DF-4019	DF-4020	DF-4021	DF-4022
carbon tetrachloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-tetrachloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-chloroethylvinyl ether		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloropropane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
methylene chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromoform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromodichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
fluorotrichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
dichlorodifluoromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chlorodibromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
tetrachloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
vinyl chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in mg/kg as received)

U-4281.5

Compound	E & E Lab. No. 86-	8804	8805				
	Sample Identity	DF-4023	DF-4024				
carbon tetrachloride		<1.0	<1.0				
1,2-dichloroethane		<1.0	<1.0				
1,1,1-trichloroethane		<1.0	<1.0				
1,1-dichloroethane		<1.0	<1.0				
1,1,2-trichloroethane		<1.0	<1.0				
1,1,2,2-tetrachloroethane		<1.0	<1.0				
chloroethane		<1.0	<1.0				
2-chloroethylvinyl ether		<1.0	<1.0				
chloroform		<1.0	<1.0				
1,1-dichloroethene		<1.0	<1.0				
trans-1,2-dichloroethene		<1.0	<1.0				
1,2-dichloropropane		<1.0	<1.0				
trans-1,3-dichloropropene		<1.0	<1.0				
cis-1,3-dichloropropene		<1.0	<1.0				
methylene chloride		<1.0	<1.0				
chloromethane		<1.0	<1.0				
bromomethane		<1.0	<1.0				
bromoform		<1.0	<1.0				
bromodichloromethane		<1.0	<1.0				
fluorotrichloromethane		<1.0	<1.0				
dichlorodifluoromethane		<1.0	<1.0				
chlorodibromomethane		<1.0	<1.0				
tetrachloroethene		<1.0	<1.0				
trichloroethene		<1.0	<1.0				
vinyl chloride		<1.0	<1.0				

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR
CHLORINATED HERBICIDES BY GC

(all results in mg/kg as received)

U-4281.6

Compound	E & E Lab. No. 86-	8796	8797	8798	8799	Blank
	Sample Identity	DF-4015	DF-4016	DF-4017	DF-4018	
2,4-D		<1.0	<1.0	<1.0	<1.0	<1.0
2,4,5-TP(Silvex)		<1.0	<1.0	<1.0	<1.0	<1.0
2,4,5-T		<1.0	<1.0	<1.0	<1.0	<1.0
2,4-DB		<1.0	<1.0	<1.0	<1.0	<1.0
Dicamba*		<25	<25	<25	<25	<1.0
Dalapon		<1.0	<1.0	<1.0	<1.0	<1.0

*Elevated detection limit due to matrix interference.

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LABORATORY REPORT

FOR

RICHARDS-GEBAUER AIR FORCE BASE

U-4281.7

Job No.: U-4281			RE: DF-4000			
Sample Date: 10/10/86			P.O. No.:			
Date Received: 10/11/86			Sampled By: E & E, Inc.			
Sample Type: Soil			Delivered By: Federal Express			
E & E Lab. No. 86-	8795	8796	8797	8798	8799	8800
Customer No.	DF-4014	DF-4015	DF-4016	DF-4017	DF-4018	DF-4019
Sample Identity						
	Results in: mg/kg as received unless noted					
Petroleum Hydrocarbons	2.8	NR	NR	NR	NR	<1
Solids, %	75	75	75	73	78	73
Arsenic	NR	1.83	5.00	<0.5	4.53	NR
Mercury	NR	<0.1	<0.1	<0.1	<0.1	NR

NR: Not requested.

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst: Jay Hahn/KS

Date: November 13, 1986

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LABORATORY REPORT

FOR

RICHARDS - GEBAUR AIR FORCE BASE

U-4281.8

Job No.:	U-4281		RE:	DF-4000		
Sample Date:	10/10/86		P.O. No.:			
Date Received:	10/11/86		Sampled By:	E & E, Inc.		
Sample Type:	Soil		Delivered By:	Federal Express		
E & E Lab. No. 86-	8801	8802	8803	8804	8805	Blank*
Customer No.	DF-4020	DF-4021	DF-4022	DF-4023	DF-4024	
Sample Identity						
	Results in: mg/kg as received unless noted					
Petroleum Hydrocarbons	1900	55	46	140	2.9	NA
Solids, %	91	78	80	81	81	NA
Arsenic	NR	NR	NR	NR	NR	<0.005
Mercury	NR	NR	NR	NR	NR	NA

NR: Not requested.
NA: Not applicable.
*: mg/L

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst: [illegible]
Date: November 13, 1986

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LABORATORY REPORT

FOR

RICHARDS-GEBAUER AIR FORCE BASE

U-4281.9

Job No.:	U-4281	RE:	DF-4000
Sample Date:	10/10/86	P.O. No.:	
Date Received:	10/11/86	Sampled By:	E & E, Inc.
Sample Type:	Soil	Delivered By:	Federal Express

RESULTS OF CHEMICAL ANALYSIS OF EXTRACTS FROM EP TOXICITY TESTS

	mg/L						Maximum Allowable Concentration (mg/L)
E & E Lab. No. 86-	8800	8801	8802	8803	8804	8805	
Customer No.	DF-4019	DF-4020	DF-4021	DF-4022	DF-4023	DF-4024	
Sample Identity							
Arsenic	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5.0
Barium	<5	<5	<5	<5	<5	<5	100.0
Cadmium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.0
Chromium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5.0
Lead	<0.5	<0.5	<0.5	<0.5	<0.5	0.989	5.0
Mercury	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	0.2
Selenium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.0
Silver	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5.0
Endrin	NR	NR	NR	NR	NR	NR	0.02
Lindane	NR	NR	NR	NR	NR	NR	0.4
Methoxychlor	NR	NR	NR	NR	NR	NR	10.0
Toxaphene	NR	NR	NR	NR	NR	NR	0.5
2,4-D	NR	NR	NR	NR	NR	NR	10.0
2,4,5-TP (Silvex)	NR	NR	NR	NR	NR	NR	1.0

NR: Not requested.

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst: Jay Hahn / LBS

H-169 Date: November 13, 1986

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LABORATORY REPORT

FOR

RICHARDS - GEBAUER AIR FORCE BASE

U-4281.10

Job No.:	U-4281	RE:	DF-4000
Sample Date:	10/10/86	P.O. No.:	
Date Received:	10/11/86	Sampled By:	E & E, Inc.
Sample Type:	Soil	Delivered By:	Federal Express

RESULTS OF CHEMICAL ANALYSIS OF EXTRACTS FROM EP TOXICITY TESTS

	mg/L						Maximum Allowable Concentration (mg/L)
E & E Lab. No. 86-	Blank						
Customer No.							
Sample Identity							
Arsenic	<0.5						5.0
Barium	<5						100.0
Cadmium	<0.1						1.0
Chromium	<0.5						5.0
Lead	<0.5						5.0
Mercury	<0.0008						0.2
Selenium	<0.5						1.0
Silver	<0.5						5.0
Endrin	NR						0.02
Lindane	NR						0.4
Methoxychlor	NR						10.0
Toxaphene	NR						0.5
2,4-D	NR						10.0
2,4,5-TP (Silvex)	NR						1.0

NR: Not requested.

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst: [illegible]

H-170 Date: [illegible] 1986

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

U-4281.11

Compound	E & E Laboratory No. 86-8805	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/kg)			
1,2-dichlorobenzene		<1.0	1.25	1.14	91
1,3-dichlorobenzene		<1.0	1.25	1.18	94
1,4-dichlorobenzene		<1.0	1.25	1.17	94
benzene		<1.0	1.25	1.11	89
toluene		<1.0	1.25	1.17	94
ethyl benzene		<1.0	1.25	1.15	92

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QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

U-4281.12

Compound	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/kg)			
1,2-dichloroethane	8805	<1.0	1.25	1.16	93
1,1-dichloroethane	8805	<1.0	1.25	1.16	93
chlorobenzene	8805	<1.0	1.25	1.24	99
1,3-dichlorobenzene	8805	<1.0	1.25	1.17	94
chloroethane	8805	<1.0	1.25	1.20	96
1,2-dichlorobenzene	8805	<1.0	1.25	1.27	102
1,4-dichlorobenzene	8805	<1.0	1.25	1.15	92
methylene chloride	8805	<1.0	1.25	1.10	88
chloromethane	8805	<1.0	1.25	1.26	101
bromomethane	8805	<1.0	1.25	1.20	96
bromodichloromethane	8805	<1.0	1.25	1.15	92
trichloroethene	8805	<1.0	1.25	1.31	105

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

U-4281.13

Parameter	E & E Laboratory No. 86-8798	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/kg)			
2,4-D		<1.0	4.0	2.1	53
Silvex		<1.0	4.0	1.7	43

% Recovery Limits: 2,4-D 67-83%
Silvex 73-97%

Re-analyses not possible due to holding time constraints.

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF EP TOXICITY EXTRACTS

U-4281.14

Parameter	E & E Laboratory No. 86-	(mg/L) Original Analysis	(mg/L) Replicate Analysis	Relative Percent Difference (RPD)
Arsenic	8805	<0.5	<0.5	--
Barium	8805	<5	<5	--
Cadmium	8805	<0.1	<0.1	--
Chromium	8805	<0.5	<0.5	--
Lead	8805	0.989	<0.5	--
Mercury	8805	<0.0008	<0.0008	--
Selenium	8805	<0.5	<0.5	--
Silver	8805	<0.5	<0.5	--

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4281.15

Parameter	E & E Laboratory No. 86-	(mg/kg)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
Petroleum Hydrocarbons	8903*	<1	<1	--
Solids, %	8802	78	78	0

*This represents 10% QC. This is not one of your samples but was analyzed in the same batch as your samples.

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MEMORANDUM

TO: Paul Kopsick

FROM: Gary Hahn GH/KS

DATE: November 12, 1986

SUBJECT: Richards-Gebauer AFB Report

REF: U-4310

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on 20 samples received at the Analytical Services Center on October 18, 1986. Analysis was performed according to the procedures set forth in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

All samples on which this report is based will be retained by E & E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00 per sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

GH/dr
Enclosure

CORRECTING WET WEIGHT TO DRY WEIGHT

To correct the wet weight sample result to dry weight, the result must be divided by the percent solids (expressed in decimal form).

FOR EXAMPLE:

A sample is 65% solids.

$$\frac{15 \text{ mg/kg as received}}{0.65 \text{ (Solids)}} = 23 \text{ mg/kg dry weight}$$

KS/lo

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SAMPLE IDENTIFICATION
CROSS-REFERENCE

U-4310

Laboratory Number 86-	Field Number	Field Location
8963	DF-4036	NE LF Boring 4 - 1-2'
8964	DF-4037	NE LF Boring 4 - 6-7'
8965	DF-4038	NE LF Boring 4 - 8-8.5'
8966	DF-4039	Oil Stain Area Boring 5 - 3-4'
8967	DF-4040	Oil Stain Area Boring 5 - 8-9'
8968	DF-4041	Oil Stain Area Boring 5 - 15.5-16.5'
8969	DF-4042	HWSA Boring 6 - 0.5-1.5'
8970	DF-4043	HWSA Boring 6 - 9-10'
8971	DF-4044	HWSA Boring 6 - 4.5-5.5'
8972	DF-4047	South LF Boring 7
8973	DF-4048	South LF Boring 7
8974	DF-4049	South LF Boring 7

SAMPLE IDENTIFICATION
CROSS-REFERENCE

U-4310.1

Laboratory Number 86-	Field Number	Field Location
8975	DF-4050	NE Landfill Boring 8 - 7.0-7.9'
8976	DF-4051	NE LF Boring 9 - 4.0-5.0'
8977	DF-4052	NE LF Boring 9 - 6.0-7.0'
8978	DF-4052D	NE LF Boring 9 - 6.0-7.0'
8979	DF-4053	NE LF Boring 9 - 9.0-10.0'
8980	DF-4054	North of NE LF Boring 10 - 1.0-2.0'
8981	DF-4055	North of NE LF Boring 10 - 4.0-5.0'
8982	DF-4056	North of NE LF Boring 10 - 7.0-8.0'

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SAMPLE TRACKING OF ANALYSES
REQUIRING HOLDING TIMES

U-4310.2

Job	Sample Number	Sample Date	VOA(14) Dead	VOA(14) Anal	Pet HC(28) Dead	Pet HC(28) Anal
U-4310	8963	10/16	10/30	10/22,20	11/13	11/3
	8964	10/16	10/30	10/22,20	11/13	11/3
	8965	10/16	10/30	10/22,20	11/13	11/3
	8966	10/17	10/31	10/22,20	11/14	11/3
	8967	10/17	10/31	10/22,20	11/14	11/3
	8968	10/17	10/31	10/22,20	11/14	11/3
	8969	10/17	10/31	10/22,21	11/14	11/3
	8970	10/17	10/31	10/22,21	11/14	11/3
	8971	10/17	10/31	10/22,21	11/14	11/3
	8972	10/17	10/31	10/21	11/14	11/3
	8973	10/17	10/31	10/21	11/14	11/3
	8974	10/17	10/31	10/21	11/14	11/3
	8975	10/17	10/31	10/21	11/14	11/3
	8976	10/17	10/31	10/21	11/14	11/3
	8977	10/17	10/31	10/21	11/14	11/3
	8978	10/17	10/31	10/21	11/14	11/3
	8979	10/17	10/31	10/21	11/14	11/3
	8980	10/17	10/31	10/21	11/14	11/3
	8981	10/17	10/31	10/21,23	11/14	11/3
	8982	10/17	10/31	10/21,23	11/14	11/3

	Confirmation Date
____	____
____	____
____	____
____	____
____	____
____	____
____	____

DEAD: Date sample holding time expires.
EXTR: Date sample was extracted.
ANAL: Date sample was analyzed.

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A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4310.3

Compound	E & E Lab. No. 86-	Blank	8963	8964	8965	8966
	Sample Identity	10-22-86	DF-4036	DF-4037	DF-4038	DF-4039
chlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,4-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
benzene		<1.0	<1.0	<1.0	<1.0	<1.0
total xylenes		<1.0	<1.0	<1.0	<1.0	<1.0
toluene		<1.0	<1.0	<1.0	<1.0	<1.0
ethylbenzene		<1.0	<1.0	<1.0	<1.0	<1.0

recycled paper

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ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4310.4

Compound	E & E Lab. No. 86-	8967	8968	8969	8970	8971
	Sample Identity	DF-4040	DF-4041	DF-4042	DF-4043	DF-4044
chlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,4-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
benzene		<1.0	<1.0	<1.0	<1.0	<1.0
total xylenes		<1.0	<1.0	<1.0	<1.0	<1.0
toluene		<1.0	<1.0	<1.0	<1.0	<1.0
ethylbenzene		<1.0	<1.0	<1.0	<1.0	<1.0

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4310.5

Compound	E & E Lab. No. 86-	8972	8973	8974	8975	8976
	Sample Identity	DF-4047	DF-4048	DF-4049	DF-4050	DF-4051
chlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,4-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
benzene		<1.0	<1.0	<1.0	<1.0	<1.0
total xylenes		<1.0	<1.0	<1.0	<1.0	<1.0
toluene		<1.0	<1.0	<1.0	<1.0	<1.0
ethylbenzene		<1.0	<1.0	<1.0	<1.0	<1.0

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RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4310.6

Compound	E & E Lab. No. 86-	8977	8978	8979	8980	8981
	Sample Identity	DF-4052	DF-4052D	DF-4053	DF-4054	DF-4055
chlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,3-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
1,4-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	<1.0
benzene		<1.0	<1.0	<1.0	<1.0	<1.0
total xylenes		<1.0	<1.0	<1.0	<1.0	<1.0
toluene		<1.0	<1.0	<1.0	<1.0	<1.0
ethylbenzene		<1.0	<1.0	<1.0	<1.0	<1.0

ECOLOGY AND ENVIRONMENT'S, INC.
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RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE AROMATIC COMPOUNDS BY GC

(all results in mg/kg as received)

U-4310.7

Compound	E & E Lab. No. 86-	B982	Blank	Blank	Blank	
	Sample Identity	DF-4056	10/21/86	10/21/86	10/22/86	
chlorobenzene		<1.0	<1.0	<1.0	<1.0	
1,2-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	
1,3-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	
1,4-dichlorobenzene		<1.0	<1.0	<1.0	<1.0	
benzene		<1.0	<1.0	<1.0	<1.0	
total xylenes		<1.0	<1.0	<1.0	<1.0	
toluene		<1.0	<1.0	<1.0	<1.0	
ethylbenzene		<1.0	<1.0	<1.0	<1.0	

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RESULTS OF SOIL ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in mg/kg as received)

U-4310.8

Compound	E & E Lab. No. 86-	Blank	Blank	Blank	8963	8964	8965
	Sample Identity	10/20/86	10/21/86	10/23/86	DF-4036	DF-4037	DF-4038
carbon tetrachloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-tetrachloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-chloroethylvinyl ether		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloropropane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
methylene chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromoform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromodichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
fluorotrichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
dichlorodifluoromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chlorodibromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
tetrachloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
vinyl chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in mg/kg as received)

U-4310.9

Compound	E & E Lab. No. 86-	8966	8967	8968	8969	8970	8971
	Sample Identity	DF-4039	DF-4040	DF-4041	DF-4042	DF-4043	DF-4044
carbon tetrachloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-tetrachloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-chloroethylvinyl ether		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloropropane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
methylene chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromoform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromodichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
fluorotrichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
dichlorodifluoromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chlorodibromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
tetrachloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
vinyl chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

ECOLOGY AND ENVIRONMENT'S, INC.
ANALYTICAL SERVICES CENTER

RESULTS OF SOIL ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in mg/kg as received)

U-4310.10

Compound	E & E Lab. No. 86-	8972	8973	8974	8975	8976	8977
	Sample Identity	DF-4047	DF-4048	DF-4049	DF-4050	DF-4051	DF-4052
carbon tetrachloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-tetrachloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-chloroethylvinyl ether		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloroform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-dichloropropane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
methylene chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromoform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
bromodichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
fluorotrichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
dichlorodifluoromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
chlorodibromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
tetrachloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
vinyl chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

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RESULTS OF SOIL ANALYSIS FOR
PURGEABLE HALOCARBON COMPOUNDS BY GC
(all results in mg/kg as received)

U-4310.11

Compound	E & E Lab. No. 86-	8978	8979	8980	8981	8982	
	Sample Identity	DF-4052D	DF-4053	DF-4054	DF-4055	DF-4056	
carbon tetrachloride		<1.0	<1.0	<1.0	<1.0	<1.0	
1,2-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	
1,1,1-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	
1,1-dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	
1,1,2-trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	
1,1,2,2-tetrachloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	
chloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	
2-chloroethylvinyl ether		<1.0	<1.0	<1.0	<1.0	<1.0	
chloroform		<1.0	<1.0	<1.0	<1.0	<1.0	
1,1-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	
trans-1,2-dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	
1,2-dichloropropane		<1.0	<1.0	<1.0	<1.0	<1.0	
trans-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	
cis-1,3-dichloropropene		<1.0	<1.0	<1.0	<1.0	<1.0	
methylene chloride		<1.0	<1.0	<1.0	<1.0	<1.0	
chloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	
bromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	
bromoform		<1.0	<1.0	<1.0	<1.0	<1.0	
bromodichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	
fluorotrichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	
dichlorodifluoromethane		<1.0	<1.0	<1.0	<1.0	<1.0	
chlorodibromomethane		<1.0	<1.0	<1.0	<1.0	<1.0	
tetrachloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	
trichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	
vinyl chloride		<1.0	<1.0	<1.0	<1.0	<1.0	

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LABORATORY REPORT

FOR

RICHARDS GEBAUER AIR FORCE BASE

U-4310.12

Job No.: U-4310			RE: DF-4000			
Sample Date: 10/16-17/86			P.O. No.:			
Date Received: 10/18/86			Sampled By: E & E, Inc.			
Sample Type: Soil			Delivered By: Federal Express			
E & E Lab. No. 86-	8963	8964	8965	8966	8967	8968
Customer No.	DF-4036	DF-4037	DF-4038	DF-4039	DF-4040	DF-4041
Sample Identity						
	Results in: mg/kg as received					
Petroleum Hydrocarbons	440	19	<1	9.0	<1	<1
Solids, %	79	83	78	77	79	80
Lead	NR	NR	NR	20.2	9.22	10.2

NR: Not requested

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst: Gary Hahn / LAS

Date: November 13, 1986

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LABORATORY REPORT

FOR

RICHARDS GEBAUER AIR FORCE BASE

U-4310.13

Job No.: U-4310			RE: DF-4000			
Sample Date: 10/16-17/86			P.O. No.:			
Date Received: 10/18/86			Sampled By: E & E, Inc.			
Sample Type: Soil			Delivered By: Federal Express			
E & E Lab. No. 86-	8969	8970	8971	8972	8973	8974
Customer No.	DF-4042	DF-4043	DF-4044	DF-4047	DF-4048	DF-4049
Sample Identity						
	Results in: mg/kg as received					
Petroleum Hydrocarbons	<1	<1	1.2	<1	<1	1.2
Solids, %	78	84	81	78	79	53

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst: Jay Hathaway

Date: November 13, 1986

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LABORATORY REPORT

FOR

RICHARDS GEBAUER AIR FORCE BASE

U-4310.14

Job No.: U-4310			RE: DF-4000			
Sample Date: 10/16-17/86			P.O. No.:			
Date Received: 10/18/86			Sampled By: E & E, Inc.			
Sample Type: Soil			Delivered By: Federal Express			
E & E Lab. No. 86-	8975	8976	8977	8978	8979	8980
Customer No.	DF-4050	DF-4051	DF-4052	DF-4052D	DF-4053	DF-4054
Sample Identity						
	Results in: mg/kg as received					
Petroleum Hydrocarbons	<1	<1	<1	<1	<1	<1
Solids, %	80	73	80	80	79	78

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst: Gary Hahn/KBJ

Date: November 13, 1986

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LABORATORY REPORT

FOR

RICHARDS GEBAUER AIR FORCE BASE

U-4310.15

Job No.: U-4310			RE: DF-4000			
Sample Date: 10/16-17/86			P.O. No.:			
Date Received: 10/18/86			Sampled By: E & E, Inc.			
Sample Type: Soil			Delivered By: Federal Express			
E & E Lab. No. 86-	8981	8982	Blank*			
Customer No.	DF-4055	DF-4056				
Sample Identity						
	Results in: mg/kg as received unless noted					
Petroleum Hydrocarbons	<1	1.0	NA			
Solids, %	79	78	NA			
Lead	NR	NR	<0.005			

*mg/l
NR: Not requested
NA: Not applicable

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst: Gary Hahn / KG

Date: November 13, 1986

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LABORATORY REPORT

FOR

RICHARDS GEBAUER AIR FORCE BASE

U-4310.16

Job No.: U-4310	RE: DF-4000
Sample Date: 10/16-17/86	P.O. No.:
Date Received: 10/18/86	Sampled By: E & E, Inc.
Sample Type: Soil	Delivered By: Federal Express

RESULTS OF CHEMICAL ANALYSIS OF EXTRACTS FROM EP TOXICITY TESTS

	mg/L						Maximum Allowable Concentration (mg/L)
E & E Lab. No. 86-	8969	8970	8971	Blank			
Customer No.	DF-4042	DF-4043	DF-4044				
Sample Identity							
Arsenic	<0.5	<0.5	<0.5	<0.5			5.0
Barium	<5	<5	<5	<5			100.0
Cadmium	<0.1	<0.1	<0.1	<0.1			1.0
Chromium	<0.5	<0.5	<0.5	<0.5			5.0
Lead	<0.5	<0.5	<0.5	<0.5			5.0
Mercury	<0.0008	<0.0008	<0.0008	<0.0008			0.2
Selenium	<0.5	<0.5	<0.5	<0.5			1.0
Silver	<0.5	<0.5	<0.5	<0.5			5.0
Endrin	NR	NR	NR	NR			0.02
Lindane	NR	NR	NR	NR			0.4
Methoxychlor	NR	NR	NR	NR			10.0
Toxaphene	NR	NR	NR	NR			0.5
2,4-D	NR	NR	NR	NR			10.0
2,4,5-TP (Silvex)	NR	NR	NR	NR			1.0

NR: Not requested

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Second Edition, U.S. EPA, 1982.

H-194 Supervising Analyst: Gary Hahn/KB

Date: November 13, 1986

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4310.17

Parameter	E & E Laboratory No. 86-8971	(mg/kg)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
chlorobenzene		<1.0	<1.0	--
1,2-dichlorobenzene		<1.0	<1.0	--
1,3-dichlorobenzene		<1.0	<1.0	--
1,4-dichlorobenzene		<1.0	<1.0	--
benzene		<1.0	<1.0	--
total xylenes		<1.0	<1.0	--
toluene		<1.0	<1.0	--
ethyl benzene		<1.0	<1.0	--

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

U-4310.18

Compound	E & E Laboratory No. 86-8981	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/kg)			
1,2-dichlorobenzene		<1.0	1.25	1.15	92
1,3-dichlorobenzene		<1.0	1.25	1.15	92
1,4-dichlorobenzene		<1.0	1.25	1.12	90
toluene		<1.0	1.25	1.19	95
ethyl benzene		<1.0	1.25	1.12	90

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4310.19

Compound	E & E Laboratory No. 86-	(mg/kg) Original Analysis	(mg/kg) Replicate Analysis	Relative Percent Difference (RPD)
carbon tetrachloride	8971	<1.0	<1.0	--
1,2-dichloroethane	8971	<1.0	<1.0	--
1,1,1-trichloroethane	8971	<1.0	<1.0	--
1,1-dichloroethane	8971	<1.0	<1.0	--
1,1,2-trichloroethane	8971	<1.0	<1.0	--
1,1,2,2-tetrachloroethane	8971	<1.0	<1.0	--
chloroethane	8971	<1.0	<1.0	--
2-chloroethylvinyl ether	8971	<1.0	<1.0	--
chloroform	8971	<1.0	<1.0	--
1,1-dichloroethene	8971	<1.0	<1.0	--
trans-1,2-dichloroethene	8971	<1.0	<1.0	--
1,2-dichloropropane	8971	<1.0	<1.0	--
trans-1,3-dichloropropene	8971	<1.0	<1.0	--
cis-1,3-dichloropropene	8971	<1.0	<1.0	--
methylene chloride	8971	<1.0	<1.0	--
chloromethane	8971	<1.0	<1.0	--
bromomethane	8971	<1.0	<1.0	--
bromoform	8971	<1.0	<1.0	--
bromodichloromethane	8971	<1.0	<1.0	--
fluorotrichloromethane	8971	<1.0	<1.0	--
dichlorodifluoromethane	8971	<1.0	<1.0	--
chlorodibromomethane	8971	<1.0	<1.0	--
tetrachloroethene	8971	<1.0	<1.0	--
trichloroethene	8971	<1.0	<1.0	--
vinyl chloride	8971	<1.0	<1.0	--

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

U-4310.20

Compound	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/kg)			
1,2-dichloroethane	8981	<1.00	1.25	0.67	53.3
1-1-dichloroethane	8981	<1.00	1.25	0.95	76.2
chlorobenzene	8981	<1.00	1.25	1.48	118
1,3-dichlorobenzene	8981	<1.00	1.25	1.57	126
chloroethane	8981	<1.00	1.25	1.24	99.2
1,2-dichlorobenzene	8981	<1.00	1.25	1.33	106
1,4-dichlorobenzene	8981	<1.00	1.25	0.93	74.4
methylene chloride	8981	<1.00	1.25	0.90	72.2
chloromethane	8981	<1.00	1.25	1.52	122
bromomethane	8981	<1.00	1.25	1.30	104
bromodichloromethane	8981	<1.00	1.25	0.64	55.4
trichloroethene	8981	<1.00	1.25	0.89	71.1

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED Soil SAMPLES

U-4310

Compound	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/kg)			
1,2-dichloroethane	8981	<1.00	1.25	0.67	53.3
1,1-dichloroethane		<1.00		0.95	76.2
Chlorobenzene				1.48	118
1,3-Dichlorobenzene				1.57	126
chloroethane		<1.00		1.24	99.2
1,2-Dichlorobenzene				1.33	106
1,4-Dichlorobenzene				0.93	74.4
[illegible]					
[illegible]					
methylene chloride		<1.00		0.90	72.2
chloromethane		<1.00		1.52	122
bromomethane		<1.00		1.30	104
bromodichloromethane		<1.00		0.64	55.4
[illegible]					
trichloroethene		<1.00		0.89	71.1
[illegible]					

LAB MASTER BOILERPLATE
DISK B2.1 PAGE SPIKED.3
DATE 8/86 TP SD

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF EP TOXICITY EXTRACTS

U-4310.21

Parameter	E & E Laboratory No. 86-	(mg/L)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
Arsenic	8971	<0.5	<0.5	--
Barium	8971	<5	<5	--
Cadmium	8971	<0.1	<0.1	--
Chromium	8971	<0.5	<0.5	--
Lead	8971	<0.5	<0.5	--
Selenium	8971	<0.5	<0.5	--
Silver	8971	<0.5	<0.5	--

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4310.22

Parameter	E & E Laboratory No. 86-	(mg/kg) Original Analysis	(mg/kg) Replicate Analysis	Relative Percent Difference (RPD)
Solids, %	8972	78	78	0
	8982	78	78	0
Petroleum Hydrocarbon	8982	1.0	1.2	18.1
Lead	8968	10.2	8.97	12.8

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

U-4310.23

Parameter	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/kg)			
Petroleum Hydrocarbons	8972	<1	170	180	106

QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

U-4310.24

Parameter	Concentrations in ug/L		Percent Difference
	Known	Determined	
Arsenic	46.0	47.2	2.6
Barium	119600	123050	2.9
Cadmium	940	950	1.1
Chromium	1030	1057	2.6
Lead	1010	1050	4.0
Mercury	4.4	4.5	2.3
Selenium	7.90	7.77	1.6
Silver	6000	6000	0

APPENDIX I

OVERVIEW OF RISK ASSESSMENT AND THE DEVELOPMENT OF STANDARDS AND CRITERIA

I.1 INTRODUCTION

This appendix discusses development of standards and criteria used in the evaluation of concentration data of chemicals in soils, groundwater, and surface water.

As a first step, E & E has prepared brief toxicological profiles for contaminants of potential concern, which are defined as those reported in groundwater samples above levels of detection and subject to at least one of the following sets of drinking water standards or criteria: EPA drinking water standards, or EPA health advisories. These profiles are found in Appendix J. In addition, based on the relevant potential route of human exposure (oral) and exposure medium (drinking water), the profiles also provide background on the applicable federal drinking water standards and criteria for each chemical.

Section I.2 presents an overview of risk assessment and criteria used by EPA to categorize each of the chemicals as carcinogens or noncarcinogens. The criterion of whether a chemical is considered a carcinogen is usually the principal factor in federal and state agency estimates of acceptable human exposure levels. Section I.3 describes the methodologies used to estimate risks for carcinogens and noncarcinogens. Section I.4 summarizes drinking water standards and criteria for the contaminants of potential concern.

I.2 CLASSIFICATION OF CHEMICALS AS CARCINOGENS OR NONCARCINOGENS

As contaminant levels decrease, there is a point at which the concern for carcinogenic risk becomes vanishingly small. Based on significantly different dose-response curves, resulting in significantly different risk estimates, chemicals are often divided into two categories--carcinogens and noncarcinogens. Risk assessment for carcinogens is based on the concept that any exposure presents a finite risk of cancer to man. Risk assessment for noncarcinogens is based on the concept that there exists a threshold exposure level, below which adverse health consequences do not occur. The term carcinogen means any chemical for which there is sufficient evidence that exposure may result in continuing uncontrolled cell division

(cancer) in humans and/or animals. The term noncarcinogen is taken to mean any chemical for which the data are either negative or are insufficient to evaluate potential carcinogenicity. These definitions are not static. Rather, at any time, additional data may become available which would shift the weight-of-evidence so that a noncarcinogen would be reclassified as a carcinogen, or a carcinogen as a noncarcinogen.

In this report, chemicals have been classified as carcinogens or noncarcinogens based on EPA weight-of-evidence criteria which take into account the quality and adequacy of the experimental data and kinds of responses (51 FR 33992, September 24, 1986). Table I-1 summarizes the five EPA weight-of-evidence categories in current use.

According to these EPA guidelines, chemicals in the first two groups--A or B (B_1 or B_2)--are considered to have sufficient evidence to be considered "human carcinogens" or "probable human carcinogens," and are subject to nonthreshold carcinogenic risk estimation procedures. Chemicals in group C, "possible human carcinogens," may or may not be subject to carcinogenic risk estimation procedures, depending upon the quality of the data. The remaining chemicals--in groups D or E--are considered to be noncarcinogens and are subject to standard threshold-based toxicological risk estimation procedures for noncarcinogenic end points

All of the contaminants have been evaluated by the EPA. Carcinogenicity classifications for these chemicals are based directly on EPA determinations. Table I-2 summarizes the classification of the contaminants.

For more details concerning categorizations, refer to the profiles of individual contaminants in Appendix J.

I.3 RISK ASSESSMENT PROCEDURES FOR CARCINOGENS AND NONCARCINOGENS

Scientists have developed several mathematical models to estimate low-dose carcinogenic risks from observed high-dose risks. Consistent with experimental findings that carcinogenesis is a multistage process in the cells of certain animal tissues, EPA currently uses a linearized multistage model (EPA 1986a). In addition to using the

Table I-1

FIVE EPA CATEGORIES FOR EVALUATING THE EVIDENCE OF CHEMICAL CARCINOGENICITY

Group	Description
Group A	Human Carcinogen - sufficient evidence from epidemiological studies
Group B	Probable Human Carcinogen -
Group B_1	• At least limited evidence of carcinogenicity to humans
Group B_2	• Usually a combination of sufficient evidence for animals and inadequate data for humans
Group C	Possible Human Carcinogen - limited evidence of carcinogenicity in animals in the absence of human data
Group D	Not Classifiable - inadequate human and animal evidence of carcinogenicity
Group E	Evidence of Noncarcinogenicity for Humans - no evidence of carcinogenicity in at least two adequate animal tests in different species or in both adequate epidemiological and animal studies

Source: EPA 1986a.

Table I-2

CARCINOGENICITY CLASSIFICATION OF SELECTED CHEMICALS ACCORDING TO EPA WEIGHT-OF-EVIDENCE CRITERIA[1]

Chemical	Classification[1]	Basis
Arsenic	A[3]	Human carcinogen based on epidemiological studies; pending resolution of essentiality in human diet; EPA has not regulated arsenic as a carcinogen in drinking water.
Benzene	A[2]	Human carcinogen based on epidemiological studies.
Cadmium	B_1[3]	Probable human carcinogen based on sufficient evidence in epidemiological studies; not regulated as a carcinogen in drinking water because there is insufficient evidence by the oral route.
Chlorobenzene	C[3]	Limited evidence in animal studies.
Chloroform	B[4]	Probable human carcinogen based on sufficient evidence in animal studies.
Chromium	A[3]	Sufficient evidence for Cr(VI) in humans and animals by inhalation route; EPA has not regulated chromium as a carcinogen in drinking water due to insufficient evidence by the oral route.
Copper	D[3]	Inadequate data to classify.
Dichlorobenzenes	D[2,3]	Inadequate data to classify.
1,1-Dichloroethane	D[7]	Inadequate data to classify.
1,2-Dichloroethane	B_2[2]	Carcinogenic in animals by ingestion.
Dichloromethane (Methylene Chloride)	B_2[5]	Carcinogenic in animal studies.
Lead	B_2[3]	Carcinogenic in animal studies; because of the extensive negative epidemiological evidence, EPA has proposed to regulate lead in drinking water based on noncarcinogenic effects.
Mercury	D[3]	Inadequate data to classify.
Nickel	B_2[3]	Carcinogenicity in animals by inhalation; insufficient evidence by oral route of exposure.
Toluene	D[3]	Inadequate data to classify.
Tetrachloroethylene	B_2[6]	Carcinogenic in animal studies.
1,1,1-Trichloroethane	D[2]	Inadequate data to classify.
Trichloroethene	B_2[3]	Carcinogenic in animal studies.

1 EPA (1986a), except for chloroform.
2 EPA (1985b).
3 EPA (1985c).
4 EPA (1985e).
5 EPA (1985f).
6 EPA (1985h).
7 EPA (1984d).
8 EPA (1986b).

linearized multistage model, EPA uses the upper 95% confidence limit for doses or concentrations in animal or human studies to estimate low-dose unit cancer risk (UCR) or potency. Following these procedures, EPA believes it would be very unlikely to underestimate the actual potency of a chemical or the potential carcinogenic risks to humans.

Noncarcinogenic effects (e.g., skin irritation, birth defects, immunological effects, organ damage, etc.) are generally thought to occur only above a minimum dose or threshold. Consequently, risk assessments for a chemical designated as a noncarcinogen attempt to derive an acceptable daily intake (ADI) or risk reference dose (RRfD) for exposure in humans based on a No-Observed-Adverse-Effect-Level (NOAEL) or No-Observed-Effect-Level (NOEL). An ADI is defined as the amount of a toxicant in milligrams per kilogram body weight per day which is anticipated will not result in any adverse effects after chronic exposure to the general population of humans, including sensitive subgroups (Dourson and Stara 1983). Adverse effects are considered as functional impairments or pathological lesions which may affect the performance of the whole organism or which reduce the organism's ability to respond to additional challenge (EPA 1980b). In the absence of a suitable NOAEL or NOEL, the ADI may be based on a Lowest-Observed-Adverse-Effect-Level (LOAEL) or Lowest-Observed-Effect-Level (LOEL). Table I-3 presents definitions of these no effect levels. Because the NOELs, NOAELs, LOAELs, and LOELS are usually determined by experiments on animals conducted at high doses to provide an added margin of safety, estimation of ADIs requires the use of uncertainty factors to compensate for data limitations and the lack of precision in extrapolating from high doses in animals to lower doses in humans. Five uncertainty factors used by EPA are summarized in Table I-4 (EPA 1985c).

ADIs are generally calculated using the formula:

$$\text{ADI (in mg/kg/day)} = \frac{\text{NOAEL in mg/kg/day}}{\text{Uncertainty Factor}} \qquad (1)$$

Adjusted ADIs (AADIs) based on estimated drinking water intake are calculated by multiplying the ADI by 70 kilograms (kg), the

TABLE I-3

DEFINITIONS OF NO EFFECT LEVELS

NOEL (No-Observed-Effect-Level) is the dose of a chemical at which there are no statistically or biologically significant increases in frequency or severity of adverse effects between the exposed population and its appropriate control.

NOAEL (No-Observed-Adverse-Effect-Level) is the dose of a chemical at which there are no statistically or biologically significant increases in frequency or severity of adverse effects between the exposed population and its appropriate control. Effects are observed at this dose, but the effects are not considered to be adverse.

LOAEL (Lowest-Observed-Adverse-Effect-Level) is the lowest dose of a chemical in a study or group of studies which produces statistically or biologically significant increases in frequency or severity of adverse effects between the exposed population and its appropriate control.

Source: Dourson and Stara 1983.

Table I-4

UNCERTAINTY FACTORS USED IN THE DERIVATION
OF ACCEPTABLE DAILY INTAKES

Uncertainty Factor	Condition of Use
10	A 10-fold uncertainty factor is used with valid experimental results on appropriate durations of exposures of humans.
100	A 100-fold uncertainty factor is used when human data are not available, and extrapolation is made from valid results of long-term animal studies.
1,000	A 1,000-fold uncertainty factor is used when human data are not available and extrapolation is made from animal studies of less than chronic exposure.
1-10	An additional uncertainty factor from 1 to 10 when using a lowest-observed-adverse-effect-level (LOAEL) instead of a no-observed-adverse-effect-level (NOAEL).
Intermediate uncertainty factor	Other uncertainty factor used, according to scientific judgment, when justified.

Source: EPA 1985c.

assumed weight for an adult, and dividing by 2 liters per day, the assumed amount of water consumed by an adult per day:

$$AADI = \frac{(NOAEL)\ (70\ kg)}{(Uncertainty\ Factor)\ (2\ liters/day)} \qquad (2)$$

ADIs (or AADIs) should not be regarded as providing the exact dividing line between "safe" (below the ADI) and "unsafe" (above the ADI) doses or exposure levels. Such an interpretation of ADIs would be equivalent to saying that "risks" abruptly disappear at a specific dose for all members of the human population. In fact, for some chemicals, the risk curve may rise through and above the ADI. For others, doses well above the ADI may fall in a low or even zero risk category. Consequently, although ADIs may be used in standards development and risk assessment, they do not represent sharp divisions in the continuum of dose-risk relations (Rodricks and Tardiff 1984).

Due to the imprecision in the ADI approach, there is currently considerable research designed to provide improved quantitative estimates of uncertainty factors for specific chemicals. Subjects under current investigation include approaches for quantification of the uncertainties related to the slope of dose-response curves, sample size of animals treated, and variability of human responses. However, in the interim period until these approaches can be validated, the current ADI approach remains the method of choice by EPA in the development of drinking water standards.

I.4 DRINKING WATER STANDARDS AND CRITERIA

Three sets of drinking water standards or criteria are relevant to the evaluation of potential groundwater contamination at Richards-Gebaur AFB:

- EPA enforceable maximum contaminant limits (MCLs), non-mandatory proposed MCLs, or non-mandatory proposed or final recommended MCLs (RMCLs);

- EPA non-mandatory health advisories (HAs);

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- EPA recommended ambient water quality criteria for the protection of human health.

This section discusses each of these in turn, followed by a summary table of the values for each of the chemicals of concern.

Depending upon the stage of rulemaking, EPA may have issued final MCLs, proposed MCLs, final RMCLs, or proposed RMCLs for an individual chemical. Proposed and final RMCLs are nonenforceable health goals issued during the first stages of rulemaking. Proposed and final RMCLs are set at 0 for substances evaluated as probable human carcinogens (Group A or B) according to EPA weight-of-evidence carcinogenicity criteria. For chemicals falling in other categories, RMCLs are usually set based on chronic toxicity, or in the absence of suitable chronic data, non-chronic data using the ADI threshold-based approach outlined in the previous section. Proposed and final MCLs are established as close to RMCLs as feasible, taking into account cost, availability of treatment technology, and analytical methods (EPA 1985b).

EPA drinking water HAs have been developed from data describing noncarcinogenic end points of toxicity, using the ADI approach described above. HAs do not incorporate quantitatively any potential carcinogenic risk from exposure. Consequently, for chemicals classified as carcinogens, the HAs should be applied only to assess non-chronic toxicity end points, with the understanding that carcinogenicity must be addressed separately (EPA 1985d). HAs for adults are developed using the ADI approach described above. Derivation of HAs for children assumes a standard 10 kilogram weight and 1 liter per day drinking water consumption. For those chemicals which are classified as human or probable human carcinogens, non-zero 1-day, 10-day, and longer-term HAs may be derived, with appropriate caveats. However, EPA has not developed and does not recommend using HAs for lifetime (chronic) exposures to carcinogens.

EPA ambient water quality criteria have been derived, as appropriate, for carcinogenic or noncarcinogenic end points (EPA 1980a). For noncarcinogens, criteria have been developed based on the ADI approach. EPA has developed criteria for carcinogens using linear or linearized multistage models to estimate drinking water levels corresponding to excess lifetime cancer risk estimates derived on the basis

of estimated lifetime consumption of drinking water (2 liters/day) and aquatic species (6.5 grams fish and shellfish/day) taken from waters containing the corresponding contaminant concentration. For the most part, these ambient water quality criteria were developed prior to 1980 and published in 1980 (EPA 1980a). Since then, EPA has revised its conclusions not only qualitatively as to the hazards presented, but also quantitatively as to the risks associated with chemical exposures and requisite exposure levels. Consequently, the water quality criteria should only be used where not superseded by EPA health advisories or drinking water standards.

Table I-5 summarizes the drinking water standards and criteria for the chemical contaminants of potential concern.

Table I-5

DRINKING WATER STANDARDS AND CRITERIA (ug/L)

Chemical	EPA Drinking Water Standards				EPA Health Advisories				EPA Ambient Water Quality Criteria	
	MCL	PMCL	RMCL	PRMCL	1-Day	10-Day	Longer Term	Lifetime	Noncancer	Cancer
Arsenic	50	--	--	50	50	50	50	50	--	2.2 ng/L
Benzene	--	5	0	--	--	233 (child)	--	--	--	0.66
Cadmium	10	--	--	5	43 (child) 150 (adult)	8 (child) 29 (adult)	-- --	5	10	--
Chlorobenzene	--	--	--	--	1,800 (child) --	1,800 (child) --	9,000 (child) 30,000 (adult)	3,150	488 (organo-leptic)	--
Chloroform	100[4]	--	--	--	--	--	--	--	--	0.19
Chromium	50	--	--	120	-- --	1,400 (child) 5,000 (adult)	240 (child) 840 (adult	120	50 [Cr(VI)] 170,000 [Cr(III)]	-- --
Copper	1,000 (secondary standard)	--	--	1,300	1,300 (child) 1,300 (adult)	-- --	-- --	--	1,000	--
o-Dichlorobenzene (1,2-Dichlorobenzene)	--	--	--	620	-- --	-- --	8,930 (child) 31,250 (adult)	620	400 (total all isomers)	--
m-Dichlorobenzene (1,3-Dichlorobenzene)	--	--	--	--	-- --	-- --	8,930 (child) 31,250 (adult)	620	400 (total all isomers)	--
p-Dichlorobenzene (1.4-Dichlorobenzene)	--	750	750	--	-- --	-- --	10,700 (child) 37,750 (adult)	750	400 (total all isomers)	--
1,1-Dichloroethane	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane (Ethylene dichloride)	--	5	0	--	--	--	740 (child) 2,600 (adult)	--	--	--
Dichloromethane (Methylene Chloride)	--	--	--	--	13,300 (child) --	1,500 (child) --	-- --	350	--	0.19 (halo-methanes)
Lead	50	--	--	20	--	--	--	20	50	--
Mercury (inorganic)	2	--	--	3	--	--	--	3	--	--
Nickel	--	--	--	--	--	1,000 (child)	--	150	13.2	--

Table I-5 (Cont.)

Chemical	EPA Drinking Water Standards				EPA Health Advisories				EPA Ambient Water Quality Criteria	
	MCL	PMCL	RMCL	PRMCL	1-Day	10-Day	Longer Term	Lifetime	Noncancer	Cancer
Tetrachloroethene (Perchloroethylene)	--	--	--	--	-- --	34,000 (child) --	1,940 (child) 6,800 (adult)	680	--	0.8
Toluene	--	--	--	2,600	18,000 (child) 63,000 (adult)	6,000 (child) 21,000 (adult)	-- --	2,000	14,300	--
1,1,1-Trichloroethane	--	200	200	--	14,000 (child) --	-- --	35,000 (child) 125,000 (adult)	200	18,700	--
Trichloroethene	--	5	0	--	--	--	--	260	6,770	--

APPENDIX J

TOXICOLOGICAL PROFILES FOR SELECTED CONTAMINANTS

Section		Page
J.1	Arsenic	J-2
J.2	Benzene	J-3
J.3	Cadmium	J-5
J.4	Chlorobenzene	J-7
J.5	Chloroform	J-8
J.6	Chromium	J-9
J.7	Copper	J-11
J.8	Cyanides	J-12
J.9	Dichlorobenzenes	J-13
J.10	1,1-Dichloroethane	J-15
J.11	1,2-Dichloroethane	J-16
J.12	Dichloromethane (Methylene Chloride)	J-18
J.13	Ethylbenzene	J-19
J.14	Lead	J-20
J.15	Mercury	J-25
J.16	Nickel	J-27
J.17	Radionuclides	J-28
J.18	Tetrachloroethene	J-31
J.19	Toluene	J-32
J.20	1,1,1-Trichloroethane	J-34
J.21	Trichloroethene	J-35
J.22	Vinyl Chloride	J-36
J.23	Xylenes	J-38

Noncarcinogenic Effects

At high doses, arsenic compounds have been shown to produce acute and chronic toxic effects including irreversible systemic damage. The trivalent compounds are the most toxic and tend to accumulate in the body. Animal studies have shown that chronic arsenic exposure may cause body weight changes, decreased blood hemoglobin, liver damage, and kidney damage.

There is evidence that arsenic is an essential element enhancing growth and development in certain animal species, and it has been suggested that arsenic may be an essential element for humans (NAS 1980). Whether or not arsenic is an essential element is the subject of continuing research.

Teratogenic effects of arsenic compounds at relatively high exposure levels have been demonstrated in a number of animal species (EPA 1984). Generally, these effects have been observed following parenteral (injection) administration; whereas, administration at lower doses by the more relevant oral route has not resulted in any significant reproductive or developmental effects.

Mutagenicity and Carcinogenicity

Arsenic has been shown to be mutagenic in several assay systems and to induce chromosomal aberrations *in vivo* and *in vitro*. Animal carcinogenicity studies have reported conflicting results. Several studies have reported an increased incidence of bronchiogenic carcinomas in rats exposed intratracheally to an arsenic-containing pesticide. Reasons for inconsistent carcinogenicity findings in animals may include inappropriate selection of an animal model, and use of flawed study designs. In humans, epidemiologic studies and case reports have reported that arsenic is associated with tumors of the skin, lungs, genital organs, and visual organs (EPA 1984b, EPA 1985c).

EPA has classified arsenic in Group A, i.e., a human carcinogen, based on extensive evidence of human carcinogenicity through inhalation and ingestion exposure (EPA 1985c).

Drinking Water Standards and Criteria

Standards. The current MCL for arsenic under the National Interim Drinking Water Regulations is 50 µg/L. The NAS Drinking Water Committee has analyzed the toxicology of arsenic (NAS 1983). Based upon this evaluation, NAS recommended the retention of the MCL pending resolution of the question whether arsenic is an essential element in the human diet.

NAS also examined the available epidemiologic studies which were designed to investigate the relationship between arsenic exposure and skin cancer in the United States. The conclusion of the report was that these studies lacked statistical power to determine if arsenic causes skin cancer. However, the report stated that precursors of skin cancer, normally seen in cases of arsenic-induced skin cancer, were not seen in these studies.

Consistent with the NAS recommendations, EPA has proposed that the RMCL remain at the current MCL of 50 µg/L. In its determination, EPA stated that the MCL was below concentrations at which noncarcinogenic toxicity had been demonstrated and was within the concentration range which might be, based on further investigation, essential for humans (EPA 1985c).

Criteria. Based upon recommendations of NAS, EPA has proposed that all health advisories for arsenic be set at 50 µg/L (EPA 1985d). NAS has not developed SNARLs for arsenic. The EPA ambient water quality criterion for the protection of human health is 22 µg/L, corresponding to 1×10^{-5} lifetime excess cancer risk calculated on the basis of an epidemiological study of skin cancer among Taiwanese exposed via drinking water (EPA 1980a).

J.2 BENZENE

Noncarcinogenic Effects

The best known and longest recognized toxic effect of benzene in humans is depression of bone marrow function. Benzene-exposed individuals have been found to display anemia, leucopenia, and/or

thrombocytopenia. When simultaneous depression of all three cell types (pancytopenia) is accompanied by bone marrow necrosis, the syndrome is called aplastic anemia.

Carcinogenicity and Mutagenicity

Excess leukemia mortality, particularly acute myelogenous and monocytic leukemia, has been demonstrated among humans occupationally exposed to benzene. In addition to this definitive human evidence, several long-term bioassays have demonstrated increased incidences of tumors and leukemia following administration in animals. Based primarily upon the direct evidence in man, EPA has classified benzene according to weight-of-evidence carcinogenicity criteria in Group A, human carcinogen-sufficient evidence from epidemiological studies (EPA 1985b).

Benzene has been tested extensively for genotoxic properties. Benzene was not mutagenic in several bacterial and yeast systems. Equivocal results have been reported for clastogenic results *in vitro*; several investigators have reported positive results in mouse micronucleus assays, as well as studies of chromosomal observations in rabbits.

Many investigators have reported significant increases in chromosomal aberrations in symptomatic and asymptomatic workers with either a current or past history of exposure to benzene.

Drinking Water Standards and Criteria

Standards. EPA is currently engaged in determining a ruling to establish an enforceable MCL for benzene in drinking water (EPA 1985b). EPA has finalized, as a first stage in the ruling, a health-based RMCL of 0, based upon the Agency's assessment that no level of exposure above 0 is an acceptable health level for a carcinogen. Based upon analytical feasibility and feasibility of removal technology, EPA has issued a proposed MCL of 5 µg/L (EPA 1985b).

Criteria. EPA has developed a 10-day drinking water HA of 233 µg/L for a 10-kg child based upon a NOAEL of 96 mg/m^3 reported in a

rat inhalation study (EPA 1985d). The HA was developed using standard assumptions (weight of 10 kg, drinking water consumption of 1 liter per day) and an uncertainty factor of 100.

Due to lack of data, EPA has not developed either 1-day or longer-term HAs. EPA did not derive a lifetime HA for noncarcinogenic effects because of benzene's carcinogenicity.

The EPA ambient water quality criterion for the protection of human health is 0.66 µg/L, corresponding to an estimated one-in-a-million (1×10^{-6}) lifetime excess carcinogenic risk calculated on the basis of human epidemiological data (EPA 1980a).

J.3 CADMIUM

Noncarcinogenic Effects

Acute and chronic exposure to cadmium in animals and humans results in renal dysfunction, hypertension, anemia, and altered liver microsomal activity. The kidney is considered to be the critical target organ in humans chronically exposed to cadmium by ingestion. The early clinical signs of renal injury include proteinuria, glucosuria, and aminoaciduria.

To calculate an adjusted acceptable daily intake (AADI), EPA used renal dysfunction as an end point, and the most widely accepted estimate for the critical (threshold) concentration of cadmium in the renal cortex, 200 µg/g. Using 4.5% absorption of the daily dose and 0.01% excretion in the total body burden per day, EPA calculated a LOAEL of 352 µg/day for renal effects in humans. Incorporating an uncertainty factor of 10, EPA has developed an acceptable daily intake (ADI) of 35 µg/day. Adjusting the ADI for consumption of 2 liters of water per day, EPA derived a provisional AADI of 18 µg/L (EPA 1985c).

Embryotoxic and teratogenic effects have been demonstrated in many mammalian species following parenteral administration of high doses of cadmium. In contrast, there is little evidence of these effects at lower doses by either of the more relevant inhalation or oral exposure routes (EPA 1981).

Carcinogenicity and Mutagenicity

Cadmium chloride aerosol administered by inhalation for 18 months produced lung tumors in rats. In contrast, all cancer bioassays in

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which cadmium has been administered orally have been negative. Recent epidemiological studies indicated that workers chronically exposed to cadmium are at risk of elevated lung cancer mortality. According to its weight-of-evidence carcinogenicity criteria, EPA has classified cadmium in Group B1 (probable human carcinogen) based on the epidemiological data (EPA 1985c).

While the Agency has concluded that cadmium is a carcinogen by the inhalation route, EPA has proposed that the MCL for cadmium not be set based on carcinogenicity, based upon the negative cancer bioassays in which cadmium was administered orally (EPA 1985c).

Drinking Water Standards and Criteria

Standards. The current MCL for cadmium, under the National Interim Primary Drinking Water Regulations, is 10 µg/L. This level was designed to prevent renal dysfunction, and was based on a critical value of cadmium in the kidney cortex of 200 ug/g, and assumptions on gastrointestinal absorption, excretion of the absorbed dose, daily excretion of the total body burden, and daily dietary cadmium intakes.

The World Health Organization (WHO) guideline for drinking water is 5 µg/L. This value was based on a value for provisional tolerable weekly cadmium intake, assuming that 25% of the total cadmium intake was attributable to drinking water. EPA has proposed a RMCL of 5 µg/L based upon the WHO guidelines and the NAS SNARL.

Criteria. Based on a NOAEL reported in a study of 43 µg/kg/day for emetic effects reported in a study of acute exposure in adult humans, EPA derived 1-day drinking water HAs of 43 µg/L (10-kg child) and 150 µg/L (70-kg adult) (EPA 1985d). These HAs were derived using an uncertainty factor of 10, based on consumption of 1 liter and 2 liters of water per day for a child and adult, respectively.

Ten-day HAs of 8 µg/L (10-kg child) and 29 µg/L (70-kg adult) were calculated based on a NOAEL reported in a chronic 24-week feeding study in rats. In deriving the 10-day HAs, EPA used a NOAEL of 80 µg/kg/day, based on proteinuria, and an uncertainty factor of 1,000.

The lifetime and longer-term HAs for a 70-kg adult, equivalent to the proposed RMCL, are 5 µg/L (EPA 1985d).

NAS has calculated a chronic SNARL of 5 µg/L using renal dysfunction as an end point based on a 24-week feeding study in rats (NAS 1982). This level was derived from the NAS and WHO guidelines of 5 µg/L by allocating 25% of total human cadmium intake to drinking water (EPA 1985c).

The EPA ambient water quality criterion for cadmium for the protection of human health is 10 µg/L, considering ingestion of water and contaminated aquatic organisms (EPA 1980a).

J.4 CHLOROBENZENE

Noncarcinogenic Effects

Chlorobenzene exerts its toxicity primarily on the central nervous system, liver, and kidney. Liver effects include necrosis and interference with porphyrin metabolism. Kidney effects include swelling of the tubular and glomerular epithelia. Hematopoietic effects (e.g., lymphocytosis and leukopenia) have been reported among chlorobenzene-exposed workers; however, it is uncertain whether these effects can be attributed to chlorobenzene or to other contaminants (EPA 1985d).

Carcinogenicity and Mutagenicity

In a single National Toxicology Program (NTP) bioassay, chlorobenzene was found not to be carcinogenic in mice and rats. The NTP report did note that chlorobenzene induced a statistically significant increased incidence of neoplastic nodules in rats exposed to the highest dose. On this basis, EPA classified chlorobenzene according to weight-of-evidence carcinogenicity criteria in Group C--limited evidence in animals, no evidence in humans (EPA 1985d).

Most mutagenicity assays of chlorobenzene in bacteria, fungal, and mammalian tissue cultures have been negative (EPA 1985k). One study, however, in *Streptomyces antibioticus* reported that chlorobenzene induced reversion to vitamin B_1 prototrophy and one study in *Saccharomyces cerevisiae* showed increased mitotic crossing (EPA 1985k).

Drinking Water Standards and Criteria

Standards. EPA has not established, nor has the Agency currently issued a proposal to establish, an MCL for chlorobenzene in drinking water.

Criteria. In the absence of suitable data, EPA has not derived a 1-day HA for chlorobenzene. EPA has, however, developed 10-day, longer-term, and lifetime HAs by application of 100-fold uncertainty factors and various intake assumptions and physiological parameters to NOAELs reported in animal studies (EPA 1985d). The 10-day advisory of 1,800 µg/L for a 10-kg child was derived from a NOAEL of 345 mg/m^3 reported in an inhalation teratology study in rats and rabbits; the longer-term HAs of 9,000 µg/L (child) and 30,000 ug/L (adult) were derived using a NOAEL of 125 mg/kg/day reported in a subchronic gavage study in mice and rats. The lifetime HA of 600 µg/L was derived from the NOAEL used in the derivation of the longer-term HA, using an additional uncertainty factor of 10 and assuming that drinking water comprises 20% of the total daily intake.

NAS has estimated, based upon the draft NTP, that a drinking water concentration of 2.3 µg/L would correspond to an estimated one-in-a-million incremental excess lifetime cancer risk (NAS 1983).

EPA has developed an ambient water quality criterion for the protection of human health of 488 µg/L and for organoleptic (odor and taste) effects of 20 µg/L (EPA 1980a).

J.5 CHLOROFORM

Noncarcinogenic Effects

Noncarcinogenic effects of chloroform at relatively high exposure levels in humans and animals results in central nervous system (CNS) depression, gastrointestinal irritation, liver and kidney damage, cardiac arrhythmia, ventricular tachycardia, and bradycardia.

Carcinogenicity and Mutagenicity

In multiple studies, chloroform has been shown to be a carcinogen following oral administration in mice and rats (EPA 1984a). The

evidence is limited for human carcinogenicity based upon epidemiological studies. According to EPA weight-of-evidence carcinogenicity criteria, chloroform can be classified in category B_2--probable human carcinogen.

Results of mutagenicity assays have been mixed, with some positive and some negative.

Drinking Water Standards and Criteria

Standards. EPA has established an MCL for total halomethanes including chloroform of 100 µg/L.

Criteria. Neither EPA nor NAS has developed HAs or SNARLs for chloroform.

Based upon animal carcinogenicity data, EPA developed an ambient water quality criterion for the protection of human health of 0.19 µg/L corresponding to the one-in-a-million (1×10^{-6}) incremental increase in lifetime cancer risk estimated on the basis of animal data (EPA 1980a).

J.6 CHROMIUM

Noncarcinogenic Effects

There are two chromium valences of principal concern in drinking water--trivalent [Cr(III)] and hexavalent [Cr(VI)] chromium. Cr(VI) is much more toxic than Cr(III) and has been shown to produce liver and kidney damage, internal hemorrhage, and respiratory disorders. EPA has developed an adjusted acceptable daily intake for total chromium based upon effects of Cr(VI) for the following three reasons (EPA 1985c):

1. The two valences are in dynamic equilibrium in aqueous media;

2. An AADI based upon Cr(VI), the more toxic of the two valences, will be conservative (health protective); and

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3. Reduction of Cr(VI) to Cr(III) in the stomach following oral intake is incomplete, and relative to Cr(III), there is greater Cr(VI) absorption and tissue accumulation.

EPA derived the provisional AADI for total chromium based upon a NOAEL reported in a study in which rats were exposed to Cr(VI) in drinking water for one year. Based upon a NOAEL of 2.41 mg/kg/day, an uncertainty factor of 500, and standard intake and physiological assumptions, the Agency derived an AADI of 170 µg/L (EPA 1985c).

Carcinogenicity and Mutagenicity

Based upon positive epidemiological studies demonstrating excess cancer mortality among Cr(VI)-exposed workers and positive animal studies, EPA has classified Cr(VI) in Group A - sufficient evidence of carcinogenicity in humans and animals (EPA 1985c). However, since chromium has not been shown to be carcinogenic by the oral route, the Agency has proposed that chromium in drinking water be regulated based upon noncarcinogenic chronic toxicity data (EPA 1985c).

Cr(VI) has demonstrated consistently positive mutagenic activity in a number of bacterial systems. Both Cr(III) and Cr(VI) have been shown to interact with DNA in bacterial assays. Cr(VI) has inhibited DNA synthesis and increased unscheduled DNA synthesis in mammalian cells in culture. Both valences have been demonstrated to produce clastogenic effects in mammalian cells. Increased frequencies of chromosomal aberrations have also been observed in occupationally exposed workers.

Drinking Water Standards and Criteria

Standards. The current MCL for chromium in drinking water is 50 µg/L. Based upon the AADI of 170 µg/L derived on the basis of chronic noncarcinogenic toxicological end points in animals, EPA has derived a proposed RMCL of 120 µg/L by factoring in data on human exposure (100 µg/day via the diet, 0 µg/day via the air) (EPA 1985c).

Criteria. In the absence of suitable data, EPA has not derived a 1-day HA for chromium. However, the Agency has derived 10-day and

longer-term HAs based upon NOAELs reported in animal toxicity studies, using an uncertainty factor of 100, and various intake assumptions and physiological parameters. The 10-day HA based on a NOAEL of 14.4 mg/kg/day reported in a 60-day study in which rats were exposed via drinking water is 1,400 µg/L and 5,000 µg/L for a 10-kg child and 70-kg adult, respectively. The corresponding longer-term HAs, based on a NOAEL of 2.41 mg/kg/day reported in a chronic study in which rats were exposed via drinking water, are 240 µg/L (child) and 840 ug/L (adult) (EPA 1985d). The lifetime HA of 120 ug/L was derived in the same manner and is equivalent to the proposed RMCL (EPA 1985d).

The EPA national ambient water quality criteria for the protection of human health are 50 ug/L and 170,000 µg/L for Cr(VI) and Cr(III), respectively (EPA 1980a).

J.7 COPPER

Noncarcinogenic Effects

Copper is toxic at high-dose levels and is an essential element at lower levels. Toxic effects following acute exposure in man and laboratory animals include gastrointestinal disturbances, hemolytic anemia, and liver and kidney damage. Limited data are available on copper's chronic toxicity; however, efficient homeostatic mechanisms generally protect mammals from excess dietary copper (EPA 1985c).

Copper is regarded as an essential element in mammalian nutrition based on its requirement in many enzymatic reactions. Copper deficiency can result in decreased iron absorption and iron deficiency, and may also lead to reproductive abnormalities (NAS 1980).

EPA has developed an AADI based upon a LOAEL of 5.3 mg/day reported in human clinical case studies (EPA 1985c). EPA derived an AADI of 1,300 µg/L from the LOAEL by applying an uncertainty factor of 2, assuming consumption of 2 liters of water per day (EPA 1985c).

Carcinogenicity and Mutagenicity

Several carcinogenicity studies in animals receiving copper orally have been negative. However, because of methodological deficiencies in these studies, as well as the absence of human data, EPA has classified copper according to weight-of-evidence carcinogenicity

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criteria in Group D--inadequate data in humans and animals (EPA 1985c).

Copper compounds have generally provided negative results in mutagenesis assays. Copper sulfate was reported to increase the frequency of recessive lethal mutations in Drosophilia melanogaster at high concentrations.

Drinking Water Standards and Criteria

Standards. There is currently no primary enforceable EPA drinking water standard for copper. Copper is included in the National Secondary Drinking Water Regulations as a nonenforceable criterion of 1,000 µg/L based upon organoleptic effects (taste and odor). EPA has issued a proposed RMCL of 1,300 µg/L equivalent to the AADI. As the AADI was based on acute effects, the Agency made no adjustments using human exposure data (EPA 1985c).

Criteria. The EPA has developed a 1-day HA for both adults and children for copper of 1,300 µg/L based upon the same methodology and data used to derive the proposed RMCL (EPA 1985c). In the absence of suitable data, the Agency did not calculate 10-day longer term or lifetime HAs.

EPA ambient water quality criterion for copper for the protection of human health based upon organoleptic effects is 1,000 µg/L (EPA 1980a).

J.8 CYANIDES

Noncarcinogenic Effects

Cyanides are organic or inorganic compounds that contain the cyanide-moiety (CM). Organic cyanides are referred to as nitriles. Cyanides are readily absorbed from the lungs, gastrointestinal tract, and skin by animals and man. Cyanides exhibit their toxicity by combining with the cellular hemoglobin, resulting in tissue hypoxia.

EPA has calculated a provisional AADI based upon a 2-year study in which rats were administered diets containing 0 to 300 mg/kg hydrogen cyanide (EPA 1985c). Using a NOAEL of 10.8 mg/kg/day, an

uncertainty factor of 500, and assuming 2-liter drinking water consumption, EPA derived an AADI of 750 ug/L for a 70-kg adult and 220 ug/L for a 10-kg child.

Effects on reproduction and development have not been reported at doses below maternally toxic doses.

Carcinogenicity and Mutagenicity

Potassium cyanide was reported to be not mutagenic in *in vitro* assays. Cyanide has been classified in EPA's Group D, not classifiable--inadequate human and animal evidence of carcinogenicity (EPA 1985c).

Drinking Water Standards and Criteria

Standards. Because they have only been rarely detected, and when they have been detected, it has been at levels greatly below the AADI, EPA has decided not to regulate cyanides in drinking water (EPA 1985c).

Criteria. EPA has developed a 1-day and 10-day HA of 220 µg/L for a 10-kg child by appropriate modification of the lifetime HA of 750 µg/L for daily drinking water intake (1 liter) and weight (10 kg) (EPA 1985d).

Both the 10-day and lifetime HAs of 750 µg/L for an adult were developed by application of a 500-fold uncertainty factor, and standard intake assumptions and physiological parameters to a NOAEL of 10.8 mg/kg/day reported in a chronic study of rats receiving cyanide in the diet (EPA 1985). EPA has not developed any longer-term HAs for cyanides.

EPA has developed an ambient water quality criterion for the protection of human health of 200 µg/L (EPA 1980). In 1985, EPA proposed to revise this level to 3,770 µg/L (EPA 1985p).

J.9 DICHLOROBENZENES (DCBs)

Noncarcinogenic Effects

The principal toxic effects of o-dichlorobenzene (1,2-dichlorobenzene or o-DCB) and p-dichlorobenzene (1,4-dichlorobenzene or p-DCB)

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in humans and other animals from acute and longer-term exposures include CNS depression; blood dyscrasias; and lung, kidney, and liver damage. Similar data are not available for m-dichlorobenzene (1,3-dichlorobenzene or m-DCB). However, based upon short-term assays, EPA has determined that short-term health assessments developed for o-DCB should apply to m-DCB.

Carcinogenicity and Mutagenicity

The few studies available on the carcinogenic potential of the DCBs have been negative. Preliminary results of an NTP gavage bioassay indicate that o-DCB was not carcinogenic under the conditions of the experiment. Pending receipt of the final NTP report for o-DCB, EPA has categorized all three DCB isomers according to Agency weight-of-evidence carcinogenicity criteria in Group D, not classifiable as to human carcinogenicity (EPA 1985j).

In general, DCBs have shown little or no mutagenic activity in a range of bacterial systems. However, several studies with mold and plant cultures treated with DCBs have reported mutations and chromosomal alterations (EPA 1985k).

Drinking Water Standards and Criteria

Standards. EPA is in the process of establishing an enforceable MCL for o-DCB and p-DCB but not m-DCB. As a first step in the process, EPA has issued a proposed RMCL for o-DCB based upon a NOAEL reported in a subchronic gavage study in mice and rats. Based upon a NOAEL of 125 mg/kg/day an uncertainty factor of 100, allocation of 20% of the total human intake from all exposure sources to drinking water, and various intake and physiological assumptions, EPA has derived a proposed RMCL for o-DCB of 620 µg/L. EPA has also issued a proposed MCL for p-DCB of 750 µg/L, based upon a NOAEL of 150 mg/kg/day reported in a rat gavage study, an uncertainty factor of 1,000, and standard intake assumptions and physiological parameters (EPA 1984c).

In the absence of sufficient data, EPA has not developed, and is not in the process of developing, a drinking water standard for m-DCB.

Criteria. No 1-day or 10-day HAs were derived by EPA for o-DCB, m-DCB, or p-DCB, due to absence of suitable data. The longer-term HA for o-DCB judged by EPA to be applicable to m-DCB was developed using a NOAEL reported in a subchronic gavage study of o-DCB in rats and mice. Based upon a NOAEL of 125 mg/kg/day, an uncertainty factor of 100, and standard intake assumptions and physiological parameters and assumptions, EPA developed a longer-term HA for o-DCB and m-DCB of 8,930 ug/L (10-kg child) and 31,250 ug/L (70-kg adult) (EPA 1985d). The longer-term HA for p-DCB was derived from a NOAEL of 150 mg/kg/day reported in a subchronic gavage study. Based on this NOAEL, an uncertainty factor of 100, and standard EPA assumptions and physiological parameters, EPA derived longer-term HAs for p-DCB of 10,700 ug/L (child) and 37,500 ug/L (adult).

The EPA lifetime HA for o-DCB of 620 ug/L was derived in the same manner and is equivalent to the proposed RMCL. However, due to the absence of suitable data, the Agency has not developed a lifetime HA for m-DCB.

The lifetime HA for p-DCB was derived based upon a NOAEL in the NTP subchronic study. Using a NOAEL of 150 mg/kg/day, a 10,000-fold uncertainty factor, and standard EPA assumptions and physiological parameters, the EPA derived a lifetime HA for p-DCB of 750 ug/L (EPA 1985d).

The EPA ambient water quality criterion for the protection of human health applicable to an individual DCB isomer or the sum total of all three DCB isomers is 400 ug/L (EPA 1980a).

J.10 1,1-DICHLOROETHANE

Noncarcinogenic Effects

The data on noncarcinogenic toxicity of 1,1-dichloroethane are extremely limited. Based upon analysis of other chlorinated toxicity data, 1,1-dichloroethane exposure probably causes CNS depression and respiratory tract and skin irritation (EPA 1984d). Findings of cardiac arrhythmias in patients following use as an anesthetic resulted in discontinuation of its use (EPA 1984d).

1,1-dichloroethane has not demonstrated teratogenic or reproductive toxicity at non-maternally toxic doses (EPA 1984d).

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Carcinogenicity

In a single carcinogenicity bioassay conducted by the National Cancer Institute (NCI), rats and mice received 1,1-dichloroethane by intubation. High mortality among all exposed groups of animals probably precluded significant occurrence of exposure-related tumors (EPA 1984).

In male mice, a marginally increased incidence of hepatocellular carcinoma, not significantly different from the incidence in the pooled vehicle control, was reported. In female mice, a significantly positive dose-response relationship in the incidence of benign endometrial polyps was reported. No significant changes in incidences were noted in male rats; female rats showed a significant dose-response relationship in the incidence of hemangiosarcoma.

Based upon the absence of clear statistical findings and low survival of all groups tested, NCI concluded that although the results were suggestive, there was no conclusive evidence of carcinogenicity in mice or rats (EPA 1984d). No human data are available. Based upon these data, EPA has classified 1,1-dichloroethane according to weight-of-evidence carcinogenicity criteria in group D--inadequate human and animal evidence of carcinogenicity (EPA 1984d).

1,1-dichloroethane has been reported as not mutagenic in an assay involving Salmonella typhimurium, whereas positive results have been reported in an assay of viral transformation in Syrian hamster embryo cells.

Drinking Water Standards and Criteria

Standards. There is no EPA drinking water standard for 1,1-dichloroethane. EPA, as yet, has not initiated a ruling procedure for the compound.

Criteria. EPA has developed neither HAs nor an ambient water quality criterion for the protection of human health.

J.11 1,2-DICHLOROETHANE (ETHYLENE DICHLORIDE OR EDC)

Noncarcinogenic Effects

At relatively high doses, 1,2-dichloroethane (EDC) produces CNS depression as well as injury to the liver, kidney, and adrenals.

Symptoms of CNS depression typically include headache, dizziness, nausea, and general weakness. Effects on the liver include necrosis and epithelial cell damage, and on the kidney degeneration of the proximal tubule (EPA 1985b).

Carcinogenicity and Mutagenicity

In a NCI bioassay, EDC administered by gavage was shown to increase the incidence of tumors in both mice and rats. Based upon these data, EPA has classified EDC according to weight-of-evidence carcinogenicity criteria in Group B_2 - probable human carcinogen (EPA 1985b).

EDC has been shown to induce gene mutations in bacteria, plants, Drosophilia melanogaster, and cultured Chinese hamster ovary cells (EPA 1985i). In addition, EDC has been reported to cause meiotic chromosomal disjunction in Drosophilia. Based upon these data, EPA has determined based upon weight-of-evidence criteria that EDC is a mutagen that may have the potential for causing adverse effects in humans (EPA 1985i).

Drinking Water Standards and Criteria

Standards. In the first stage of a procedure to establish an enforceable MCL for EDC in drinking water, EPA has established a nonenforceable health-based RMCL of 0. This RMCL was predicated on the EPA conclusion that no exposure to a "probable human carcinogen" is acceptable. Based upon considerations of analytical feasibility and feasibility of control, EPA has issued a proposed MCL for EDC of 5 ug/L. At the completion of the ruling, EPA will establish an enforceable MCL.

Criteria. In the absence of suitable data, EPA has not developed 1-day or 10-day HAs for EDC. EPA has, however, developed a longer-term HA based upon a NOAEL reported in a rat inhalation study. Based upon a NOAEL of 405 mg/m^3, an uncertainty factor of 100, and various intake assumptions and physiological parameters, EPA derived longer-term HAs of 740 µg/L (10-kg child) and 2,600 µg/L (70-kg adult) (EPA

1985d). Because EDC was judged to be a probable human carcinogen, EPA did not develop a lifetime HA for noncarcinogenic effects.

EPA has not developed an ambient water quality criterion for EDC for the protection of human health.

J.12 DICHLOROMETHANE (METHYLENE CHLORIDE or DCM)

Studies in humans and animals of dichloromethane (DCM) have largely been limited to the inhalation route. Mild exposures result in CNS disturbances, followed by rapid and complete recovery. Following more severe exposure, greater disturbances to the CNS and peripheral nervous system occur. DCM can be cardiotoxic to the heart, causing arrhythmias following acute exposure. Following intake, DCM is metabolized to carbon monoxide, resulting in decreased oxygen transport to cells via the blood, which in turn results in tissue hypoxia.

Carcinogenicity and Mutagenicity

DCM has been shown to be carcinogenic in male and female mice (EPA 1985f). In addition, there is some evidence of carcinogenicity in male rats (EPA 1985f). No elevated cancer risks have been demonstrated in humans in epidemiological studies; however, EPA has judged these studies to be methodologically inadequate to detect cancer in man (EPA 1985f). Based upon EPA weight-of-evidence carcinogenicity criteria, EPA has placed DCM in category B_2--probable human carcinogen.

DCM *in vitro* mutagenicity assays have been positive in four different systems (EPA 1985e). Based upon weight-of-evidence criteria, EPA judged DCM to be a mutagen with the potential for inducing gene mutations in exposed human cells (EPA 1985e). In addition, the Agency concluded a positive response in cultured mammalian cells indicates that DCM may also cause chromosomal aberrations, but additional studies would be required to confirm these data (EPA 1985f).

Drinking Water Standards and Criteria

Standards. EPA has not established an MCL for DCM, and has not, as yet, initiated rule-making procedures to establish an MCL.

Criteria. EPA has derived a 1-day HA for DCM in drinking water based on an acute toxicity study in which rats were exposed by gavage. Using a LOAEL of 1,326 mg/kg/day, an uncertainty factor of 1,000, and standard intake assumptions and physiological parameters, EPA developed a 1-day HA of 13,300 µg/L for a 10-kg child (EPA 1985d).

Based upon a NOAEL reported in a 13-week oral rat study, EPA derived a 10-day HA for a 10-kg child. The 10-day HA of 1,500 ug/L was derived by application of a 100-fold uncertainty factor along with standard intake assumptions to a NOAEL of 15 mg/kg/day (EPA 1985d).

In the absence of appropriate data, EPA did not derive a longer-term HA. However, EPA did calculate a lifetime HA based upon a NOAEL reported in a chronic study in which rats received DCM in drinking water. Based upon a NOAEL of 5 mg/kg/day, a 100-fold uncertainty factor, and standard intake assumptions, EPA derived a lifetime HA for noncarcinogenic effects of 1,750 µg/L (EPA 1985d).

EPA has developed an ambient water quality criterion for DCM for the protection of human health based upon noncarcinogenic effects of 13,400 µg/L (EPA 1980a).

J.13 ETHYLBENZENE

Noncarcinogenic Effects

The major effects following acute and chronic exposure to ethylbenzene are kidney and liver pathologies and nervous system disorders (EPA 1985c).

EPA derived an AADI from a study in which rats received ethylbenzene orally for 5 days/week for 6 months. Using a NOAEL of 136 mg/kg/day, an uncertainty factor of 1,000, and various physiological parameters and intake assumptions, EPA derived a provisional AADI of 3,400 µg/L (EPA 1985c).

In a single inhalation study, no maternal toxicity, embryotoxicity, or tetratogenicity was exhibited (EPA 1985d).

Carcinogenicity and Mutagenicity

A carcinogenicity bioassay for ethylbenzene has been initiated by NCI, but, as yet, data are not available. Pending receipt of the NTP

results, EPA has classified ethylbenzene, according to Agency weight-of-evidence carcinogenicity, in Group D--not classifiable as to human carcinogenicity (EPA 1985c).

Based upon a limited number of assays in Salmonella typhimurium, ethylbenzene has not been shown to be a mutagen.

Drinking Water Standards and Criteria

Standards. EPA is currently engaged in a rule-making procedure to establish an enforceable MCL for ethylbenzene in drinking water (EPA 1985c). Based upon the provisional AADI of 3,400 µg/L for noncarcinogenic effects, EPA has issued a proposed RMCL of 680 µg/L assuming 20 percent of total daily intake is from drinking water.

Criteria. In the absence of appropriate data for the oral route, EPA has developed a 1-day HA based upon a study of 8-hour inhalation exposures to human male volunteers. Based upon a NOAEL of 435 mg/m^3, an uncertainty factor of 10, and various physiological parameters and intake assumptions, EPA derived 1-day HAs of 20,700 µg/L and 72,500 µg/L for a 10-kg child and 70-kg adult, respectively (EPA 1985c, 1985d). In the absence of toxicity data following the appropriate exposure duration, EPA has developed 10-day HAs criteria of 2,070 µg/L (child) and 7,250 µg/L (adult) by application of a 10-fold uncertainty factor to the 1-day HAs (EPA 1985d). In the absence of suitable data, EPA has not derived any longer-term HAs. EPA's lifetime HA, equivalent to the proposed RMCL, is 680 µg/L.

EPA ambient water quality criteria for protection of human health is 1,400 µg/L (EPA 1980a).

J.14 LEAD

Noncarcinogenic Effects

When toxicity information is considered for noncarcinogenic effects of substances, the data are evaluated based on their dose-related response characteristics and the establishment of an exposure level below which no adverse effects are observed. Historically, the observed threshold or no-effect level for lead-induced toxic effects

has continued to decline as more sophisticated experimental and clinical measures are employed to detect more subtle effects. These include alterations in physiological functions at PbB levels below the currently accepted maximum safe level for exposure to children, a segment of the population currently regarded to be at highest risk of lead-induced effects (EPA 1985c).

The most serious effects associated with markedly elevated PbB levels are severe neurotoxic effects that include irreversible brain damage. For most adults, such damage does not occur until PbB levels exceed 100 to 120 micrograms per deciliter (ug/dl). At these PbB levels, severe gastrointestinal symptoms and effects on several other organ systems are often found. Precise thresholds for occurrence of overt neurological and gastrointestinal signs and symptoms of lead exposure in cases of subencephalopathic lead intoxication have yet to be established, but such effects have been observed in chronically exposed adult lead workers at PbB levels as low as 40 to 50 µg/dl.

Toward the lower range of PbB levels associated with overt lead intoxication, less severe but important signs of impairment in normal physiological functioning in several organ systems are evident among apparently asymptomatic lead-exposed adults (EPA 1985c). These include:

- Slowed nerve conduction velocities indicative of peripheral nerve dysfunction (at PbB levels as low as 30 to 40 ug/dl);

- Altered testicular function (at PbB levels of 40 to 50 µg/dl); and

- Reduced hemoglobin production (at approximately 50 µg/dl).

EPA has concluded that all of the above effects point toward a generalized impairment of normal physiological functioning of several different organ systems as adult PbB levels exceed 30 to 40 ug/dl. Evidence of impaired heme synthesis effects in blood occur at even lower levels.

More recent research has indicated that there is a relationship between PbB levels and increases in blood pressure. Preliminary

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review of this work indicates a statistically significant correlation between PbB levels and diastolic blood pressure in white males, ages 40 to 50, with no threshold apparent in the range of 6 to 30 µg/dl. Of particular concern is the finding of a 2 mm Hg increase in diastolic pressure per incremental PbB level increase of 0.5 µg/dl. Possible increases in risk of more severe medical events (stroke, heart attack, death) associated with lead-induced increases in blood pressure are also estimated in one of the recently published studies.

Children represent a sensitive subpopulation with regard to lead toxicity. As with adults, lead affects many different organ systems and biochemical/physiological processes across a wide range of exposure levels. Effective PbB levels for producing encephalopathy or death in children are lower than in adults, starting at approximately 80 to 100 µg/dl. Permanent mental retardation and other marked neurological deficits are among lasting neurological sequelae typically seen in cases of nonfatal childhood lead encephalopathy. Other overt neurological signs and symptoms of subencephalopathic lead intoxication, such as peripheral neuropathies (functional and/or pathological changes in the peripheral nervous system), have been detected in some children at PbB levels as low as 40 to 60 µg/dl. Chronic kidney disease is not evident at PbB levels above 100 µg/dl. Moreover, colic and other overt gastrointestinal symptoms occur in children, at least down to 60 µg/dl. Frank anemia is also evident at 70 µg/dl, representing an extreme manifestation of reduced hemoglobin synthesis at PbB levels as low as 40 µg/dl. All these effects are widely accepted as adverse health effects, and are reflective of widespread marked impact of lead on the normal physiological functioning of many different organ systems (EPA 1984e, 1985c).

Additional studies demonstrate further important health effects occurring in non-overtly lead-intoxicated children at similar or lower PbB levels than those indicated above. Among the most important and controversial of these electrophysiological and neuropsychological effects are indications of peripheral nerve dysfunction, indexed by slowed nerve conduction velocities (NCV) found in children with PbB levels lower than 30 ug/dl. EPA has concluded that while none of these studies on CNS effects can individually be regarded as conclusively proving significant cognitive (IQ) or behavioral effects

occurring below 30 ug/dl, they clearly indicate likely associations between neuropsychologic deficits and PbB levels as low as 30 to 50 ug/dl. The magnitude of average observed IQ deficits is approximately 5 points at mean PbB levels of 50 to 70 ug/dl and about 4 points at mean levels of 30 to 50 µg/dl. Whether a smaller risk exists at somewhat lower levels (15 to 30 µg/dl) cannot be determined at this time (EPA 1984e, 1985c).

Many different impacts (representing potentially impaired functioning and depleted reserve capacities of many different tissues and organs) have been noted at PbB levels below 30 ug/dl.

At PbB levels around 10 to 15 µg/dl, initial signs of detectable heme synthesis impairment occur in many different organic systems, indications of increasing degrees of pyrimidine metabolism interference, signs of altered nervous system activity, and interference in vitamin-D metabolism. EPA has stated that, on the basis of these data, these effects might be viewed as becoming sufficiently adverse to warrant avoidance as PbB levels exceed 20 to 25 µg/dl (EPA 1985c).

Reproduction and Development

There is a paucity of data on which to evaluate the effects of lead on reproduction and development in humans. Early studies of pregnant women exposed to high levels of lead indicated toxic, but not teratogenic, effects on the conceptus. One recently reported study hints at birth anomalies possibly associated with exposure to low lead levels (mean cord blood level of 15 µg/dl) among women in the general population. However, the significance of these studies has been questioned because of the absence of reported statistically significant associations between cord blood levels and specific types of minor anomalies or any major anomalies. There are also no reliable data pointing to adverse effects in human offspring following lead exposure to fathers.

EPA has concluded that the current collective human data regarding lead's effects on reproduction on *in utero* development are insufficient for accurate estimation of exposure-effect or no-effect levels (EPA 1984c). In the absence of sufficient data, it has been suggested that it would be prudent to avoid lead exposures resulting in PbB levels exceeding 25 to 30 µg/dl to pregnant women and women of

child-bearing age in general. This conclusion was based on the known equilibration between maternal and fetal blood lead concentrations and growing evidence of deleterious effects in young children as PbB levels approach 25 to 30 µg/dl. Industrial lead exposure of men with PbB levels of 40 to 50 µg/dl also appears to result in altered testicular function.

Carcinogenicity

Several studies have reported renal tumors in Wistar rats following ingestion of high doses of a lead salt (lead acetate). Lead subacetate (another lead salt) has produced benign tumors (renal carcinomas or adenomas) in Swiss mice and several strains of rats, but not golden hamsters. Gliomas (CNS tumors) were also observed in many of these studies.

There have been a number of epidemiological studies which have assessed the mortality experience of lead-exposed workers. In some of the studies, no excess cancer mortality was observed. In one study, non-statistically significant excess cancer mortality of the respiratory system and cancer of the digestive organs and peritoneum was reported, which on evaluation by other statistical techniques by another investigator was reported to achieve statistical significance. Another study has reported increased mortality from renal cancer among a group of lead smelting workers. However, this excess mortality, based on only six cases, did not achieve statistical significance. On review of all of these studies, EPA concluded that the absence of good lead exposure documentation made it difficult to assess the contribution of lead to the observed results.

The International Agency for Research on Cancer (IARC) has classified lead in Group 3, inadequate evidence for carcinogenicity in humans, sufficient evidence for carcinogenicity in animals (for some salts). EPA has classified lead in category B_2 (sufficient evidence in animals, insufficient evidence in humans) according to the Agency's Guidelines for Carcinogen Risk Assessment (51 Federal Register 33992-34003 September 24, 1986). However, the Agency noted that the doses inducing kidney tumors in positive rat studies were beyond the human lethal dose, and several epidemiological studies have not demonstrated an association between lead exposure and elevated cancer

occupationally exposed workers. Consequently, EPA has recently proposed to set an RMCL in drinking water based on noncarcinogenic endpoints.

Drinking Water Standards and Criteria

Standards. The current MCL for lead under the National Interim Primary Drinking Water Regulations is 50 µg/L. This limit was designed to limit PbB levels in 99.5% of the population of below 30 µg/dl.

NAS (1984) has stated that the current MCL, in view of other environmental sources of exposure, may not provide a sufficient margin of safety, particularly for fetuses and young children.

EPA, in agreement with this assessment, has recently taken the first step in lowering the MCL by issuing a proposed RMCL of 20 µg/L. This level was derived based on a target PbB level of 15 µg/dl for protecting children and infants, using a conversion factor of 6.25 to translate PbB to lead in drinking water (assuming a consumption of 1 liter of water per day) and an uncertainty factor of 5 (EPA 1985c). After finalization of the RMCL, EPA would then factor in other data, such as technological feasibility, to establish a revised MCL.

Criteria. EPA has not developed 1-day, 10-day, or longer-term HAs for lead. The lifetime HA of 20 µg/L is equivalent to, and was derived in the same manner as, the proposed RMCL (EPA 1985d).

The EPA ambient water quality criterion for the protection of human health is 50 µg/L (EPA 1980a).

J.15 MERCURY

Noncarcinogenic Effects

In the environment mercury typically exists in two basic forms: inorganic salt and organic mercury compounds. Inorganic mercury is poorly absorbed through the gastrointestinal tract, does not penetrate cell membranes rapidly, and is less toxic than methyl mercury. The principal target organ of inorganic mercury is the kidney. Organic

mercury compounds typically exhibit their toxicity in the central nervous system. Contamination of fish and shellfish by methyl mercury compounds has resulted in Minimata Disease in Japan, characterized by mental disturbances, ataxia, speech disturbances, and hearing impairment. As inorganic mercury is the form found in this study, the remainder of this profile will concentrate on inorganic mercury.

EPA has calculated an AADI of 5.5 µg/L for inorganic mercury based upon a NOAEL of 50 µg/kg/day reported in a study of rats, a factor of 0.739 to adjust for the content by weight of mercury in mercuric chloride, the specific chemical administered in the study; an uncertainty factor of 1,000; and an additional factor of 10 to compensate for the difference in absorption between subcutaneous exposure in the study and oral exposure in man (EPA 1985c).

Parenteral (injection) administration of highly toxic doses of inorganic and organic mercury to animals has resulted in teratogenic and reproduction effects. The human relevance of these experimental findings is unknown due to the high dosages used, and differences between routes of exposure (injection in animals versus ingestion or inhalation in man) (EPA 1984f).

Carcinogenicity and Mutagenicity

Mutagenicity studies of inorganic mercury have been equivocal. EPA has classified mercury in Group D, not classifiable---inadequate human and animal evidence of carcinogenicity (EPA 1985c).

Drinking Water Standards and Criteria

Standards. The current MCL for inorganic mercury under the National Interim Drinking Water Regulations is 2 µg/L. EPA has recently initiated a rule-making process to revise the MCL and has proposed an RMCL of 3 µg/L based upon the AADI of 5.5 µg/L, factoring in data on human exposure (4.3 µg/day via diet and 1 µg/day via air) (EPA 1985c).

Criteria. EPA has not established 1-day, 10-day, or longer-term HAs for mercury. The EPA lifetime HA was established in the same

manner and is equivalent to the EPA proposed RMCL of 3 ug/L (EPA 1985d).

EPA has not developed an inorganic mercury ambient water quality criterion for the protection of human health.

J.16 NICKEL

Noncarcinogenic Effects

Laboratory studies in animals have demonstrated depressed body weight gain, alterations in hematology parameters, cytochrome oxidase activity, and iron contents of organs following high oral nickel exposure.

Studies evaluating the effects of nickel administration on animal reproductive systems have produced varying results. Nickel is known to cross the placental barrier in animals, and some data suggest this is also true for humans. Intraperitoneal and intravenous injections of nickel compounds have produced some tetratogenic effects in animals. Increased fetal mortality and reduced fetal weights also were observed. In some studies, high dosages resulted in reduced fetal survival and decreased fetal weights in the absence of frank teratogenesis.

Feeding studies involving administration of various nickel compounds to rats are more applicable to human exposure situations. Various studies have reported a correlation between nickel concentration in food or water and reproductive performance. Nickel exposure has also been reported to impair male gametogenesis in mice and rats. No adverse reproductive effects linked to nickel exposure have been reported in humans.

Carcinogenicity and Mutagenicity

The chemical form and route of exposure may be important factors in determining the carcinogenic potential of nickel. Insoluble nickel compounds (e.g., metallic nickel, nickel subsulfide, and nickel carbonyl) have been shown to produce tumors following inhalation exposure. However, multiple studies in which nickel was administered orally to rats and mice have been uniformly negative (EPA 1985c). In

humans, excess respiratory cancer mortality has been demonstrated in epidemiological studies of nickel smelting and refining workers.

EPA has classified nickel in group B_2--sufficient evidence for carcinogenicity in animals, limited evidence in humans--according to guidelines for carcinogenic risk assessment (51 Federal Register 33992-34003 September 24, 1986), based upon the positive animal evidence for nickel subsulfide and carbonyl compounds.

Nickel chloride was not mutagenic, whereas nickel sulfate was found to be mutagenic in *in vitro* assays.

Drinking Water Standards and Criteria

Standards. There is no federal drinking water standard for nickel. EPA, however, has established a lifetime drinking water health advisory of 150 µg/L (EPA 1985c).

Criteria. EPA has derived 10-day HAs for a 10-kg child and 70-kg adult based on a NOAEL of 10 mg/kg/day reported in a study in rats (EPA 1985c). Ten-day HAs of 1,000 µg/L (child) and 3,500 µg/L (adult) were derived from the NOAEL using an uncertainty factor of 100, and standard EPA intake assumptions and physiological parameters.

Using a NOAEL of 5 mg/kg/day, reported in a 2-year feeding study in rats, EPA has derived an AADI and a lifetime HA for nickel in drinking water (EPA 1985c, EPA 1985d). An AADI of 350 µg/L was derived by applying an uncertainty factor of 100, an adsorption efficiency of 0.2, and assuming consumption of 2 liters per day (EPA 1985d). Using this AADI, EPA has derived a lifetime HA of 150 µg/L by factoring in human exposure (food of 400 µg/day and from air of 0.6 µg/day).

EPA's proposed ambient water quality criterion for the protection of human health is 632 µg/L (49 Federal Register 4551 February 1984).

J.17 RADIONUCLIDES

Introduction

There are approximately 2,000 known radioisotopes or radionuclides which emit radiation (e.g., alpha particles, beta particles,

gamma rays, or photon radiations) as they decay (EPA 1986b). Radionuclides can be classified into two categories--natural and man-made. The natural radionuclides are, for the most part, alpha particle emitters with some beta particle activity. The natural radionuclides involve three decay series which start with uranium-238, thorium-232, or uranium-235, and are called the uranium, thorium, and actinium series, respectively. Each series decays by either an alpha or beta particle through several radionuclides and ending with a stable isotope of lead.

Man-made radionuclides fall into two subcategories. The first, the transuranics (those radionuclides of elements higher on the periodic table than uranium), generally decay by both alpha and beta particle modes. The second, radionuclides below lead on the periodic table, undergo decay primarily by beta and/or gamma ray emission.

Humans are exposed to radiation from numerous sources including cosmic rays, radiation from the ground, and intake of radionuclides in food and drinking water. The annual average effective dose equivalent for natural background in the United States is approximately 200 millirems (mrem)/year, about 50 percent of which arises from inhalation of radon-222 and its decay products (EPA 1986b).

Health Effects

Radiation causes three general types of adverse health effects in humans: developmental and teratogenic effects, genetic effects, and somatic effects which include carcinogenesis, cataract of the lens of the eye, nonmalignant damage to the skin, and gonadal cell damage and impairment of fertility (EPA 1986b).

Based upon review of considerable epidemiologic evidence, including that of survivors of the Hiroshima and Nagasaki atomic bombings, EPA has classified radionuclides according to weight-of-evidence carcinogenicity criteria in Group A, human carcinogens (EPA 1986b). Although direct epidemiology studies do not exist for ingested uranium, the Agency has classified it in Group A--human carcinogen--because there is sufficient information that it deposits inbene and emits alpha particles and gamma rays in a way similar to radium, for which sufficient epidemiological evidence exists (EPA 1986b).

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Standards. The National Interim Primary Drinking Water Regulations for radionuclides were promulgated on July 9, 1986 (41 FR 28404). Interim MCLs were set at 5 picocuries per liter (pCi/L) for radium-226 and 228, 15 pCi/L for gross alpha activity (excluding radon and uranium), and a total dose equivalent of 4 mrem/year for man-made radioactivity. A separate standard was set for radium because, at the time of promulgation, EPA believed radium to be the most toxic of the radionuclides (EPA 1986b). The gross alpha particle activity standard was designed as a screening device to measure compliance with the radium MCL. When gross alpha activity exceeds 3 pCi/L, the regulations require determination of radium-228 and if it exceeds 5 pCi/L for radium-228. In addition, the standard serves as a gross indicator of high levels of other radionuclides (EPA 1986b).

The gross beta particle activity standard was designed to be a screening device to measure man-made radionuclides. The regulations require determination of gross beta particle activity, tritium, and strontium concentrations in every sample required under the regulation, and further require that the combination of all man-made radionuclides cannot result in a dose that exceeds 4 mrem/year. Strontium was specified because it is one of the most toxic fission products; tritium because it cannot be detected by the gross beta screening procedure (EPA 1986b). If the gross beta particle activity is greater than 50 pCi/L, then the drinking water must be re-analyzed to determine which other radionuclides are present. The dose from these radionuclides cannot exceed 4 mrem/year (EPA 1986b).

Criteria. EPA will shortly issue proposals to revise the interim drinking water standards for radionuclides. Based upon categorization in Group A, human carcinogens, EPA will establish a proposed RMCL of 0 to satisfy the statutory mandate which requires they be set so that "no known or anticipated adverse effects on persons will occur, with an adequate margin of safety" (EPA 1986b).

EPA has developed an AADI of 60 μg/L for uranium based upon noncarcinogenic effects, based upon a NOAEL of 1 mg/kg/day reported in animal studies. EPA derived the AADI based upon an uncertainty factor

of 100, animal uptake of one percent, human uptake of 5%, and standard assumptions (2 liters/day and 70-kg weight) (EPA 1986b). This AADI corresponds to 40 pCi/L (EPA 1986b).

J.18 TETRACHLOROETHENE (PERCHLOROETHYLENE or PERC)

Noncarcinogenic Effects

The principal toxic effects following acute exposure in animals to tetrachloroethene (PERC) are depression of the CNS, ataxia (failure of muscular coordination), and respiratory cardiac arrest. Subchronic and chronic effects in animals include damage to the liver and kidney effects. In humans, the principal effects are CNS depression and liver toxicity.

Carcinogenicity and Mutagenicity

A 1977 NCI bioassay in which PERC was administered by gavage reported increased incidence of liver tumors in mice but not rats (EPA 1985d). A draft report of a NTP inhalation bioassay, currently under internal review, has noted an increased incidence of tumors in mice and rats. Although EPA has previously categorized tetrachloroethylene in Group B_2--probable human carcinogen (EPA 1985b, 1985h)--the Agency is awaiting final results of the NTP bioassay before commencing a rule-making for the chemical in drinking water.

PERC has been evaluated for its ability to cause gene mutation, chromosomal aberrations, unscheduled DNA synthesis, and mitotic recombination. In general, these responses have been weak and were observed at high concentrations that were cytotoxic (EPA 1985h). Additionally, no dose-dependent relationships were demonstrated in these studies (EPA 1985h).

Drinking Water Standards and Criteria

Standards. EPA has not established a MCL for PERC in drinking water. The agency is scheduled to begin rule-making procedures to establish a MCL in the near future.

Criteria. In the absence of suitable data, EPA has not derived a 1-day HA for PERC. EPA derived a 10-day HA based upon a LOAEL of 70

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mg/m^3 reported in a study of humans following inhalation for 7 hours per day for 5 consecutive days. Using the LOAEL, an uncertainty factor of 1,000, and various intake and physiological assumptions, EPA derived a 10-day HA for a 10-kg child of 34,000 µg/L.

Using a NOAEL of 475 mg/m^3 reported in a subchronic inhalation study in rats, a 100-fold safety factor, and standard assumptions, EPA derived longer-term HAs of 1,940 µg/L (child) and 6,800 µg/L (adult). Using a similar methodology, EPA derived a lifetime noncarcinogenic HA of 680 µg/L for 70-kg adult based on a NOAEL of 475 mg/m^3 reported in a chronic inhalation study of rats (EPA 1985d).

As noted by EPA, the lifetime HA applies to noncarcinogenic effects only, and would correspond to significant estimated lifetime cancer risks (EPA 1985d).

NAS has calculated 1-day and 10-day SNARLs for noncarcinogenic effects of 172,000 µg/L and 24,500 µg/L, respectively (NAS 1980).

The EPA ambient water quality criterion for the protection of human health corresponding to an one-in-a-million incremental lifetime excess risk estimated on the basis of animal data is 0.8 µg/L (EPA 1980a).

J.19 TOLUENE

Noncarcinogenic Effects

Acute or chronic exposure to high levels of toluene in animals results in CNS depression and effects on the lungs, liver, and kidney.

EPA has derived an AADI for drinking water consumption based upon a 24-month inhalation study in rats (EPA 1985c). Based upon a NOAEL of 1,130 mg/m^3, an uncertainty factor of 100, and assuming 50 percent pulmonary absorption, EPA derived an AADI of 10,100 µg/L (EPA 1985c).

Carcinogenicity and Mutagenicity

Only one long-term carcinogenicity bioassay of toluene has been reported. This study concluded that toluene was not carcinogenic following inhalation in rats. NTP is conducting carcinogenicity

studies in which toluene is being administered by inhalation and gavage to rats and mice. In addition, carcinogenicity studies by European investigators are expected to be published in the next few years. According to weight-of-evidence carcinogenicity criteria, EPA has classified toluene in Category D, not classifiable as to human carcinogenicity (EPA 1985c).

Toluene has not been shown to be mutagenic in *in vivo* or *in vitro* assays (EPA 1985c).

Drinking Water Standards and Criteria

Standards. In the first stage of the rule-making process designed to establish a MCL for toluene in drinking water, EPA has issued a proposed RMCL of 2,600 µg/L derived from the AADI of 10,100 µg/L by allocating a 20 percent drinking water contribution to total intake from all sources of exposure (EPA 1985c). Subsequent to finalization of the RMCL, EPA will evaluate analytical feasibility and feasibility of control in establishing an enforceable MCL.

Criteria. In the absence of adequate dose-response data for oral exposure to toluene, EPA derived a 1-day HA, based on NOAEL of 377 mg/m^3 reported in studies of humans, the subjects of single inhalation exposures for up to 8 hours. Based upon the NOAEL, an uncertainty factor of 100, and a variety of physiological parameters and intake assumptions, EPA derived 1-day HAs of 18,000 ug/L and 63,000 µg/L for a 10-kg child and 70-kg adult, respectively (EPA 1985d).

In the absence of sufficient data, EPA derived 10-day HAs of 6,000 µg/L (child) and 21,000 µg/L (adult), by applying an uncertainty factor of 3 to the 1-day HA. The Agency utilized a three-fold rather than the usual 10-fold uncertainty factor because toluene is rapidly distributed and excreted and because the chemical presents little bioaccumulation potential relative to typical toxicants (EPA 1985d).

The EPA ambient water quality criterion for the protection of human health is 14,300 µg/L (EPA 1980a).

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Noncarcinogenic Effects

The principal noncarcinogenic effects of 1,1,1-trichloroethane (TCA) following exposure in animals and man are depression of the CNS, increase in liver weight, and cardiovascular changes. Current data do not suggest that TCA is reproductive of developmental toxin.

EPA has developed a risk reference dose (RRfD) of 0.35 mg/kg/day based upon a NOAEL of 1,365 mg/m^3 reported in a study in which mice were exposed by inhalation for 14 weeks. EPA derived the RRfD by application of an uncertainty factor of 100, a 30% absorbed dose, and standard physiological parameters (EPA 1985d).

Carginogenicity and Mutagenicity

There have been two TCA carcinogenicity bioassays. The first, conducted by NCI, was judged to be inadequate due to poor survival in treated animals. Preliminary results of the second, by NTP, showed elevated incidences of hepatocellular carcinomas. These initial results have been questioned and the study is currently being audited (EPA 1985b).. Based upon these results, EPA has classified TCA according to weight-of-evidence criteria in Group D, not classifiable--inadequate human and animal evidence of carcinogenicity (EPA 1985b).

Drinking Water Standards and Criteria

Standards. Currently, there is no MCL for TCA in drinking water. In the first phase of a regulatory program to establish a MCL, EPA has issued a final RMCL of 200 µg/L (EPA 1985b). The RMCL was derived from the RRfD of 35 mg/kg/day by application of standard weight (70 kg), drinking water intakes (2 liters/day), and allocation of 20% of total daily intake to drinking water intake (EPA 1985b).

Criteria. EPA has developed a 1-day HA based upon a LOEL of 1.4 g/kg/day reported in a study of rats receiving a single oral dose of TCA. Based upon the LOEL, and standard weight and intake assumptions, EPA derived a 1-day HA of 14,000 ug/L for a 10-kg child (EPA 1984d). In the absence of sufficient data, EPA has not developed a 10-day HA.

EPA has developed longer-term HAs of 35,000 µg/L (child) and 125,000 µg/L (adult), based upon a NOAEL of 0.5 g/kg/day reported in a study in rats receiving TCA by gavage for 12 weeks (EPA 1985d).

The EPA lifetime HA of 200 µg/L is equivalent to and was derived by the same methodology as the RMCL (EPA 1985d).

The EPA ambient water quality criterion for TCA for the protection of human health is 18,700 µg/L (EPA 1980a).

J.21 TRICHLOROETHENE (TCE)

Noncarcinogenic Effects

The principal toxicological effect of concern for trichloroethene (TCE) is carcinogenicity. Noncarcinogenic effects include CNS disturbances and kidney and liver damage following exposure to relatively high airborne concentrations.

Carcinogenicity and Mutagenicity

Six studies of the carcinogenicity of TCE in animals have been published. Two have reported significant increases in liver tumors in mice. EPA has judged three others as technically flawed. A sixth reported that TCE, containing epichlorohydrin and epoxybutane, was carcinogenic in a less responsive mouse strain, but pure TCE was not (EPA 1985b). Recognizing the lower responsiveness of the mice in the latter study, EPA has classified TCE based upon weight-of-evidence carcinogenicity guidelines in Category B2--probable human carcinogen.

Commercial TCE containing stabilizers has been reported to be weakly mutagenic in a variety of *in vitro* and *in vivo* assays representing a wide evolutionary range of organisms (EPA 1985g). Based on these data, EPA has concluded that commercial TCE may have the potential to cause weak or borderline increases above the spontaneous level of mutagenic effects in exposed human tissues (EPA 1985g).

Drinking Water Standards and Criteria

Standards. EPA is currently conducting a rule-making procedure to establish a MCL for TCE in drinking water (EPA 1985b). As a first

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step in the ruling, EPA has established an RMCL of 0 based upon the Agency's determination that no level of exposure above 0 is an acceptable health goal for a carcinogen. Based upon analytical feasibility and control considerations, EPA has issued a proposed MCL of 5 µg/L. Subsequent to review of the rule-making record, EPA will establish an enforceable MCL.

Criteria. In the absence of suitable data, EPA has not developed 1-day, 10-day, or longer-term HAs for TCE (EPA 1985d). Based upon a LOAEL reported in a 14-week rat inhalation study, EPA developed a lifetime HA of 260 µg/L (EPA 1985d). In the derivation, EPA applied a 1,000-fold uncertainty factor and various intake assumptions to a LOAEL of 300 mg/m^3. However, as TCE has been classified as a probable human carcinogen, this level should not be applied (EPA 1985d).

EPA has also developed an ambient water quality criterion for protection of human health based upon noncarcinogenic effects of 6,770 µg/L (EPA 1980a).

J.22 VINYL CHLORIDE

Noncarcinogenic Effects

Chronic exposure to relatively high levels of vinyl chloride in man has resulted in CNS disturbances, pulmonary insufficiency, gastrointestinal toxicity, and hepatoxicity (EPA 1985d). In addition, administration of animals has resulted in hematologic, biochemical, and organ weight effects.

Currently, data do not indicate that vinyl chloride is a reproductive and developmental toxin.

Carcinogenicity and Mutagenicity

Vinyl chloride has been shown to be a human and animal carcinogen. In humans, vinyl chloride exposure is associated with angiosarcoma of the liver. In animals, following oral administration or inhalation, several tumor types have been reported including: mammary carcinomas, liver angiosarcomas, and pulmonary angiosarcomas. Based

on these data EPA has classified vinyl chloride, according to weight-of-evidence carcinogenicity criteria, in Group A--human carcinogen (EPA 1985b).

Vinyl chloride is mutagenic in a variety of in vitro assay systems. In workers, findings of chromosomal aberrations have conflicted with some studies reporting positive and effects other studies reporting negative effects.

Drinking Water Standards and Criteria

Standards. There is currently no MCL for vinyl chloride in drinking water. In the first phase of a rule-making process to establish a MCL, EPA has developed a final RMCL of 0, established on the basis that no level of exposure above 0 is an acceptable health goal for a carcinogen (EPA 1985b). Based upon analytical feasibility and feasibility of removal technology, EPA has issued a proposed MCL of 1 ug/L (EPA 1985b).

Criteria. In the absence of sufficient data for calculation of a 1-day HA, EPA has suggested that the 10-day HA be used as a 1-day HA. The 10-day HA of 2,600 µg/L for a 10-kg child was based upon a NOAEL of 30 mg/kg/day reported in a study in which rats received vinyl chloride by gavage for 13 weeks. The longer-term HA of 13 µg/L for a 10-kg child was based upon a NOAEL of 0.13 mg/kg/day reported in a lifetime study in rats receiving vinyl chloride by gavage. Derivation of both 10-day and longer-term HAs was performed using an uncertainty factor of 100 and standard intake and physiological assumptions. Because vinyl chloride is classified as a human carcinogen, EPA has declined to develop a lifetime HA based upon noncarcinogenic effects.

Using the 95% upper confidence limit of animal data, and the multistage model, NAS has estimated that lifetime exposure to 1 µg/L vinyl chloride would correspond to the estimated incremental one-in-a-million ($1x\ 10^{-6}$) increased lifetime cancer risk (NAS 1977).

The EPA ambient water quality criterion for the protection of human health is 2 µg/L, corresponding to an estimated 1×10^{-6} lifetime cancer risk estimated on the basis of animal data (EPA 1980a).

J.23 XYLENES

Noncarcinogenic Effects

Exposure to high concentrations of xylene has resulted in central nervous system disturbances such as changes in numerative ability, reaction time, short-term memory, and electroencephalographic patterns.

In the absence of sufficient dose-response data for the oral exposure route, EPA has derived an AADI for xylene in drinking water based upon a NOAEL of 337 mg/m^3 reported in a 90-day inhalation study in rats, guinea pigs, cats, and dogs (EPA 1985c). EPA derived an AADI of 2,200 µg/L by application of an uncertainty factor of 1,000, and standard intake assumptions and physiological parameters to the NOAEL (EPA 1985c).

Carcinogenicity and Mutagenicity

Little data are available on the carcinogenicity of xylene. One study examined the dermal effects of xylene and concluded that xylene was not a skin tumorigen. A long-term carcinogenicity bioassay is being conducted by NTP. Pending the findings of this study, EPA has classified xylene according to its weight-of-evidence carcinogenicity criteria in Group D, not classifiable as to human carcinogenicity (EPA 1985c); o-xylene, m-xylene, or p-xylene were not mutagenic in a limited number of *in vivo* and *in vitro* assays.

Drinking Water Standards and Criteria

Standards. In the first stage of a rule-making procedure designed to establish a MCL for xylene in drinking water, EPA has issued a proposed RMCL of 440 µg/L. EPA derived the proposed RMCL based upon the AADI of 2,200 µg/L assuming that drinking water contributed 20 percent of total daily intake. Subsequent to finalization of the RMCL, EPA will propose and finalize a MCL by incorporating analytical feasibility and feasibility of control factors into the RMCL.

Criteria. In the absence of sufficient dose-response data for the oral route, EPA derived 1-day and longer-term HAs based upon

inhalation studies. Based upon a NOAEL of 1,300 mg/m^3 reported in a study in human volunteers, an uncertainty factor of 10, and various physiological parameters and intake assumptions, EPA derived 1-day HAs of 12,000 µg/L (10-kg child) and 42,000 µg/L (70-kg adult).

Ten-day and longer-term HAs were derived from a NOAEL of 200 mg/m^3 reported in a rat inhalation study involving exposure to mixed xylenes. Based upon the NOAEL, an uncertainty factor of 100, and standard intake assumptions and physiological parameters, the Agency derived 10-day HAs of 7,800 µg/L (child) and 27,000 ug/L (adult).

The Agency derived a lifetime HA of 440 ug/L by applying an uncertainty factor of 1,000 and standard assumptions and physiological parameters to a NOAEL of 337 mg/m^3 reported in a subchronic inhalation toxicity study in rats, guinea pigs, monkeys, and dogs (EPA 1985d).

EPA has not developed an ambient water quality criterion for xylene for the protection of human health.

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15 409

APPENDIX L

BIOGRAPHIES OF KEY PERSONNEL

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PAUL R. KOPSICK

Project Manager
Chief Geologist

EDUCATION:

M.A., Geology, State University of New York at New Paltz
B.S., Geology, State University of New York at New Paltz
A.A., Ulster County Community College

EXPERIENCE:

With six years' directly related, professional experience, Mr. Kopsick specializes in hydrology, environmental geology, geomorphology, and the geological aspects of hazardous waste site investigation. In addition to his geohydrological technical and management assignments, he has been responsible for the development of several customized computer applications that have streamlined E & E's administrative and technical efforts for hazardous waste site investigation.

For example, Mr. Kopsick developed a method to provide quality control checks of Hazard Ranking System (HRS) site scoring worksheets. This application checks the 80+ calculations needed to complete the form and enables prediction of HRS scores under a number of hypothetical and "worst-case" scenarios. One benefit derived from this check is that the program may be used as a sensitivity analysis to determine sites that may achieve a more significant score for ranking. The technique is used as a cost/benefit analysis.

Mr. Kopsick was E & E project manager for a Resource Conservation and Recovery Act site investigation to evaluate solid waste management units at the Vulcan hazardous waste site in Wichita, Kansas, to determine whether releases had occurred which could pose a threat to human health or the environment. For this site, Mr. Kopsick also led the preliminary assessment/site inspection.

In addition, Mr. Kopsick was project manager for E & E evaluations of environmental problems associated with several federal facilities, including Whiteman Air Force Base (AFB) and Richards-Gebaur AFB in Missouri, Vance AFB in Oklahoma, and Norton AFB in California under the Air Force Installation Restoration Program. He also has directed Comprehensive Environmental Response, Compensation, and Liability Act investigations at the Sunflower Army Ammunition Base in Kansas and the former United States Navy Ammunition Base in Hastings, Nebraska.

ROBERT A. MARSZALKOWSKI Technical Program Coordinator

EDUCATION:

M.S., Environmental Engineering, Polytechnical University of Warsaw, Poland
B.S., Civil Engineering, State University of New York at Buffalo

EXPERIENCE:

Mr. Marszalkowski has been a hazardous and toxic substance project manager with E & E for three years. He is responsible for developing and managing feasibility studies for government and private clients and participates in the development of liquid waste treatment systems to reclaim water contaminated by hazardous substances.

He was program technical coordinator for E & E's work for the United States Air Force Installation Restoration Program, which involves the performance of remedial investigations (RIs) at various installations nationwide. In particular, Mr. Marszalkowski managed the presurvey and survey activities, including the preparation of work plans and detailed cost estimates for multiple-site RIs, at Whiteman, Reese, Richards-Gebaur, and Vance Air Force bases. He also led special investigations in Oregon at five suspected hazardous waste sites, including three municipal/industrial landfills, a munitions factory, and a wood-preserving chemical plant. For these assignments, he was responsible for logistics, timeliness, and technical quality.

Mr. Marszalkowski held responsibility for the development of sampling specifications and estimation of manpower schedules, equipment, and associated costs for waste tank sampling, analysis, decontamination, removal, and disposal at the Bridgeport Rental and Oil Services National Priorities List (NPL) site in New Jersey, which involves the single largest Superfund allocation to date (over $55 million). He assisted in delineating the complex groundwater situation that exists beneath the site (i.e., three separate groundwater zones with areas of vertical migration between the upper and middle zone and the middle and deep zone); helped define potential contaminant migration pathways; and used this information to resolve engineering questions related to the design of the most appropriate remedial measures.

Mr. Marszalkowski designed remedial action strategies, completed a detailed feasibility evaluation of alternatives, and provided environmental engineering input to the preparation of a community relations presentation describing the selected remedial alternative for the Whitehouse Oil Pits NPL site. He was project manager for RI support activities conducted for the Commonwealth of Pennsylvania at the Welsh Road hazardous waste site, for which he wrote the remedial action master plan and work plan. He also assisted in the engineering review of remedial action plans during E & E's extensive investigative work at the Hyde Park NPL site in Niagara Falls, New York.

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ANDREW P. CLIFTON Direct r, Analytical Services Center

EDUCATION:

B.S., Chemistry, cum laude, University of Sussex, Great Britain

EXPERIENCE:

As director of E & E's Analytical Services Center (ASC), Mr. Clifton has overall responsibility for the facility's operation as a multi-functional, high-quality environmental laboratory. He directs a staff of over 30 professional chemists and ensures that the laboratory quality assurance/quality control (QA/QC) program, laboratory and field sample chain-of-custody documentation and reporting procedures, and laboratory safety protocol are continually reviewed to incorporate the most current methodologies.

Mr. Clifton was instrumental in attaining the ASC's certification for the United States Environmental Protection Agency Contract Laboratory Program for the organic analysis of Superfund site samples. For this contract, Mr. Clifton is responsible for maintaining the ASC's state-of-the-art capabilities in gas chromatograph/mass spectrometer (GC/MS) and GC/electron capture detection instrumentation, and for insuring that the laboratory produces data that will withstand scrutiny in administrative and judicial proceedings.

With 16 years' experience as an analytical chemist, Mr. Clifton has managed and performed analyses of environmental samples for routine indicators of pollution as well as for specific pollutants such as pesticides, polychlorinated biphenyls and other toxic organics, and heavy metals. He was the manager of the environmental and analytical laboratory operated by E & E for the Royal Commission for Jubail and Yanbu at Madinat Yanbu Al-Sinaiyah, Saudi Arabia, where he was responsible for the analysis of seawater, groundwater, sanitary and industrial wastewater, and drinking water using atomic absorption, autoanalysis, gas chromatography/mass spectrometry, and classical laboratory techniques. He conducted ambient air and upper air monitoring using state-of-the-art automatic air quality instrumentation and meteorological equipment. As laboratory manager, he provided quality control and appropriate sample chain of custody, and he conducted and directed laboratory data computation and report preparation activities. In addition to his laboratory duties, he assisted in the extensive underwater biological surveys conducted at Yanbu.

GERALD L. WEINSTEIN **Toxicologist**

EDUCATION:

M.S., Environmental Science (Health), George Washington University
B.S., Chemistry, Carnegie-Mellon University

EXPERIENCE:

With 13 years' experience in toxicology, chemistry, and the interpretation of pertinent federal and state regulations, Mr. Weinstein specializes in toxicological risk and endangerment assessment. For E & E investigations of hazardous waste sites, he interprets data concerning chemical characteristics, migration routes, and concentrations to determine exposure media, the human population at risk and potential adverse health impacts on sensitive environmental receptors.

For the Sapp Battery federal Superfund site in Florida, Mr. Weinstein conducted a comprehensive multimedia human health and environmental risk assessment for lead and other heavy metals to evaluate potential exposure to the public and to aquatic life. Human exposure routes evaluated included ingestion and inhalation of contaminated soil particles and ingestion of contaminated drinking water and fish. Based on the assessment, Mr. Weinstein developed media-specific cleanup criteria that were used for the selection, screening, and design of remedial alternatives for the site. Mr. Weinstein also has performed risk assessments for the remediation of human health risks posed by dioxins, polychlorinated biphenyls, and other chemicals at the Hyde Park, New York, federal Superfund site. Other risk assessments involving potential human health threats from heavy metals and organic chemicals have been conducted for the United States Air Force, State of Florida, and National Guard.

Mr. Weinstein worked for five years as a project manager with the Occupational Health and Safety Administration (OSHA) in Washington, DC. As project manager responsible for the development and promulgation of regulations designed to protect workers exposed to carcinogens, he critically evaluated toxicological and epidemiological studies assessing the toxic effects and associated risks of chemicals on humans; conducted briefings and prepared position papers for OSHA decision makers analyzing the major regulatory options; conducted field visits to analyze work processes, control technologies, industrial hygiene programs, and work health hazards; and wrote technical analyses representing OSHA determinations concerning the severity of health hazards, feasibility of control technology for reducing exposures, and derivation of the maximum permissible exposure limits. These written analyses appeared in the Federal Register as preambles to proposed and final OSHA health standards.

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WILLIAM KWOKA

Soil Gas Survey
Manager

EDUCATION:

M.S., Chemistry, Trinity College
B.A., Chemistry, University of Connecticut
A.S., Chemistry, New Haven College

EXPERIENCE:

Mr. Kwoka has 16 years' experience in hazardous waste site investigation and safety, chemical laboratory analysis, and the handling of toxic and radioactive materials. As an E & E regional safety and training coordinator, he has reviewed the hazards at over 300 waste sites, reviewed site safety plans to determine compliance with corporate and regulatory safety criteria and standard operating procedures, and conducted on-site safety audits. He has performed soil gas sampling to evaluate the extent of vertical and horizontal contamination and has assisted in refining the technique to increase the sensitivity of the analysis. Mr. Kwoka also has performed field screening tests on drum samples at hazardous waste sites and has made recommendations for emergency drum removal operations.

In all, Mr. Kwoka has provided on-site chemical expertise to E & E field investigations at over 100 sites. He has served as project manager for about 20 preliminary assessments and three site investigations. He has supervised the sampling and evaluation of two sites that were contaminated with radioactive isotopes (uranium, radium, and radon). He has completed over 10 site scoring assignments using the federal Hazards Ranking System. In addition, Mr. Kwoka has provided project management, documentation, safety, and sampling for 20 dioxin-contaminated sites, two sites contaminated with polychlorinated biphenyls, a wood-preservative site in central Missouri, and a mine tailing site in Missouri/Kansas.

Mr. Kwoka has performed endangerment assessments for sites in Colorado and Iowa. He overviewed the chemical data and hazard evaluation for the Des Moines trichloroethylene National Priorities List site in Iowa and performed soil gas analyses in support of the investigation. He also has performed specialized sampling at sites where acute exposure to chemical agents was suspected. In one case, he sampled the air in a residence for mercury vapor to determine if it was the source f mercury that appeared to be poisoning an infant. In another instance, he sampled for volatile chemicals to investigate why on-site workers felt dizzy and why several persons in downwind locations suddenly lost consciousness.

JOSEPH C. CHANDLER — Health and Safety Officer

EDUCATION:

B.S., Agricultural (Soil and Water) Engineering, Iowa State University at Ames

EXPERIENCE:

Mr. Chandler, an Engineer-in-Training in Iowa, provides environmental engineering expertise for E & E field investigations of hazardous waste sites. He participates in the engineering design and evaluation of environmental pollution control measures and assists in the finalization of cost estimates and engineering design plans and specifications.

He recently has completed several Resource Conservation and Recovery Act (RCRA) facility assessments under E & E's REM IV contract with the United States Environmental Protection Agency. For example, he assisted in the preparation of the preliminary review report and sampling visit (SV) work plans for the Iowa Army Ammunition Plant (IAAP) and Mobay Corporation, a pesticide manufacturer. Mr. Chandler also was site safety officer and a member of the field team that conducted the visual site inspection (VSI)/SV for IAAP; and he participated in the Mobay VSI. He has provided training in RCRA facility assessments to new E & E personnel.

Mr. Chandler also has served as E & E manager for two Tier 3 National Dioxin Strategy site studies and has supported numerous other dioxin sampling efforts. He also has managed 18 preliminary assessments and nine site investigations. He has performed five site cleanup priority scorings using the federal Hazard Ranking System and has assisted in the development of three emergency action assessments.

Mr. Chandler served for several years as an environmental engineer for the State of Iowa Department of Water, Air and Waste Management. For two years, he led state technical and project management personnel conducting investigations under the RCRA/Uncontrolled Hazardous Waste Site Program, assisted in preparing the application to authorize the State of Iowa to take over the federal hazardous waste program, and developed departmental procedures for the performance of hazardous waste site preliminary assessments and field investigations. He led state personnel and supervised consultants in investigations of the following National Priorities List sites: Aidex, Council Bluffs, Vogel Paint, LaBounty Landfill, Des Moines TCE, and Frit Industries. He supervised state-led remedial investigation/feasibility studies (RI/FSs) for the Vogel Paint & Wax Company, Aidex, and ALCOA sites and participated in the Des Moines TCE RI/FS and the LaBounty Landfill focused feasibility study.

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MARK R. MAYO Environmental Specialist

EDUCATION:

B.S., Environmental Engineering Technology, Kansas State University
B.S., Biology, Kansas State University

EXPERIENCE:

Mr. Mayo participates in E & E field investigations and emergency response actions, evaluates site regulatory compliance, and participates in site-specific engineering designs.

As part of E & E's work under the REM IV contract with the United States Environmental Protection Agency, Mr. Mayo has performed Resource Conservation and Recovery Act facility assessments at Bob's Home Service (BHS), a secure landfill in Wright City, Missouri; and at Radium Petroleum, an oil recycling facility and hazardous waste incinerator site in Kansas City, Missouri. He prepared the preliminary review reports and sampling visit (SV) work plans for both facilities. In addition, he was the team leader for the visual site inspections and SVs for both sites.

Mr. Mayo was a member of the E & E team that conducted an extensive dioxin sampling and analysis program at two United States military installations to provide third-party verification of the feasibility of various destruction technologies to remove dioxin from soils, as well as to determine the feasibility of using an electric arc reactor to volatilize dioxin from soil. During the program, Mr. Mayo participated in the collection of verification samples of untreated and treated soil, effluent water from the process carbon filter, solids from the scrubber liquid, and nitrogen vent gas. For the evaluation of the electric gas reactor process, he sampled untreated and treated soil, baghouse particulates, and carbon from the process carbon filter.

Mr. Mayo's other site investigation experience includes the performance of pump tests at the Des Moines trichloroethylene site, a National Priorities List hazardous waste site in Des Moines, Iowa; monitoring-well sampling at several landfills in Kansas; service as site safety officer during an E & E reconnaissance of the Co-Op Grain and Supply site in Blue Hill, Nebraska; and performance of a geophysical survey at the Baldwin Park site in Aurora, Missouri.

Mr. Mayo also has been an emergency response team member for several transportation-related spill incidents. In Kansas City, Missouri, he sampled leaking drums and arranged for their disposal; and also served as site safety officer. In Lebo, Kansas, he investigated drums on a truck that were leaking a flammable resin (butyl alcohol and xylene). He coordinated the cleanup of a transportation-related oil spill in Painesville, Ohio.

SHARON P. MARTIN Geophysical Survey Manager

EDUCATION:

M.S., Geology, University of Missouri at Kansas City
B.S., Geology, University of Missouri at Kansas City
B.A., Sociology, University of Missouri at Kansas City

EXPERIENCE:

At E & E, Ms. Martin conducts geophysical and geohydrological investigations of hazardous waste sites. Her work encompasses environmental sampling and monitoring and determination of the presence of contaminants, extent of contamination, and contaminant migration pathways. Ms. Martin has conducted electromagnetic conductivity, magnetometer, resistivity, and seismic surveys at 10 hazardous waste sites. The results of her geophysical studies at these sites, which include Whiteman Air Force Base in Missouri and Hastings Naval Ammunitions Depot in Nebraska, reduced the scope of future phases of work by lowering the requirements for laboratory analysis. She performed other geophysical surveys using electromagnetic and magnetic techniques and seismic and resistivity methods at Johnson County Industrial Airport in Kansas, the Rosencrans Landfill in Missouri, and the Maytag Dump in Iowa. She also has prepared a guide for the use of electromagnetic conductivity surveys at hazardous waste sites, for use in characterizing wastes, geology, and groundwater in the field. She conducted sampling and hazard evaluations of Economy Products in Nebraska and the Red Oak City Landfill in Iowa. For the latter site, Ms. Martin also completed the federal Hazard Ranking System score.

Ms. Martin also has led large-scale site inspections at hazardous waste sites to determine the extent of contamination. The work at two of these sites required the aquisition and oversight of subcontractor personnel.

Ms. Martin has been team leader for three dioxin sampling expeditions in the St. Louis, Missouri, area (Monsanto, Redbird/Simpson landfills, and the Times Beach spur levee construction areas). She has completed summary reports for three additional dioxin sites, incorporating preliminary assessment information with the available data for Jones Truck Line and Hamill Transfer in St. Louis, and Bull Moose Tube in Gerald, Missouri. She also prepared the site sampling map for the Syntex facility in Verona, Missouri.

Ms. Martin is E & E geophysicist for the Resource Conservation and Recovery Act preliminary assessment/site inspection of Vickers, Inc., in Joplin, Missouri.

MICHAEL MICHALOWSKI Environmental Specialist

EDUCATION:

B.S., Human Development/Family Life, University of Kansas at Lawrence
B.S., Environmental Studies, University of Kansas at Lawrence
A.S., Environmental Protection Technology, Kansas Technical Institute

EXPERIENCE:

Mr. Michalowski has 10 years' experience in environmental field investigation. At E & E, he conducts sampling of soil, sediment, surface water, and groundwater; performs sample field screening using portable instrumentation; and monitors the work of drilling and other on-site contractors to assure compliance with technical and budgetary contract stipulations. In addition, he conducts literature searches and interviews with site, public, and agency representatives. He uses the results of his fieldwork to assist in determining the nature, extent, magnitude, and pathways of contamination.

Mr. Michalowski worked for eight years with the United States Geological Survey (USGS) in Kansas. For 2 1/2 years, as a hydrologic technician in Lawrence, he collected and computed hydrologic field data for publication in the 1983 and 1984 Kansas Water Resources publication. He computed streamflow measurements, collected water quality and sediment samples, and measured and monitored groundwater wells. As a water quality/hydrologic technician in Salinas for 5 1/2 years, Mr. Michalowski completed most of USGS' water quality projects in central Kansas. His responsibilities encompassed the collection of chemical, biochemical, biological, and sediment samples; fabrication of a basic water quality laboratory within the USGS warehouse and conversion of a stock van into a mobile laboratory van; maintenance of the equipment inventory; preparation of chemical standards and bacterial agars for field sampling; preparation and shipment of water and sediment samples to various government laboratories; and performance of hydrologic data collecting, surface water measurements, and field data computations.

As a microbiology and physics laboratory assistant at Kansas Technical Institute, Mr. Michalowski prepared chemical standards, reagents, and bacterial alagers and helped design and build the institute's miniature water treatment plant.

EDUCATION:

B.S., General Studies, University of Kansas at Lawrence

EXPERIENCE:

Mr. Cook is a team geologist for E & E investigations of hazardous waste sites. He conducts sampling of soil, surface water, sediment, and groundwater; plans and installs groundwater monitoring-well networks; supervises the activities of drilling subcontractors; conducts geophysical surveys utilizing magnetometer, ground-penetrating radar, and seismic refraction instrumentation; and conducts soil gas screening. He uses the results of his fieldwork to determine the extent and pathways of contamination and to aid in the selection and evaluation of site-specific remedial alternatives.

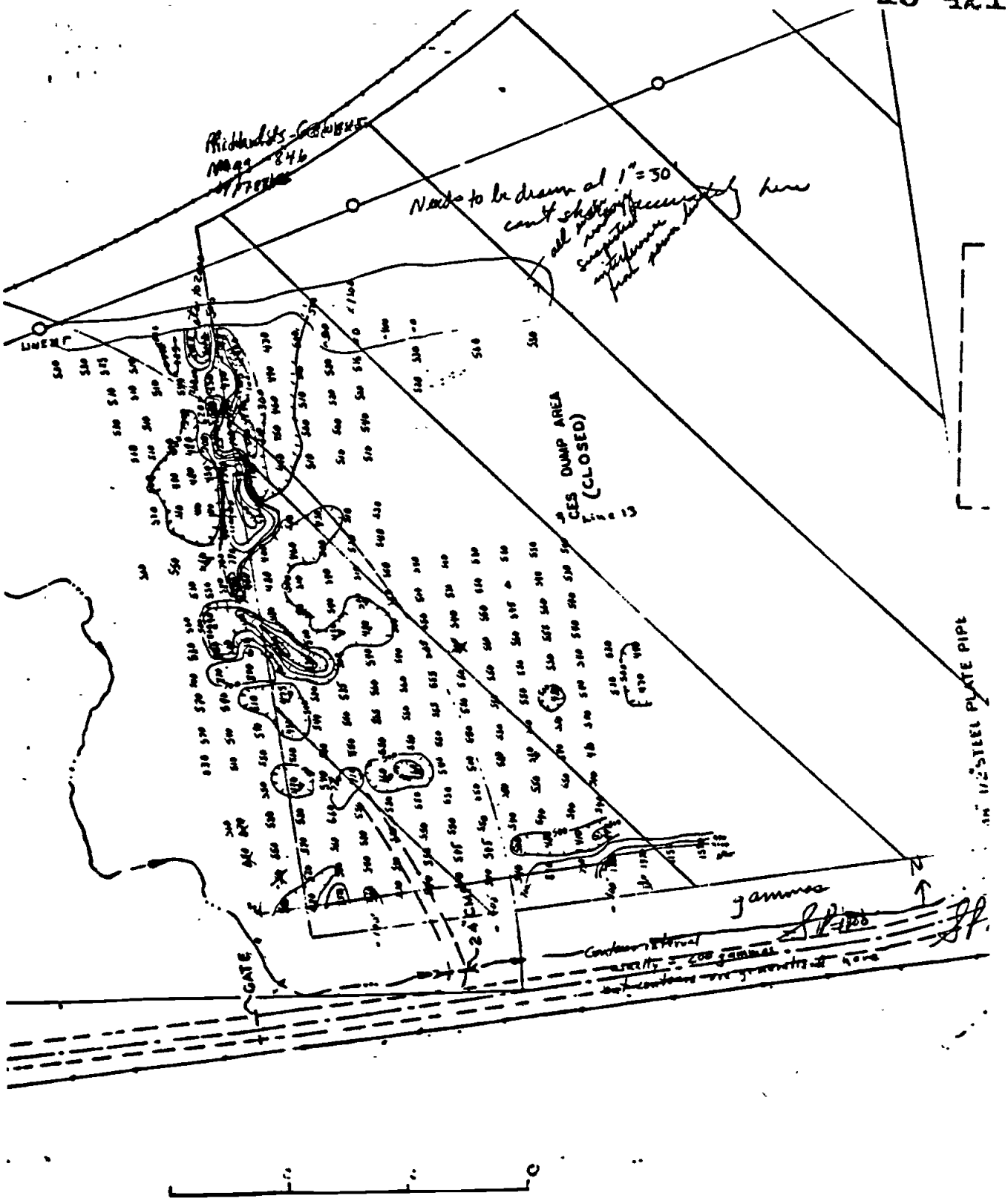
As an environmental technician with the Kansas Department of Health and Environment, Bureau of Environmental Remediation, Mr. Cook assisted in the preparation of technical reports and maps for three hazardous waste sites that later were placed on the National Priorities List: Mid-American Refinery, Western Petrochemical, and Coral Refinery. He also conducted file reviews for the state underground storage tank program. He evaluated gamma ray/ density and other geophysical logs to determine the salt roof thickness of underground storage caverns for liquefied petroleum gas/ hydrocarbon products; performed file reviews for Class II and III underground injection wells to determine the level of compliance required by state and federal underground injection control programs; and assisted in the development of a groundwater model used to delineate aquifer susceptibility to surface pollutant migration. In addition, Mr. Cook entered chemical analytical data into the Kansas Water Data Base to determine the extent and nature of volatile organic contamination of public water supplies, assisted in hydrogeologic evaluations using water well records and published information, and assisted in the evaluation of water well data for use in facility compliance tracking. He is familiar with the State of Kansas spill response program and has assisted in the coordination and implementation of remedial activities for spill responses.

While attending the University of Kansas, Mr. Cook prepared detailed structural geology maps and cross sections of sedimentary and complex metamorphic environments using United States Geological Survey topographic maps and aerial photographs. He also drafted stratigraphic sections.

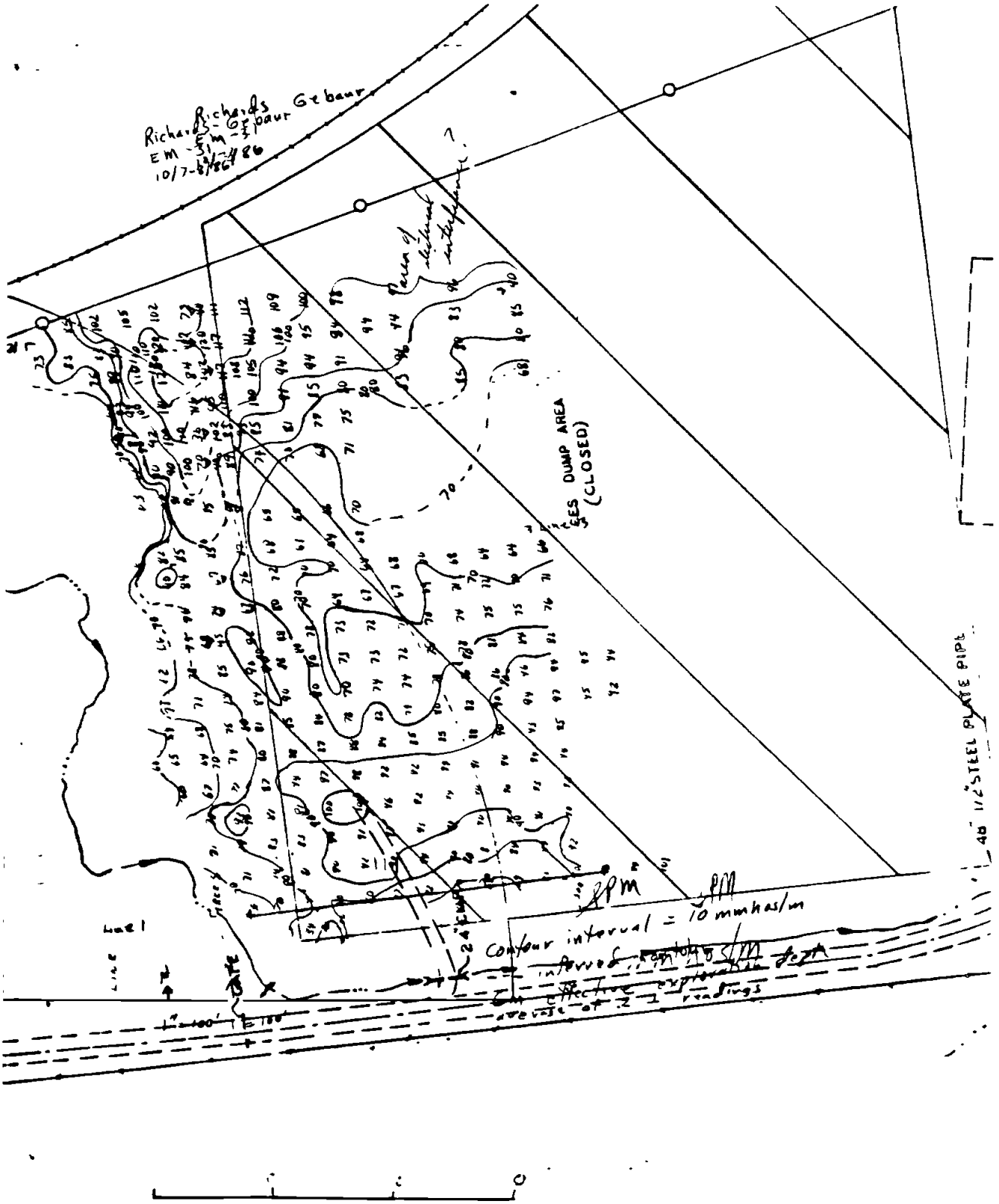
APPENDIX M

GEOPHYSICAL SURVEY TRACINGS

Recycled Paper



MAGNETOMETER DATA



EM-31 DATA

recycled paper

15 423

APPENDIX N

TECHNICAL OPERATIONS PLAN

recycled paper

15 424

APPENDIX O

MONITORING WELL LOCATIONS AND SURVEY NOTES

ANDERSON SURVEY COMPANY
6412 EAST 87TH STREET
KANSAS CITY, MO. 64138
361-5555

15 425

LETTER OF TRANSMITTA

DATE	JOB NO.
7-22-87	87-7-39692-1

ATTENTION: John Parks

RE: Richards-Gebaur Air Force Base Well Locations

Whiteman Air Force Base Well Locations

TO Ecology & Environment, Inc.
Cloverleaf Bldg #3
6405 Metcalf, O.P., Kan

GENTLEMEN:

WE ARE SENDING YOU ☑ Attached ☐ Under separate cover via the following items:

☐ Description ☐ Prints ☐ Plans ☐ Copy of letter

☐ _____

COPIES	DATE	NO.	DESCRIPTION
1	7-17-87	1	Coordinate sheet for wells
1	"	2	State Plane map coordinate based from
1	"	3	state Plane map used for siting station
1	"	4	Bench Marks used for elevations
1 set		5	Copy field notes on Richards-Gebaur survey
1 set		6	Copy field notes on Whiteman survey

THESE ARE TRANSMITTED as checked below:

☐ For approval
☑ For your use
☐ As requested
☐ For review and comment
☐ Revised Prints
☐ Approved as noted
☐ Prints returned after loan to us
☐ _____

REMARKS _____

COPY TO _____

SIGNED: Dana G. Kinsley

If enclosures are not as noted, kindly notify us at once.

87-7-34694-1
35-47-33
RICHARD-GEBAUR

ANDERSON SURVEY COMPANY

Sheet 1 of 4
7-17-87
By DGK

STATE PLANE COORDINATES AND ELEVATIONS ON 6 MONITOR WELLS ON THE RICHARDS-GEBAUR AIRBASE, JACKSON COUNTY, MISSOURI

FOR: ECOLOGY AND ENVIRONMENT, INC
CLOVERLEAF BLDG. #3
6405 METCALF
OVERLAND PARK, KANSAS, 66202

ATTN: JOHN PARKS, P.E.

15 42

STATE PLANE COORDINATES ARE ON THE CENTER OF THE WELL RISER PIPES.

R.G.W. #6
N 978,075.79'
E 490,636.43'
EL. 981.73'

R.G.W. #5
N 977,573.29'
E 490,932.79'
EL 964.05'

R.G.W. #3
N 977376.57'
E 490435.98'
EL. 963.74'

R.G.W. #2
N 977,392.10'
E 490,143.90'
EL. 967.39'

R.G.W. #4
N 977,379.31'
E 490,748.87'
EL. 961.90'

R.G.W. #1
N 976,945.92'
E 486,875.55'
EL. 1000.08'

NOTE:
CUT '+' ON TOP OF RISER PIPE WHERE ELEVATIONS WERE SHOT.

CORPS OF ENGINEERS, U.S. ARMY CONTROL STATION DESCRIPTION PROJECTION: Mercator	PROJECT: Richards-Gebaur AFB STATE: Mo.	CLOSURE: 1:150000

STATE PLANE COORDINATE SYSTEM: Missouri, West Zone

CITY, TOWN, OR COUNTY	NAME OF STATION	YEAR ESTABLISHED
Jackson Co.	C-10	1986
N = 974946.083	VERTICAL DATUM	ELEVATION
E = 486639.908	NGVD	1003.751'

ESTABLISHED BY: Corps of Engineers

DISTANCES AND DIRECTIONS TO TRAVERSE STATIONS AND AZIMUTH MARKS

*	STATION OR AZIMUTH MARK	DISTANCE	GRID AZIMUTH
T	C-7	2046.047'	94-43-57
T	C-11	809.685'	322-05-06

DETAILED DESCRIPTION: About 135' E. and 28' N. of the SW cor Sec. 35, T-47-N, R-33-W, Jackson Co., Mo. On Richards-Gebaur AFB, about 500' W. of the junction of Arnold Ave. and Westover Road, approximately 200' WSW of Bldg. #602, and 28' N. of the centerline of Arnold Ave. A H.D.R. monument with cap stamped "C-10 1986", driven 10' into the ground and set inside a 6" PVC pipe which is 0.1' below the ground surface.

TO REACH:

REFERENCES:

No references available.

Steel posts and sign set 1' N. and 1' S.

* T=TRAVERSE STATION & A=AZIMUTH MARK

MRK Form 58
Revised 1 Apr 85

Sheet 3 of 4

CORPS OF ENGINEERS, U.S. ARMY CONTROL STATION DESCRIPTION PROJECTION: Mercator	PROJECT: Richards-Gebaur AFB STATE: Mo.	CLOSURE: 1: 60000

STATE PLANE COORDINATE SYSTEM: Missouri, West Zone

CITY, TOWN, OR COUNTY	NAME OF STATION	YEAR ESTABLISHED
Jackson, Co.	C-7	1986
N = 975114.888	VERTICAL DATUM	ELEVATION
E = 484600.836	NGVD	1045.895'

ESTABLISHED BY: Corps of Engineers

DISTANCES AND DIRECTIONS TO TRAVERSE STATIONS AND AZIMUTH MARKS

*	STATION OR AZIMUTH MARK	DISTANCE	GRID AZIMUTH
T	C-6	556.251'	0-16-30
T	C-8	2595.126'	228-23-29
T	C-10	2046.047'	274-43-57

DETAILED DESCRIPTION: About 1900' W. of the SE cor. Sec. 34, T-47-N, R-33-W, Jackson Co., Mo. On Richards-Gebaur AFB, 74' NW of the junction of Arnold Ave. and Walker Road, 7' S. and 11' E. of the SE corner of Bldg. #925. A H.D.R. monument with cap stamped "C-7 1986", driven into the ground and set inside a 6" PVC pipe which is 0.1' below the ground surface.

TO REACH:

REFERENCES:

28.75' SSW to nail and shiner in telephone pole.
11.98' NW to SE cor. Bldg. #925.
34.65' N to nail and shiner in power pole.
Steel posts and sign set 1' E. and 1' W.

* T=TRAVERSE STATION & A=AZIMUTH MARK

MRK Form 58
Revised 1 Apr 85

RICHARDS GEBAUR A.F.B.
LEVELS BY W.D. DODSON - 1986

15 429

TBM "C" Starting B.M. — 4.5' S.W. & 4.5' S.E. of S.E. corner building # 948. A chiseled square on N.E. corner of concrete pad around most E. sewer line manhole of two. 32' westerly of centerline concrete road that runs to flight line.

ELEV. 1042.813

BM C-8 Closing B.M. — About 700' S. and 100' W. of the E. 1/4 cor. sec. 34. T-47-N R-33-W JACKSON CO. MO. About 270' SE of the SE corner of building # 947. A H.D.R. monument with cap stamped "C-8 1986" driven 5' into the ground and set inside a 6-inch PVC pipe which is 0.1' below the ground surface.
39.07' SW to nail and shiner in telephone pole.
55.06' W to red painted spot on steel fence cor post.
76.46' NW to nail and shiner in power and telephone p.
Steel posts and sign set 1' E. and 1' W.

ELEV. 1038.270

BM C-9 — About 300' N. and 600' W. of the E. 1/4 cor. sec. 34. T-47-N R-33-W JACKSON CO. MO. About 99' N.E. OF N.E. edge of concrete apron, and 18.93' S.E. of POL 55-E. A H.D.R. monument with cap stamped "C-9 1986" driven 10' into the ground and set inside a 6-inch PVC pipe which is 0.1' below the ground surface. 3' N.E. of being in line with a new fence.
14.69' NW to nail and shiner in fence post.
steel posts and sign set 1' E. and 1' W.

ELEV. 1046.342

BM AP-RG-52 — Set Brass Cap flush in concrete, 52.6' N. of & in line with E. edge building # 819.

ELEV. 1049.991

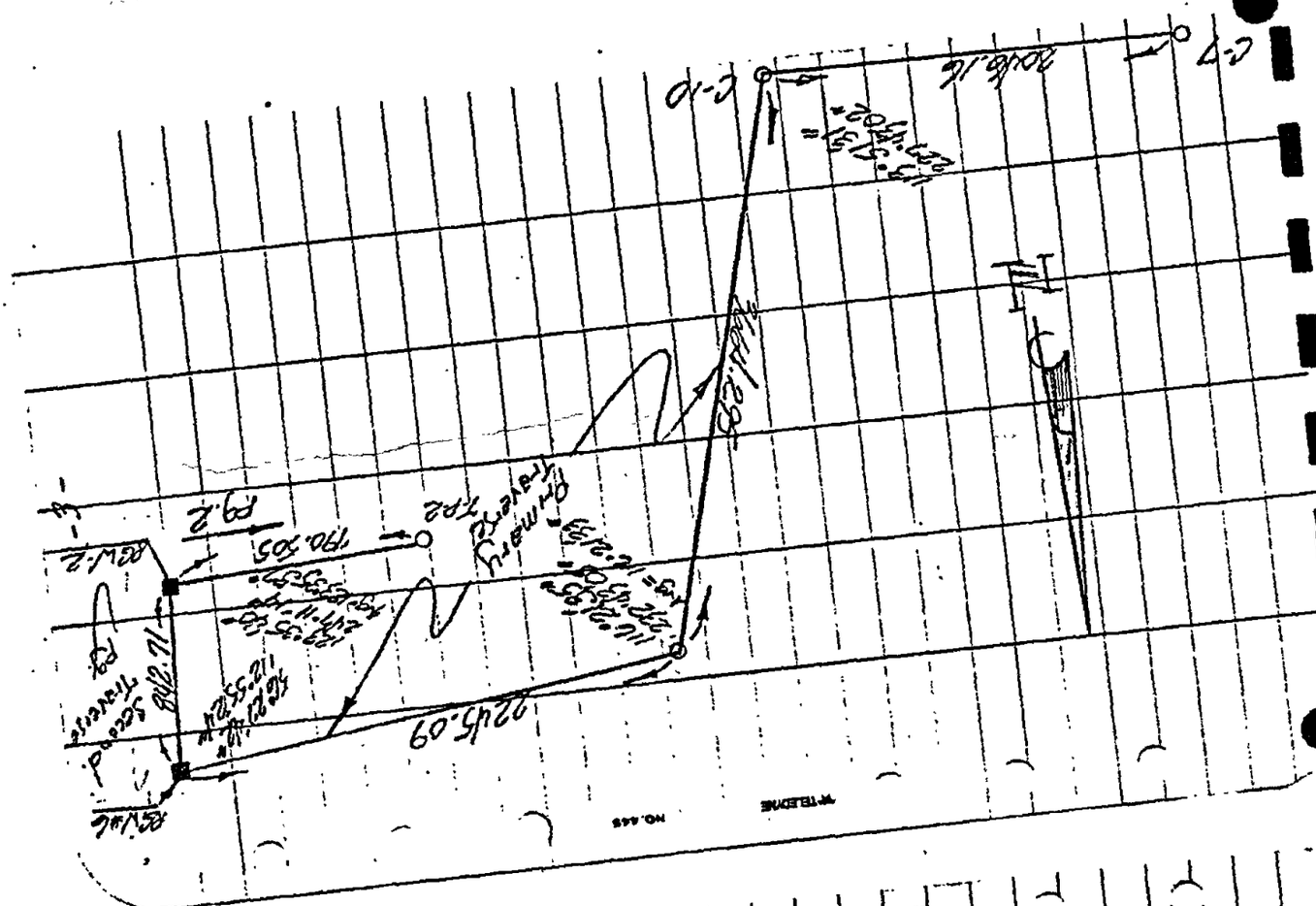
BM C-7 — About 1900' W. of the SE cor. sec. 34. T-47-N R-33-W JACKSON CO. MO. On Richards-Gebaur AFB, 74' NW of the junction of Arnold Ave. and Walker Road, 7' S. and 11' E. of the SE corner of bldg. # 925. A H.D.R. monument with cap stamped "C-7 1986", driven into the ground and set inside a 6-inch PVC pipe which is 0.1' below the ground surface.
28.75' SSW to nail and shiner in telephone pole.
11.98' NW to SE cor. bldg. # 925.
34.65' N to nail and shiner in power pole.
steel posts and sign set 1' E. and 1' W.

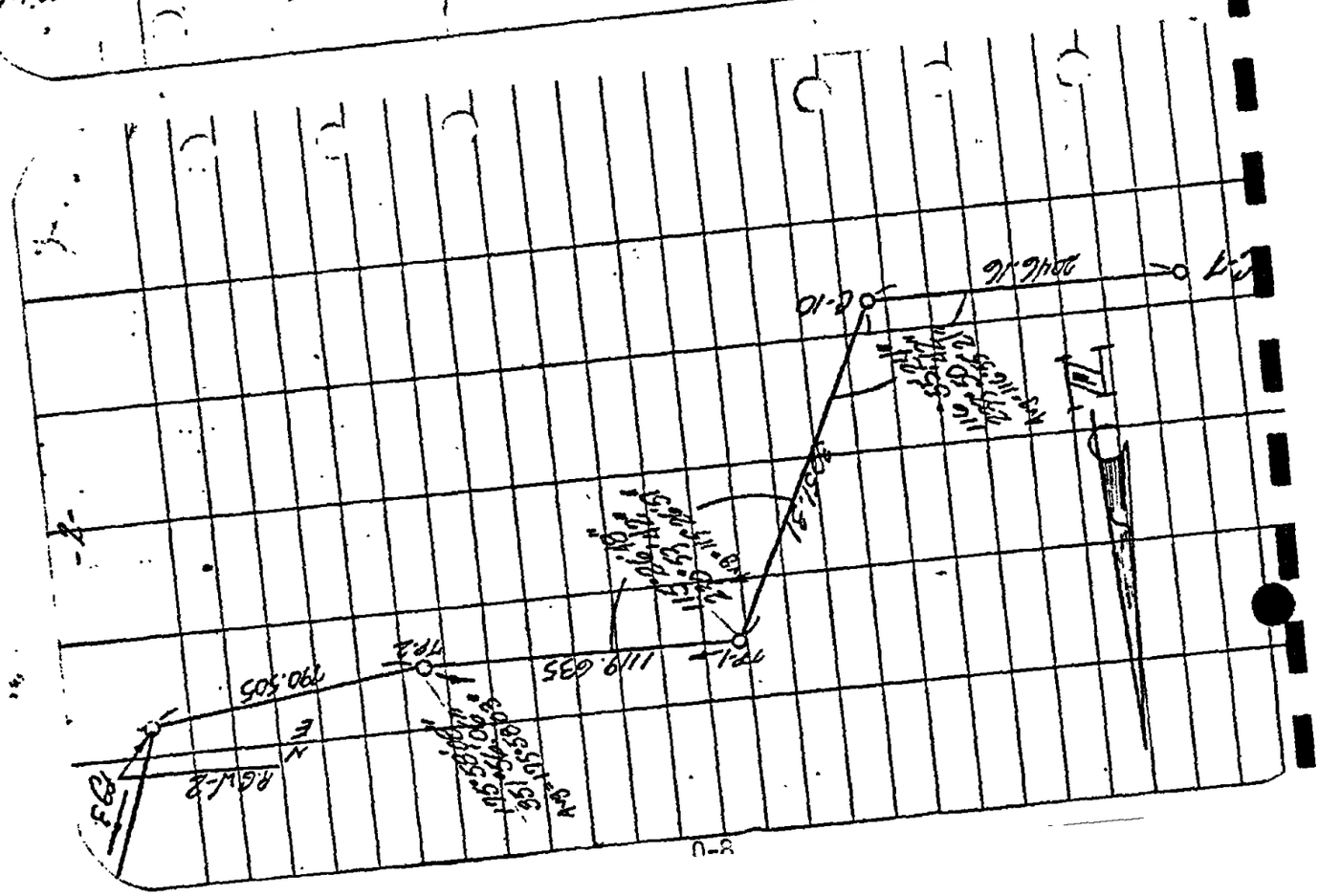
ELEV. 1045.895

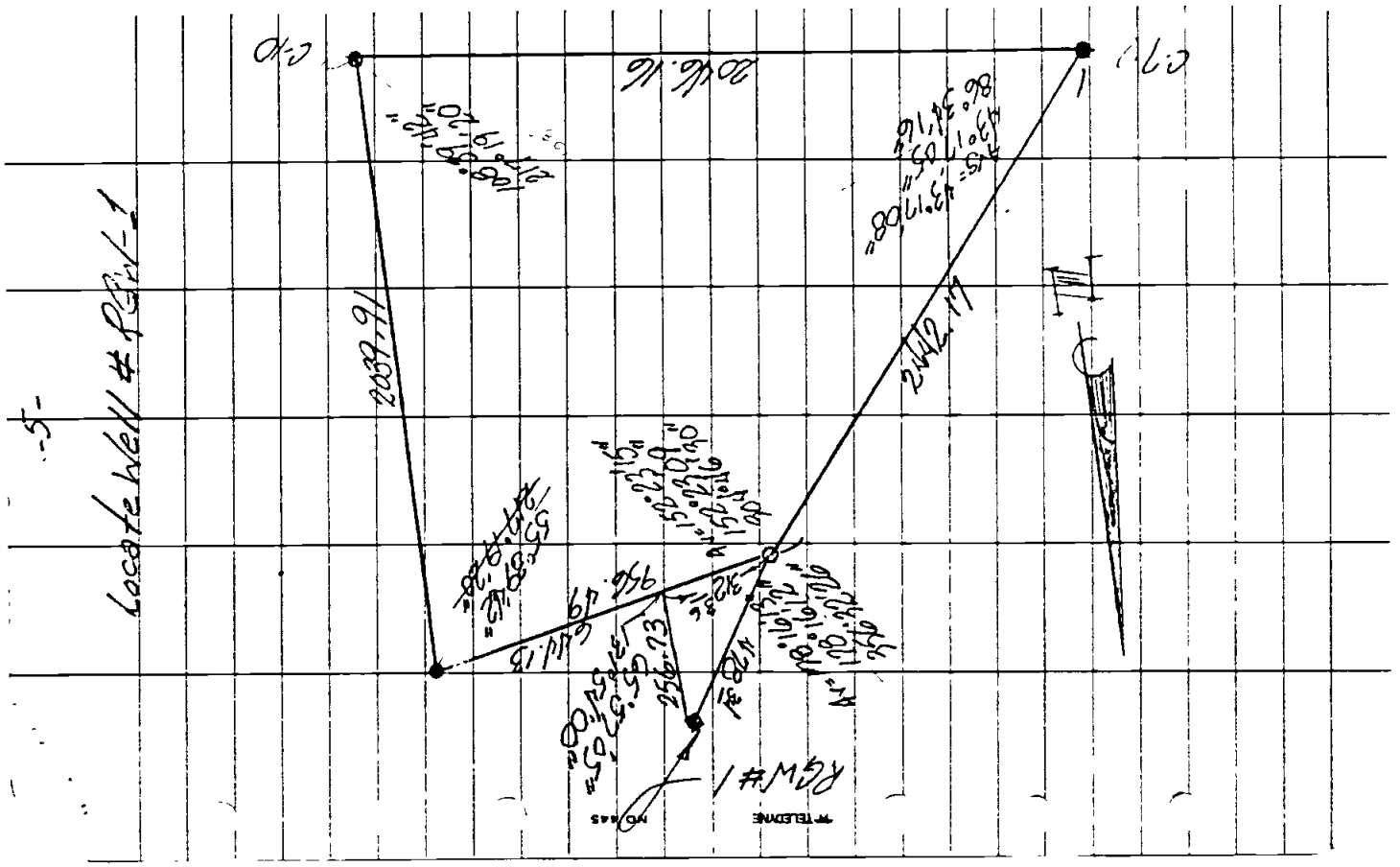
	35-47-33 Richards-Gebaur Ja. Co. Mo.			7-17-87 Geren Bradford Trainer
87-7-34694-1				P.O. 80
	Ecologie & Environment Inc. c/o Mr. John Parks			
	Locate & Determine Elevations of 6 Wells as instructed at Richards-Gebaur Air Force Base.			

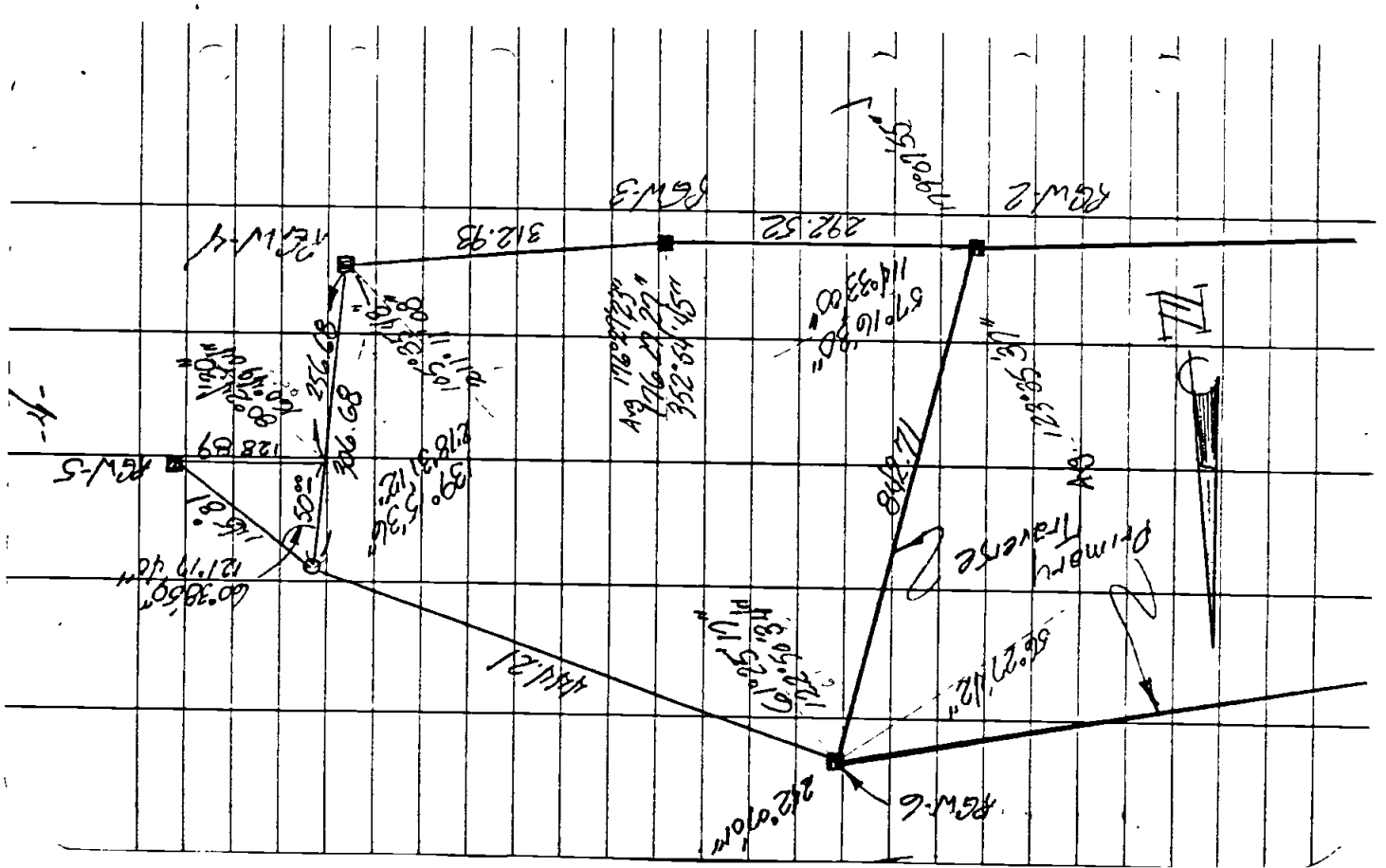
NO. 645 TELEDYNE

15 450


C-10
C-7
2046.16
2245.09
790.505
Primary Traverse
Second Traverse
RGW-2
RGW-6
P9.2
P9.3
TP-2
TP-1
1119.635
2051.21
N
E


C-10
C-7
2046.16
790.505
1119.635
RGW-2
P9.3
TP-2
TP-1
N
E


-5-
Locate Well # RGW-1
RGW #1
2039.91
2442.17
2046.16
C-10
C-11
TELEDYNE
NO 445


-4-
RGW-2
RGW-3
RGW-4
RGW-5
RGW-6
312.93
292.52
444.21
Primary Traverse

BM- "C"-"D" Cut on NE Cor Conc Pad around E Sewer MH - 32' West of ℄ Conc. Rd to Flight line 1/5 SW & 1/5 SE of NE Cor Bldg #940				1042.81
T	1.69	1044.50		
⊙			15.75	1028.75
T	0.31	1029.06		
⊙			22.49	1006.57
T	2.35	1008.92		
⊙ Cut "7" on Top of Well Case #RGW#1			8.84	1000.08
T	8.50	1008.58		

		1008.58			
⊙			15.87	992.71	
↑	8.11	1000.82			
⊙			4.12	996.70	
↑	1.64	998.34			
⊙			4.45	993.89	
↑	4.46	998.35			
⊙			7.70	990.65	
↑	3.12	993.77			
⊙			9.17	984.60	
↑	0.18	984.78			
⊙			14.53	970.25	
↑	2.33	972.58			

		972.58		
⊙	Cut "7" on Top of Well Case # RGW-2			
			5.19	967.39
↑	0.96	968.35		
⊙	Cut "7" on top of Well Case # RGW-3			
			4.61	963.74
↑	2.49	966.23		
⊙	Cut "7" on top of Well Case # RGW-4			
			4.33	961.90
↑	2.64	964.54		
⊙			3.25	961.29
↑	6.45	967.74		
⊙	Cut "7" on top of Well Case # RGW-5			
			3.69	964.05
↑	4.17	968.22		

NO 445 TELEDYNE

-10-

		968.22		
⊙			1.01	967.21
T	7.37	974.58		
⊙			2.48	972.10
T	11.93	984.03		
⊙	Cut "T" on top of Well Case # RGW-6			
			2.30	981.73
T	1.91	983.64		
⊙			12.35	971.29
T	2.87	974.16		
⊙			13.04	961.12
T	5.25	966.37		
⊙			1.21	965.16
T	9.78	974.94		

-11-

		974.94		
⊙			0.36	974.58
T	15.18	989.76		
⊙			1.02	988.74
T	2.31	991.05		
⊙			1.14	990.91
T	3.77	998.68		
⊙			3.55	995.13
T	6.79	1001.92		
⊙			9.10	992.82
T	15.87	1008.69		
⊙			2.82	1005.87
T	23.86	1029.73		

NO. 445
TELEDYNE

		1029.73			
O			4.15	1025.58	
T	18.05	1043.63			
BM- C-8- +/- 700'S & 100'W of E¼ Cor					
34-47-33. +/- 270'SE of SE Cor					
Bldg # 947-A.H.D.P Monu Stamp "C-8 1986"					
			5.37	1038.26	1038.27

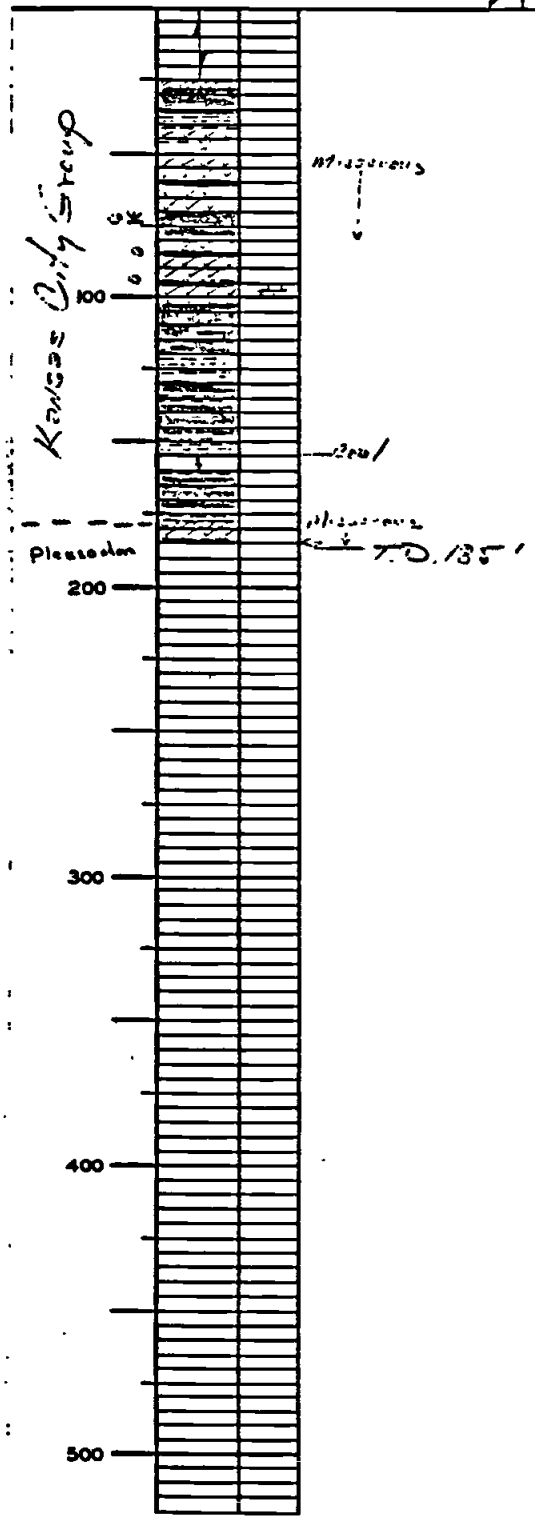
APPENDIX P

WATER WELLS WITHIN ONE MILE OF THE BASE

DIVISION OF
GEOLOGICAL SURVEY AND WATER RESOURCES

LOG NO. 26102	OWNER JOHN MELLINGER
COUNTY CASS	FARM / WELL NO.
T 46N R 33W	DRILLER BURGESS & PRATER
	DATE AUG. 15, 1968
27 / 0	ELEV. Mellon 1027 / PROD. 30 GPM ½ GPM
	LOGGED BY J. THOMPSON 2-9-70

REMARKS 167' of 5½" Plastic, 8' of 6¼" steel csg.

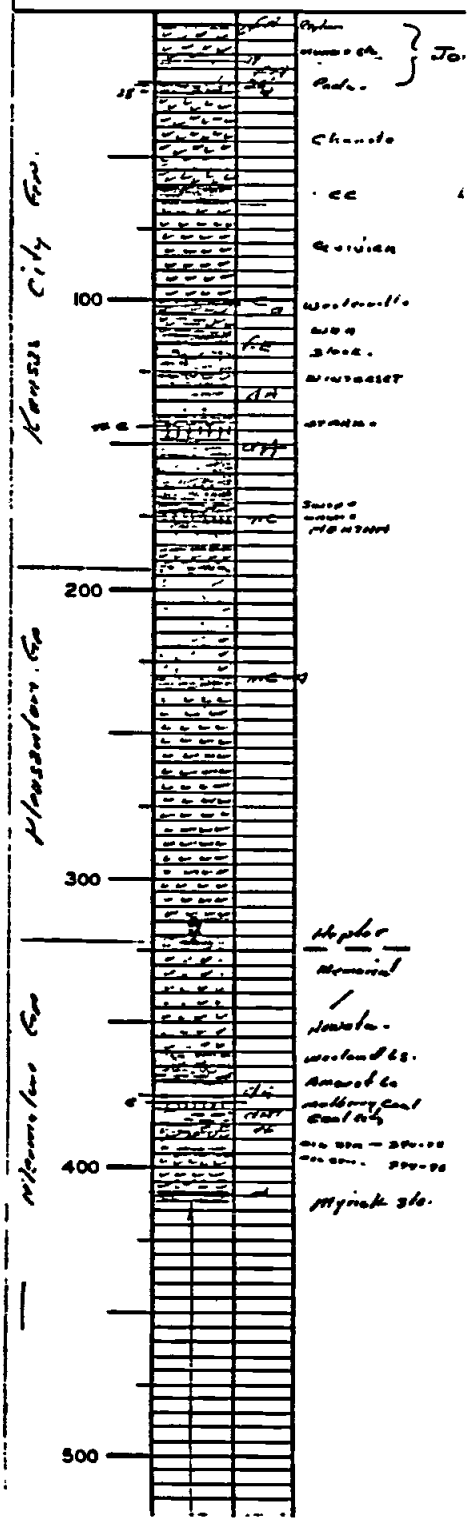


DIVISION OF
GEOLOGICAL SURVEY AND WATER RESOU

LOG NO. 27531	OWNER JACK A. WAG
COUNTY Jackson	FARM FEE
T 47 R 33	DRILLER Cullum & Brown
400' fsl 800' fel / 9	DATE Spud: 28-1-74 Comp.
	ELEV. / PROD. Plugged bac 170' and us Water Supply.
	LOGGED BY WEILS March '74

15 438

REMARKS 8 5/8" csg set @ 22' w/7



BACKGROUND INFORMATION ON WATER WELLS

Well No. 1 - Property owner Mrs. Clark Rhoden. Spoke with Charles G. Randall, Estate Executor, P.O. Box 322, Grandview, MO 64030 (941-2290). He purchased the property in 1980 and unsuccessfully tried to locate the well. Well is apparently inactive and no other information is available.

Well No. 2 - Appears to be located on Air Force property. Well may be in open field near electric substation which is Air Force property. North of the field is Marine Corps family housing. Air Force has no information on this well. Well apparently was abandoned when the Air Force acquired the property.

Well No. 3 - E & E talked with the oldest residents in the area. None of them knew anything about a well at this location.

Well No. 4 - Two wells at Liz Ann Trailer Court. Both inactive for about 10 years since court switched to city water. Current owner never used the wells and has no information on them. The former owner, Robert Jones (331-6442), could not be located.

Well No. 5 - Inactive well in the vicinity of 115-127 Markey, Belton. Brown Bros. Excavation (331-6289) may have used the well. Probably supplied water to an old house which once stood on site.

Well No. 6 - Inactive well used for a brief time to supply water to a trailer court. Has not been used for 25 years. No other information.

Well No. 7 - Two wells. Property owner Joe Harding (331-3581). One well is hand dug, 3 to 4-foot diameter, 20 feet deep, 7 feet to water. Inactive until June 1988. Owner now is pumping water to irrigate garden. Other well is immediately south of hand-dug well. Owned by the City of Belton. Approximately 250 feet deep; inactive 25 to 30 years; flow rate 60,000 gal/day maximum; high sulfur content.

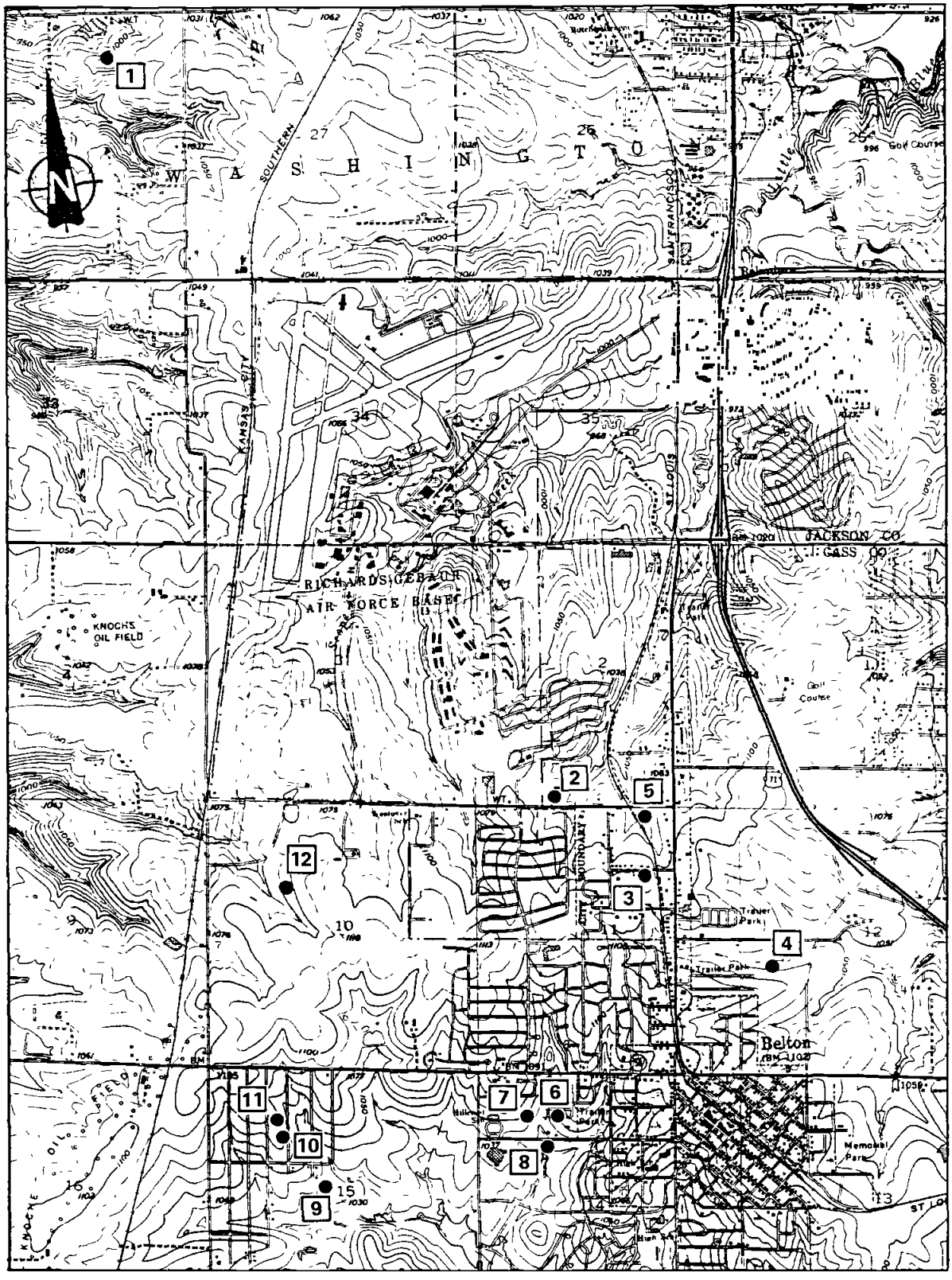
Well No. 8 - Located on west side of creek. Apparently on school property and inactive.

Well No. 9 - Property owner John Wedgeworth. Inactive well. Approximately 10 feet to water. Reportedly drilled by Calvin Jackson to supply water to subdivision.

Well Nos. 10, 11 - Unable to locate. Possibly drilled by Calvin Jackson and originally designed to supply water to housing development (see No. 9).

15 4'40

Well No. 12 - Unable to access area. Appears to be on Air Force property, southwest of munitions maintenance and storage--controlled area. Possibly may be Belton property, but they have no information on well. The Air Force has no information on this well. It probably was abandoned when the Air Force acquired the land.



SCALE

0 ½ 1 1½ 2 MILES

0 .5 1 1.5 2 KILOMETERS

KEY:

● Water Well

Figure P–1 LOCATION OF WATER WELLS

15 442

DF-4900-D990

TECHNICAL OPERATIONS PLAN
PHASE II, STAGE 2 CONFIRMATION STUDY
INSTALLATION RESTORATION PROGRAM
RICHARDS-GEBAUR AFB, MISSOURI

September 19, 1986

Prepared for:

UNITED STATES AIR FORCE
Occupational and Environmental
Health Laboratory
Technical Services Division
Brooks Air Force Base, Texas 78235

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15 4

1. INTRODUCTION

Ecology and Environment, Inc., (E & E) has prepared this Technical Operations Plan for studies at Richards-Gebaur Air Force Base (AFB), Belton, Missouri. The plan presents the site-specific work plans to be used to satisfy the requirements set forth in the delivery order to the Survey--Phase II Installation Restoration Program (IRP).

This document is the result of an evaluation of the Phase I--Records Search Report, an evaluation of the Phase II--Confirmation Report for the two landfills on the base, participation in a presurvey meeting and tour of the sites on the base, and additional information agreed to during the presurvey meeting with Dr. John K. Yu (OEHL/TSS) and participating personnel. The work plans for each site are designed to address the scope of activities described for either Stage 1 or Stage 2 of the Phase II program depending upon whether or not the site has been previously investigated. The current delivery order identifies this investigation as a Stage 2 investigation, which consists of the quantification of data on sites deemed as needing additional work in the Stage 1 report.

The field investigation procedures to be followed are consistent with rules and regulations set forth by the United States Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), Nuclear Regulatory Commission (NRC), and the Department of Transportation (DOT). Investigations will also be conducted in accordance with provisions of the Resource Conservation and Recovery Act (RCRA), and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA).

The installation history and practices involving hazardous wastes are described in the Phase I report and will not be reiterated here. The listings of sites recommended in the Phase I and II reports for investigation includes the following:

- South Landfill;
- Northeast Landfill, as defined by new information from the Phase II, Stage 1 report;
- North Burn Area (Fire Training Area);
- Herbicide Burial Area;
- Oil-Saturated Area;
- Hazardous Waste Drum Storage Area--Bldg. 923; and
- POL Storage Area.

2. PROPOSED WORK PLANS FOR STAGE 2 SITE INVESTIGATIONS

The work plans were developed to accomplish those tasks designated under directive F33615-83-D-4003, Proposed Order 13, Phase II, Stage 2 investigation of Richards-Gebaur AFB, Belton, Missouri. These tasks are described in Section 1 of the directive and consist of:

- Determining the presence or absence of contaminated substances within the specified areas of investigation;

- If contamination exists, determining its magnitude and extent and the potential for migration of these contaminants in the various environmental media;

- Assessing the potential environmental and health risks associated with contaminants in the local environment. This assessment will be based on applicable local, state, and/or federal standards only.

- Delineating additional investigations required beyond the present investigation stage to accomplish Phase II objectives.

To accomplish these goals, several field investigation techniques will be used, including:

- Geophysical surveys to determine the perimeter of the various landfill sites and to characterize buried metal, drums, and unique subsurface features, including contaminant plumes;

- Soil/sediment sampling, both grab and composite, to determine the presence or absence of shallow subsurface contamination;

- Monitoring well installation, with sampling of both the new and existing wells to determine potential environmental or health risks.

All samples will be split in the field, with delivery of 10% of the splits to OEHL/SA at Brooks AFB, Texas.

All soil and sediment samples will be monitored in the field for volatile contaminants. Water samples will be tested in the field for pH, conductivity, and temperature.

Laboratory analyses for water samples, as described in the analytical parameters subsections of this plan, have been assigned identification numbers in the Chemical Analyses Price Schedule of the contract. The parameters and corresponding numbers are listed in Table 2-1.

2.1 SOUTH LANDFILL (SITE 1)

Setting

The South Landfill (Site 1) is located in the south-central part of the base east of the flightline and on the west bank of Scope Creek (Figure 2-1, Number 1). There is a small man-made lake directly west and upgradient of the landfill. Site 5, the South Burn Area, is believed to be associated with this site but could not be identified during the presurvey site visit. The landfill officially was open from 1956 to 1960. Unauthorized dumping has been reported, and the majority of the material seen at the surface and toward the bank appears to have been disposed of after closure of the facility, based on the degree of weathering observed. During the presurvey site visit, the undergrowth was very thick and the water table was very high. No leachate seeps were observed at this time, although a seep was sampled during the Stage 1 investigation. Potential contaminants of concern are volatile organics, heavy metals, pesticides, phenols, and oil and grease.

Table 2-1

I.D. Number	Chemical Test Category
1	Trihalomethanes
2	Heavy Metals--Primary
3	Heavy Metals--Secondary
4	Oil and Grease
5	Total Organic Carbon (TOC)
6	Polychlorinated Biphenyls (PCBs)
7	Chlorinated Hydrocarbons (Pesticides)
8	Herbicides
9	Priority Pollutants (GC/MS Confirmation)
10	Purgeable Organics
11	Base/Neutral Extractables
12	Acid Extractables
13	Primary Drinking Water Standards
14	Secondary Drinking Water Standards

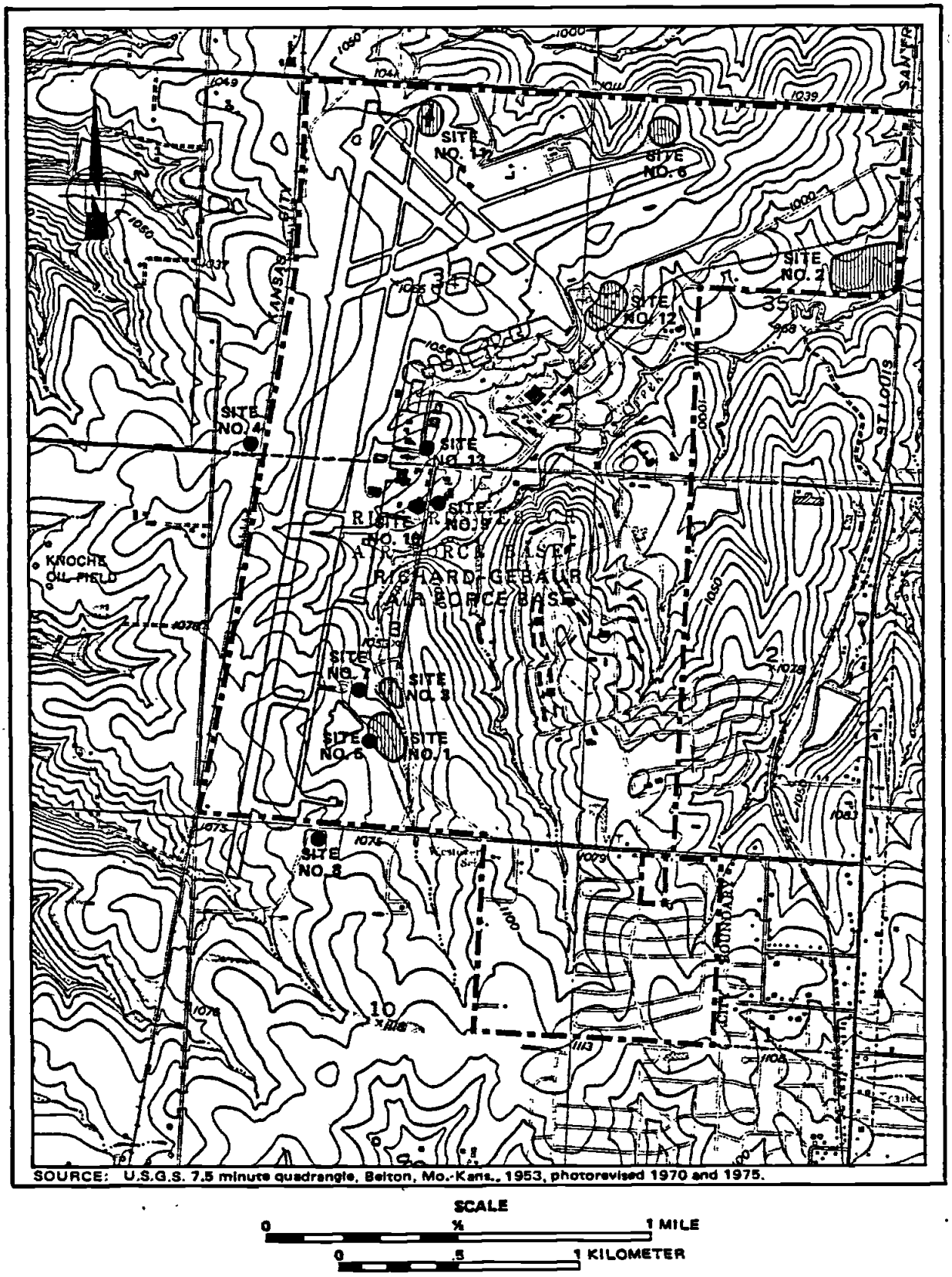

Figure 2–1 SITE LOCATION MAP, RICHARDS-GEBAUR AFB

Investigation

Borings. To determine the presence or absence or contamination and to augment the Stage 1 investigation, one soil boring is proposed in order to determine if contaminants have moved vertically in the soil column. This boring will be drilled to a depth of 15 feet and three split-spoon soil samples will be retrieved.

All drill cuttings will be drummed and staged until the analytical results are known. Richards-Gebaur AFB will provide a secure area for the drums and will be responsible for assigning the ultimate disposal points for the contaminated cuttings and groundwater.

Soil/Sediment Samples. A total of seven soil/sediment samples will be taken. Three will come from the shallow boring and three from discrete locations along the perimeter of the landfill along the creek. The last sample will be located further upstream along Scope Creek to serve as a background standard.

Water Samples. A total of five water samples also will be taken. One sample will be taken from the shallow boring, if groundwater is present; and three from Scope Creek or any leachate seeps that are detected. One sample will be taken from Scope Creek upgradient from the landfill.

Analytical Parameters. The soil samples will be analyzed for petroleum hydrocarbons and volatile organics (EPA 8010/8020). The water samples will be analyzed for volatile organics (EPA 601/602), total dissolved solids (TDS), priority pollutant metals, extractable priority pollutants (EPA 625), common anions, and phenols.

2.2 NORTHEAST LANDFILL (SITE 2)

Setting

The Northeast Landfill (Figure 2-1, Number 2) was vaguely identified in the Phase I report and investigated as such during Phase II Stage 1 work. The Stage 1 final report does indicate that additional information on the landfill was provided which identifies three

trenches at the western end of the site (Figure 2-2). These three trenches are the main goal of the present study, which will treat this investigation as a Stage 1 confirmation study.

The landfill is located on the northeastern edge of the property boundary east of the firing range and adjacent to Scope Creek where the creek exits the base. It appears to have been opened after the South Landfill officially was closed in 1960, and remained in operation to approximately 1971. The suspected contaminants are organics, oil and grease, pesticides, and heavy metals. A portion of the original site boundary recently has been trenched for sewer lines and valuable information might be found in records from those operations.

Investigation

Background and Remote Sensing. To support the field investigation, resources have been allotted to locate and review any new information dealing with the Northeast Landfill and the nearby sewer lines. Available aerial photographs that cover the site for the years in question will be located and interpreted. This information will aid in locating the soil borings and grid lines for the geophysical study.

Geophysical Studies. To delineate the locations of the trenches, two geophysical surveys will be performed concurrently. First, a magnetometer survey will be conducted using a proton precession magnetometer to determine the presence of subsurface metal objects in the area where the trenches should be located. For the second survey, an electromagnetic terrain conductivity meter (Geonics EM-31 or EM-34) will be used to detect lateral changes in ground conductivity. Any lateral changes in conductivity should delineate the area disturbed by the trenches. It also may be possible to detect a contaminant plume associated with these trenches because of the reasonably high seasonal water table at this site.

Borings. A total of six shallow soil borings will be drilled to a depth of 20 feet. Three borings are allotted for the west trench and three borings for the double trench. One boring will be completed

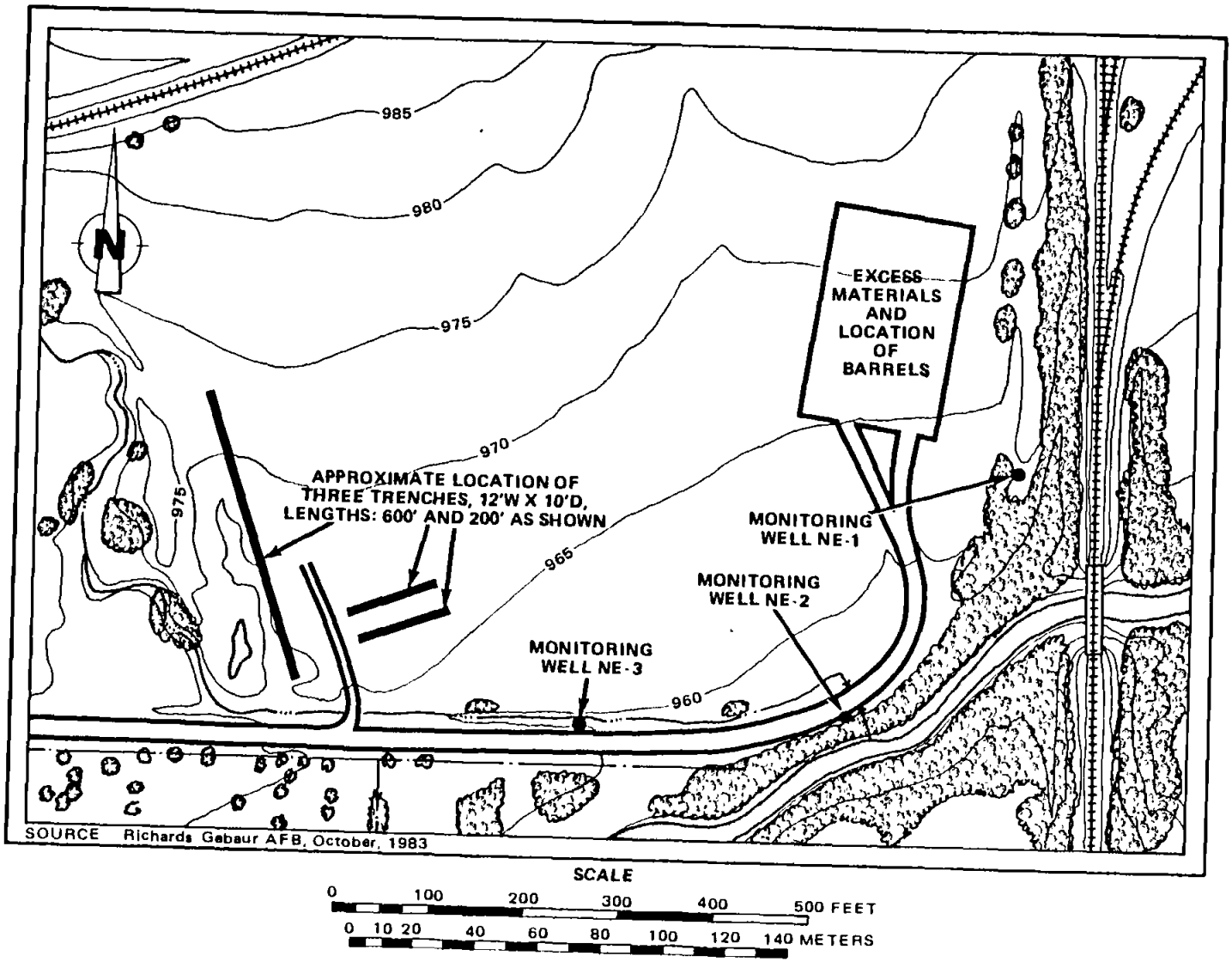

Figure 2–2 POSSIBLE LOCATIONS OF TRENCHES AT NORTHEAST LANDFILL

as a monitoring well. A maximum of three split-spoon soil samples will be taken at each boring.

Monitoring Wells. One monitoring well will be located downgradient of the trenched areas in the west part of the landfill in order to determine the effects of the trenches on groundwater quality. An additional well will be installed for background north of the landfill. Well installation methods are outlined in Section 8.

Soil/Sediment Samples. A total of 18 soil/sediment samples are proposed. These samples will come from the six shallow soil borings.

Water Samples. A total of 10 water samples also will be taken: five from the shallow boring holes, two from each of the new monitoring wells, and three from the existing monitoring wells. All three existing wells were located during the presurvey fieldwork; however, the wells were not opened to determine their current status.

Analytical Parameters. The soil/sediment samples will be analyzed for petroleum hydrocarbons, and volatile organics (EPA 8010/8020). The water samples will be analyzed for petroleum hydrocarbons, priority pollutant metals, extractable priority pollutants, common anions, phenols, TDS, and volatile organics (EPA 601/602).

2.3 NORTH BURN AREA (SITE 6)

Setting

The North Burn Area (Figure 2-1, Number 6) is located to the north of the northeast flightline just below the northernmost boundary of the base. During the presurvey meeting, an apparent overflow of material into the drainage pathway was cited and added to the investigation of the site as originally proposed in the Phase I report. The facility has been in operation since the close of the South Burn Pit in 1965, and currently is in operation today. Recent improvements to the facility include a six-inch concrete rim around the concrete-lined pit.

Investigation

Soil Gas Survey. A soil gas survey will be performed using a maximum of 30 probes to characterize contamination at the site.

Borings. A total of three soil borings to a depth of 15 feet each will be drilled. They will be located along the perimeter so as best to identify any vertical contamination at the site.

Monitoring Wells. Three monitoring wells will be installed, two downgradient of the site and one upgradient. The wells will be sampled once, for a total of three groundwater samples.

Soil/Sediment Samples. Fifteen soil samples will be taken: nine from the three boreholes and six composite surface samples covering the area of overflow and along the surface drainage pathway. A composite sample will consist of no more than six aliquots within a radius of one meter around a central reference point. Aliquots will be taken from the top 12 inches of soil.

Water Samples. If water is encountered in the boreholes, three water samples will be taken. One surface water sample also is allocated at this time for any ponded water in the drainage pathways. Three groundwater samples will be taken.

Analytical Parameters. The soil samples will be analyzed for petroleum hydrocarbons and volatile organics (EPA 8010/8020). The water samples will be analyzed for petroleum hydrocarbons, TDS, and volatile organics (EPA 601/602).

2.4 HERBICIDE BURIAL AREA (SITE 8)

Setting

The Herbicide Burial Site (Figure 2-1 Number 8) is located just east and adjacent to the main flightline in the southwest part of the base. The site was active only from mid-1970 to mid-1971. The activities included the burial of small amounts of pesticides in small

pits. The information about these activities is not well documented and the locations are vague. During the site visit, the field where the pesticides were reported to have been buried was covered in two feet of native grasses. However, there were several small areas, roughly two feet in diameter, that exhibited vegetative stress. The surface drainage is southward to a small pond.

Investigation

Soil/Sediment Samples. A total of four composite soil samples will be taken. These composite samples will consist of no more than six aliquots within a radius of one meter around the area of stressed vegetation. Aliquots will be taken from depths of 0-3 inches, homogenized in a stainless steel tray, and placed into sample jars.

Water Sample. One water sample will be taken from the small pond which drains the site.

Analytical Parameters. The four composite soil samples will be analyzed for herbicides, arsenic, and mercury. The water sample will be analyzed for pesticides, arsenic, mercury, and TDS.

2.5 OIL-SATURATED AREA (SITE 9)

Setting

The Oil-Saturated Area (Figure 2-1, Number 9) is identified as being located outside of Building 704. This is a maintenance and storage area that has been in operation since the mid-1950s. Through the years, oil has leaked onto the ground surface.

Investigation

Borings. One 15-foot soil boring is proposed for this site to identify the depth to which the oils have saturated the soil column. Three split-spoon samples will be taken.

Soil/Sediment Samples. Nine soil/sediment samples will be taken at this site: three from the borehole, and six composite surficial samples from the area draining the oil-saturated zone.

Water Samples. Two water samples will be taken: one from the borehole, should groundwater be encountered; and one from the surface water drainage pathway downgradient from the site.

Analytical Parameters. The soil samples will be analyzed for petroleum hydrocarbons, lead, and volatile organics (EPA 8010/8020). The water samples will be analyzed for petroleum hydrocarbons, lead, TDS, and volatile organics (EPA 601/602).

2.6 HAZARDOUS WASTE DRUM STORAGE AREA--BLDG. 923 (SITE 10)

Setting

The compound around Building 923 (Figure 2-1, Number 10) has been used as a repository for hazardous materials for an as-yet undetermined number of years. The compound is partially surfaced in asphalt and tarmac but the runoff from the stained area flows into a grassy drainage ditch. The handling and characterization of these drummed wastes is an ongoing operation. During the presurvey field visit, all of the drums were stored on wooden flats and categorized according to their contents. A drum overpacking operation was in progress in one of the Quonset huts in the compound. The area where the drums had been stored outside was noticably stained, indicating leakage from the drums. A list of the contents of 46 of the 69 barrels was prepared by General Testing Laboratories of Kansas City, Missouri, in January 1985. This report lists the pH, water miscibility, and flash points of the sampled barrels. The report was presented to E & E prior to the presurvey.

Investigation

Borings. One shallow soil boring will be drilled inside the compound near the stained area to determine if any hazardous compounds have migrated vertically in the soil column. The maximum depth of the

borehole will be 15 feet. Three split-spoon samples will be taken from the boring.

Soil/Sediment Samples. Three soil samples will be collected from the borehole. Six surface soil samples will also be taken: one from the stained area, four downgradient, and one upgradient from the stained area.

Water Samples. Three water samples are planned: one from the shallow borehole, if groundwater is encountered; and two from the surface drainage pathway, one above and one below the stained area. The surface drainage way will be sampled if water exists during the fieldwork.

Analytical Parameters. The soil/sediment samples will be analyzed for EP toxicity metals, petroleum hydrocarbons, and volatile organics (EPA 8010/8020). The water samples will be analyzed for TDS, priority pollutant metals, volatile organics (EPA 601/602), petroleum hydrocarbons, barium, and mercury.

2.7 POL STORAGE AREA (SITE 12 [INCLUDES BLDG. 953])

Setting

The POL (fuel) storage area (Figure 2-1, Number 12) is a compound which includes three fuel storage tanks in bermed enclosures, underground pipes, and several pump houses. The incident involved with this facility is the release of some 3,000 gallons of JP4 fuel into one of the tank enclosures. The spill was cleaned, but there is a chance that fuel had leaked into the subsurface soils and may be contaminating a nearby creek. The compound is located in the north-central part of Richards-Gebaur AFB and is upgradient from the sewage treatment facility. The floor drains in one of the pumphouses also were noted as a potential discharge point for fuels to escape the facility.

Investigation

Borings. Because of safety and access problems, hand augers will be employed to sample the subsurface of the fuel spill in the storage tank enclosure. Three borings will be made and a maximum of three split-spoon samples collected from each boring.

Monitoring Well. A downgradient monitoring well will be completed outside the confines of the compound. Twenty linear feet have been allocated to complete this well.

Soil/Sediment Samples. A total of 11 soil/sediment samples are proposed: nine from the hand auger locations, and two near the outfall of drains from Building 953.

Water Samples. A total of four water samples are proposed: one from the monitoring well, two from the stream draining the POL tank area, and one from the drain outfall from Building 953.

Analytical Parameters. The soil samples will be analyzed for petroleum hydrocarbons and aromatic volatile organics (EPA 8020). The four water samples will be analyzed for petroleum hydrocarbons, TDS, and aromatic volatile organics (EPA 602).

3. FIELD SET-UP

Following approval of the proposed project plan, E & E will be responsible for ordering, acquiring, and mobilizing all required personnel and equipment to the facility.

The Air Force will be requested to supply a secure building on the facility to which equipment and supplies can be directly sent and stored prior to and during the project. This building will also be used as a central field and equipment maintenance office, and as a sample handling and storage area.

In addition to the building, a secure fenced-in area preferably adjacent to or near the building will be required for storage of the drilling rig and its equipment when not in use.

During the on-site work, equipment and supplies will be staged at the central location prior to being moved to the specific site under investigation. Following the day's activities, all equipment will be returned to the secured storage areas. No equipment will be left unattended at an investigation site.

The actual in-field set-up of equipment at an investigation site will follow E & E's established procedures. Figure 3-1 shows the basic concept of the standard field set-up. Site-specific considerations will probably necessitate some variations. All entry to an immediate work area will be controlled at all times during field activities in order to minimize the potential health and safety risk to both in-field personnel and any observers.

Prior to the start-up of work, a detailed work plan and a site safety plan will be prepared. The site safety plan will include the

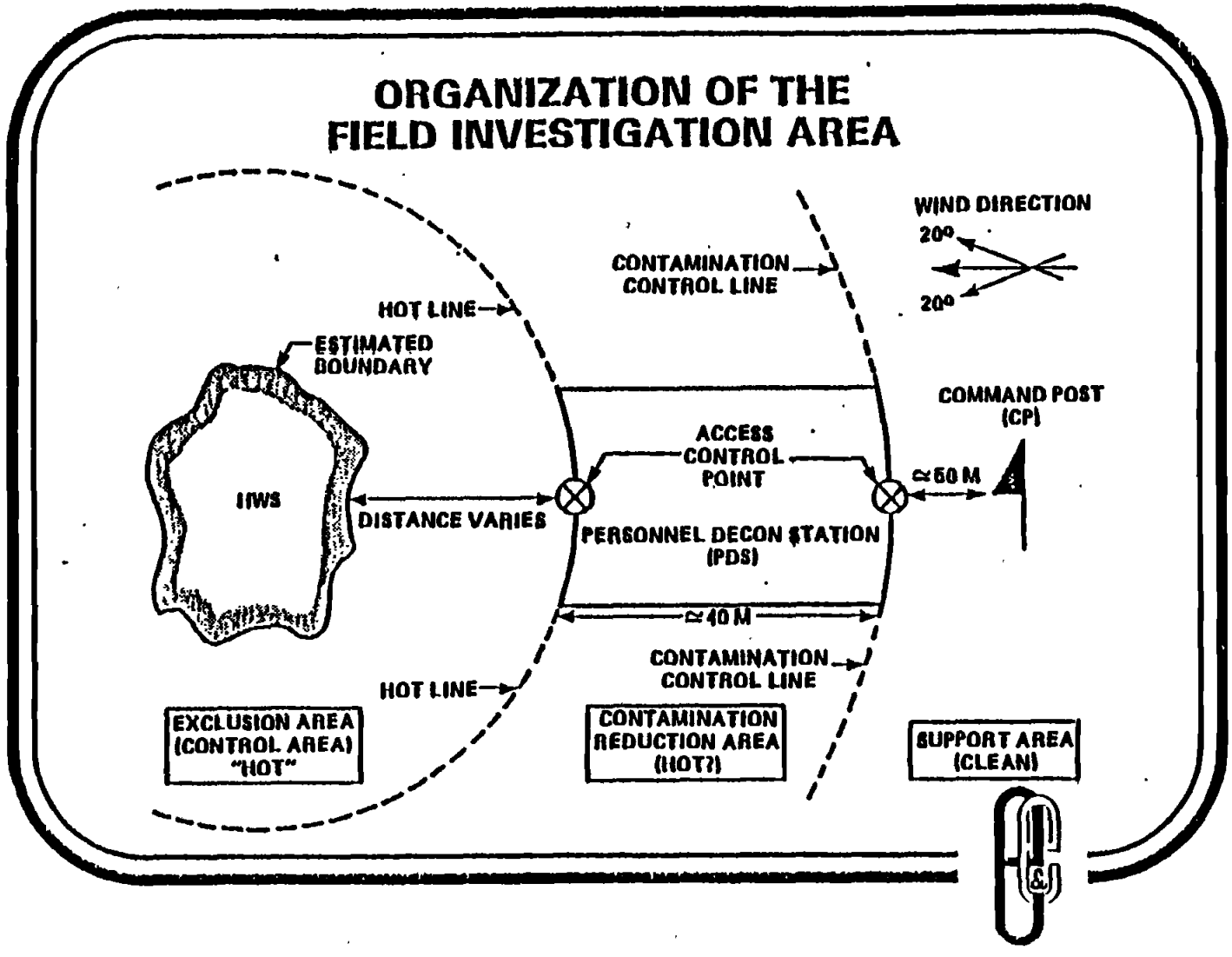

Figure 3–1 ORGANIZATION OF THE FIELD INVESTIGATION AREA

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level of personal protection required by on-site personnel. Based on existing information concerning the sites at the facility, Level C presently is planned. However, if necessary, the site safety officer (see Section 15) may upgrade or downgrade the level of protection based on new or changing observations of site conditions. This would result in a cost increase or decrease, respectively. The Health and Safety Plan is presented in Appendix A.

E & E will utilize qualified local subcontractors to support the field investigation, as required. All subcontracted work will be overseen by the E & E project manager to insure compliance with the Statement of Work specified in the delivery order to the Phase II Survey of the IRP.

4. CALIBRATION OF FIELD EQUIPMENT

All field equipment should have been calibrated prior to delivery to the site. However, because of shock received during shipping and handling, the instruments may require either recalibration or an operational check prior to field use. The method and frequency of calibration for each instrument is generally based on such factors as the type of equipment, extent of use, degree of accuracy required, and manufacturer's specifications. Instrument calibration should be certified by documented standards of accuracy, whether performed at E & E headquarters or by outside calibration or repair services. E & E requires that records of calibration dates and standards be maintained for each instrument subject to calibration.

Each piece of equipment requiring periodic calibration or calibration prior to each use must be accompanied by a bound logbook. The logbook will note the instrument's current calibration status with regard to the date last calibrated, instrument settings during calibration, and the initials of the person performing the calibration.

All instruments are to be stored, transported, and handled with care to preserve the equipment's accuracy. Equipment found to be damaged prior to or during use must be taken out of service immediately and cannot be used again until a qualified technician repairs and recalibrates the equipment in question.

5. PREVENTATIVE MAINTENANCE OF FIELD EQUIPMENT

All equipment used by E & E in the field is subject to standard preventative maintenance schedules established by corporate equipment protocols. All equipment is inspected at least twice daily, once before start-up in the morning and again at the end of the work shift prior to overnight storage or return to the charging rack. Regular maintenance such as cleaning lenses, replacement of in-line filters, and removal of accumulated dust is to be conducted according to manufacturer's recommendations and in-field need, whichever is appropriate. All preventative maintenance performed will be entered in the individual equipment's logbook and the site safety logbook.

In addition to preventative maintenance procedures, daily calibration checks will be performed at least once a day in the morning prior to use and duly recorded in the respective logbooks. Additional calibration checks will be performed as required.

All logbooks will become part of either the permanent site file or the permanent equipment file.

6. FIELD ANALYTICAL PROCEDURES AND DATA REPORTING

All field analytical procedures and sampling at a facility or from the environment may become physical evidence in a legal action. An essential part of E & E's protocols is that the analysis or sample be controlled at all times and thoroughly documented. E & E maintains serialized field data records (FDRs) in the form of individual sheets or bound logbooks. Company analysts record all on-site measurements and field observations in the FDRs, including all pertinent information necessary to explain and reconstruct site operations. Each page of the FDR is dated and signed by all individuals making entries on that page. The leader of the field team on duty is responsible for insuring that the FDR is used during all activities and is stored safely to avoid possible tampering.

In addition to individual field sheets and daily logbooks, project managers must complete weekly summary sheets delineating the past week's activities. All data sheets, logbooks, and weekly summary sheets become part of the permanent site/project file. Figures 6-1 through 6-5 are examples of the weekly summary sheets that will be used.

6.1 CHEMICAL DATA

Chemical field analyses are generally limited to preliminary testing of pH and conductivity and surveying for organic vapors or other hazardous emissions (i.e., HCN, H_2S, and contaminated dust). All findings are recorded in the site logbook, site safety logbook,

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FIELD ACTIVITIES
WEEKLY PROGRESS REPORT

Work Site: _____ E & E Job No.: _____ Week Ending: _____

Start Date: _____ Percentage of Field Work Completed: _____

Client: _____

Contractor(s): _____

Personnel and Duties: _____

Drilling:

Number of Holes Drilled: _____ Total Feet Drilled: _____ Average Feet/Day: _____

Material and Types of Equipment Used: _____

Comments: _____

Sampling:

Number of Samples Taken: ____ Water ____ Soil/Sediment ____ Average Samples/Day: ____

Materials and Types of Equipment Used: _____

Comments: _____

Other Field Activities:

Type of Work Performed: _____

Comments: _____

Future Work Plans: _____

_____
Signature/Date

cc: V.P. Technical Services, Project Director, Project Manager, Project File 447025

Figure 6–1 FIELD ACTIVITIES WEEKLY PROGRESS REPORT

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DRILLING
WEEKLY PROGRESS REPORT

Work Site: _____ E & E Job No.: _____ Week Ending: _____

Driller: _____ Driller's Helper: _____ Geologist: _____

Number of Drill Holes Drilled and Completed: _____ Average Feet/Day: _____

Drill Hole Information:

1. Hole Designation: _____ Total Depth: _____ Static Water Level: _____

   How Hole was Drilled and Equipment Used: _____

   Was Hole Cased? _____ Type and Amount of Casing Used: _____ Screened Interval: _____

   Type and Size of Well Screen: _____

   Amount of Sand, Gravel or Cement Used: _____

   Was Hole Developed? _____

   Problems Encountered: _____

2. Hole Designation: _____ Total Depth: _____ Static Water Level: _____

   How Hole was Drilled and Equipment Used: _____

   Was Hole Cased? _____ Type and Amount of Casing Used: _____ Screened Interval: _____

   Type and Size of Well Screen: _____

   Amount of Sand, Gravel or Cement Used: _____

   Was Hole Developed? _____

   Problems Encountered: _____

3. Hole Designation: _____ Total Depth: _____ Static Water Level: _____

   How Hole was Drilled and Equipment Used: _____

   Was Hole Cased? _____ Type and Amount of Casing Used: _____ Screened Interval: _____

   Type and Size of Well Screen: _____

   Amount of Sand, Gravel or Cement Used: _____

   Was Hole Developed? _____

   Problems Encountered: _____

_____
Signature/Date

cc: V.P. Technical Services, Project Director, Project Manager, Project File 448025

Figure 6–2 DRILLING ACTIVITIES WEEKLY PROGRESS REPORT

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GEOPHYSICAL SURVEYS
WEEKLY PROGRESS REPORT

Work Site: _____ E & E Job No.: _____ Week Ending: _____

Work Completed: _____

Grid System Used (area covered, spacing and designation): _____

EM Survey:

Type Equipment Used: _____

Area Covered: _____ Time (Hours) Required*: _____

Number of Data Points Collected: _____ Fullspace _____ Halfspace _____

Problem Areas: _____

Comments: _____

Magnetometer Survey:

Type Equipment Used: _____

Area Covered: _____ Time (Hours) Required*: _____

Number of Data Points Collected: _____

Problem Areas: _____

Comments: _____

Seismic Survey:

Type Equipment Used (include number of channels): _____

Area Covered: _____ Time (Hours) Required*: _____

Number and Length of Lines Run: _____

Problem Areas: _____

Comments: _____

Other Geophysical Work: _____

*Total hours charged to project.

_____
Signature/Date

cc: V.P. Technical Services, Project Director, Project Manager, Project File 446025

Figure 6–3 GEOPHYSICAL SURVEYS WEEKLY PROGRESS REPORT

ecology and environment, inc.

WATER SAMPLING
WEEKLY PROGRESS REPORT

Work Site: _____ E & E Job No.: _____ Week Ending: _____

Total Number of Samples Taken: _____ Average Samples/Day: _____

Procedures and Types of Equipment for Sampling: _____

Comments: _____

A. Sample I.D. and Location: _____
   Type of Sample: _____
   How Sample was Taken: _____
   Comments: _____

B. Sample I.D. and Location: _____
   Type of Sample: _____
   How Sample was Taken: _____
   Comments: _____

C. Sample I.D. and Location: _____
   Type of Sample: _____
   How Sample was Taken: _____
   Comments: _____

D. Sample I.D. and Location: _____
   Type of Sample: _____
   How Sample was Taken: _____
   Comments: _____

E. Sample I.D. and Location: _____
   Type of Sample: _____
   How Sample was Taken: _____
   Comments: _____

F. Sample I.D. and Location: _____
   Type of Sample: _____
   How Sample was Taken: _____
   Comments: _____

_____
Signature/Date

cc: V.P. Technical Services, Project Director, Project Manager, Project File 444025

Figure 6–4 WATER SAMPLING WEEKLY PROGRESS REPORT

ecology and environment, inc.

SOIL/SEDIMENT SAMPLING
WEEKLY PROGRESS REPORT

Work Site: _____ E & E Job No.: _____ Week Ending: _____

Total Number of Samples Taken: _____ Average Samples/Day: _____

Procedures and Types of Equipment for Sampling: _____

Comments: _____

A. Sample I.D. and Location: _____
   Type of Sample: _____
   How Sample was Taken: _____
   Comments: _____

B. Sample I.D. and Location: _____
   Type of Sample: _____
   How Sample was Taken: _____
   Comments: _____

C. Sample I.D. and Location: _____
   Type of Sample: _____
   How Sample was Taken: _____
   Comments: _____

D. Sample I.D. and Location: _____
   Type of Sample: _____
   How Sample was Taken: _____
   Comments: _____

E. Sample I.D. and Location: _____
   Type of Sample: _____
   How Sample was Taken: _____
   Comments: _____

F. Sample I.D. and Location: _____
   Type of Sample: _____
   How Sample was Taken: _____
   Comments: _____

G. Sample I.D. and Location: _____
   Type of Sample: _____
   How Sample was Taken: _____
   Comments: _____

_____
Signature/Date

cc: V.P. Technical Services, Project Director, Project Manager, Project File 445025

Figure 6–5 SOIL/SEDIMENT SAMPLING WEEKLY PROGRESS REPORT

and field data sheets, if appropriate. Any further chemical analysis conducted in the field would be recorded using the procedures stated above.

6.2 HYDRAULIC DATA

Several techniques are employed in hydrological investigations. These may be employed separately or two or more may be combined, depending on the client's needs and the nature of a particular study. The contract scope of work normally details the procedures to be followed, describes the facilities, and identifies the equipment required to conduct the hydrologic investigations. The degree of calibration necessary and the exact method of documentation are site/project-specific.

Detailed procedures to be used in hydrologic studies during the Phase II Confirmation Study at this facility may include:

- Water sample collection, preparation, and shipment;
- Pump testing;
- Swabbing;
- Surging;
- Limited field analysis of groundwater samples; and
- Determination of water levels.

All data gathered during hydrologic investigations will be maintained in serialized field logbooks or on individual sheets as previously stated. Figures 6-6 through 6-9 are examples of field data sheets which may be used by E & E field personnel.

6.3 SOIL BORING DATA

For each boring and well installation, a field log must be completed by the geohydrologist supervising the operation. The completed log describes the operation, identifies any analyses conducted with findings, and provides a graphic description of the geohydrological environment encountered. The field logs become part of the permanent site file and must be kept in a secure location. Figures 6-10 and 6-11 are examples of the typical field log sheets used by E & E personnel.

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DEPTH TO WATER

Well Name/Number _____ Date _____

Time (Military) #1 _____ #2 _____ #3 _____ #4 _____ (C.D.T.) (C.S.T.)

Name of Operator _____

I.D. of Equipment (Vehicle or Iron Horse Number) _____

Date of Last Calibration _____ To be Calibrated (Date) _____

Correction Factor _____ Measuring Point (MP) _____

Land Surface Datum (LSD) to MP _____ (Units)

Depth to Water (DTW) from MP (If measurement is within 0.1% of subsequent measurement, only 2 are necessary)

	#1	#2	#3	#4	
In reading (1)					(Units)
Out reading					(Units)
Add or subtract (2) from Out reading					(Units)
Sum of (1) & (2)					(Units)
MP to LSD					(Units)
DTW from LSD					(Units)
Correction factors of equipment					(Units)
Corrected DTW from LSD					(Units)

Tool used to obtain DTW (float switch, magnesium (copper) screw, transducer -- if transducer, list range and serial number) _____

Other equipment used (digital multimeter, recorder, etc.) List as appropriate
make _____ model _____ serial number _____
calibrated _____ calibration date _____

Procedure number used _____

Altitude of MP _____ (Units) Altitude of water level _____ (Units)

Comments _____

Figure 6–6 DEPTH TO WATER FIELD LOG SHEET

15 4/72

MONITORING EQUIPMENT

Well: _____

Date: _____

Time: _____ (Time Reference)

Name of Operator: _____

I.D. of logging equipment (vehicle) and/or cable reel No. _____

Serial Number of transducer: _____

Range of transducer: 0 to _____ (Units)

Calibration of transducer: _____ (mv/ft or mv/m)

Voltage to transducer (measured at power supply output with transducer attached): _____

Millivolts or volts as related to barometric pressure (ie. barometric pressure may be 26.73 but is printed on data acquisition system as 2.67v. Therefore entry would be 2.67v = 26.73 inches of Mercury: _____

Other equipment used (type, Serial Number, when calibrated) _____

_____

_____

_____

TRANSDUCER CALIBRATION POINTS

FT/M 1/	UP	MV	MV Change 2/

1/ Indicate which units

2/ Per interval or per unit

Figure 6–7 MONITORING EQUIPMENT FIELD LOG SHEET

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Pump Test

Sheet 1 of 1

Hole no. _____ Test no. _____ Pump setting _____ft; Geologist/Engineer _____

Cased interval _____ft; Perforated interval _____; Open hole _____ Diameter _____ in ____

Pump I.D. no. _____; Cable correction _____ft/ft; Measuring point is _____

Date 19__	Hour (Military)	Elapsed time (minutes)		Water-level measurement (feet or meters)				Discharge (gpm)	Temp (°F)	Comments
		Pumping (t)	Recovery (t')	D/W Below MP	I.H. Cable correction	D/W Below LSD	Drawdraw			

Figure 6–8 PUMP TEST FIELD LOG SHEET

Swabbing-bailing test form _____ Hole _____ Area

Observed by: _____ Date: _____

Hole depth _____ diameter _____ Cased interval _____

Perforated intervals _____ Tested interval _____

Water levels measured with _____

Measuring point is _____ which is _____ below land surface.

Static water level _____ below measuring point.

BAILING TESTS

Type of bailer _____ length _____ diameter (ID) _____

capacity

SWABBING TESTS

Method of measurement (barrel, tank, etc.) _____

Tank dimensions: Width _____ length _____ height _____

Capacity: 1 = _____ 0.1 = _____ 0.01 = _____

Measuring point _____

_____

Depth Casing set _____ Depth swabbing from _____

Weight of fluid at end of cleanout _____ _____ ft.

Time	Bailer or swab trip no.	Water removed	Depth to water below MP	t', time since discharge stopped	Remarks (temperature, color, specific conductance, etc. of sample)

Figure 6–9 SWABBING-BAILING TEST FIELD LOG SHEET

E & E Drilling and Testing Co., Inc.

FIELD LOG OF BORING
AND WELL INSTALLATION

PROJECT NUMBER AND NAME:	BORING/WELL No.:
PROJECT MANAGER: LOGGED BY:	SURFACE ELEVATION: DEPTH OF HOLE:
BORING DIAMETER: WELL DIAMETER:	CASING MATERIAL:
BORING METHOD:	FIELD CHEMIST:
HAMMER WT. (lbs):	DRILLER:
DROP (inches):	START TIME: COMPLETION TIME: DATE: DATE:

SAMPLING RECORD

SAMPLE NUMBER	SAMPLE INTERVAL	TYPE OF ANALYSIS			
		OVA	HNu	pH	Cond.

MATERIALS RECORD

DESCRIPTION	QUANTITY
TOTAL BORING (FT)	
TOTAL CORING (FT)	
NUMBER OF SPLIT SPOON SAMPLES	
TOTAL CASING (FT)	
TOTAL SCREEN (FT)	
NUMBER OF CAPS AND/OR PLUGS	
SAND-L.P. No.	
BENTONITE-L.P. No.	
CEMENT-L.P. No.	
SECURITY CAP (Y OR N)	
WELL DEVELOPMENT (Y OR N)	

LOCATION DIAGRAM:

Figure 6–10 FIELD LOG OF BORING AND WELL INSTALLATION (Form 1)

E & E Drilling and Testing Co., Inc.
FIELD LOG OF BORING
AND WELL INSTALLATION

DEPTH (FT)	GRAPHIC LOG	DEPTH TO WATER TABLE	SCREENED INTERVAL	BACKFILL MATERIAL	PROJECT NUMBER AND NAME: / DESCRIPTION	BORING/WELL NO.:	SAMPLE NUMBER AND INTERVAL	BLOW COUNTS/6 IN.	DEPTH (FT)

Figure 6–11 FIELD LOG OF BORING AND WELL INSTALLATION (Form 2)

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6.4 SURVEY DATA

All site surveying will be recorded at the time of the work in either the site logbook or a separate bound logbook, and retained in the secured permanent site file. All entries will be made in ink, with errors indicated by a single line through the initial entry followed by the corrected entry and the initials of the person making the correction.

All surveying will be conducted to an accuracy of 0.01 feet $\pm$ 0.005 feet, thus enabling static water level measurements to be used to determine groundwater flow directions.

7. SAMPLE NUMBERING SYSTEM

7.1 PROJECT IDENTIFICATION

Project management is a complex and demanding process that requires an established framework to track a project's progress. E & E has established a Work Breakdown Structure (WBS) management plan which is at the heart of project cost control and tracks a project's progress through the identification of discrete tasks or elements, each with its own specific identification number. The overall project will have a six-digit alphanumeric code called the project number sequentially followed by specific task and subtask codes. All work performed or expenses incurred for the project will be attributed to one of the specific task or subtask codes, thereby enabling easy tracking of the project's progress and cost.

For this facility, specific task and subtask codes will be assigned for the different work segments (i.e., drilling of monitoring wells, sampling of groundwater, etc.) following approval of the work plan and receipt of an authorization to proceed from the Air Force.

7.2 SITE IDENTIFICATION

All environmental monitoring and sampling sites will be identified using the Air Force's standard format of a nine-digit, alphanumeric code consistent with that required for completion of AF Form 2752. The identifier will be made up of the installation code, followed by the sampling site type code and site location number. All documentation for a specific site will include the site identification code for ease of tracking.

7.3 SEQUENCE NUMBER

All samples collected during the project will be identified with an eight-digit alphanumeric code consistent with that required for completion of AF Form 2752. All documentation referencing samples taken will be identified using this system. The sample numbers will classify the sample as to the method and type of sample and the calendar year, and will sequentially identify each sample taken.

7.4 SPLIT SAMPLES

If required, sample splits will be obtained, one portion to be retained by the client and one portion to be sent to E & E's Analytical Services Center (ASC) for analysis. Identical sample numbers will be attached to the two (or more) containers and documented in the site logbook. All sample splits will be retained under standard chain-of-custody procedures until they are relinquished to authorized personnel.

7.5 FIELD QC SAMPLES

Additional samples taken in the field are used to evaluate both sampling and analytical methods. The three basic categories are blanks, duplicates, and spiked samples. Field spikes are rarely used because complicated manipulations of measured volumes of solutions are undesirable in the field. General criteria are that there will be one blank sample for each 20 field samples, or for each batch, whichever is smaller. Approximately one in 10 samples will be taken in duplicate. The actual quantities and types of QC samples will be decided by the project manager in consultation with the ASC manager. QC samples will be labelled, preserved, transported, and secured in exactly the same manner as samples (see Sections 12 and 13).

Field Blanks

Various types of blanks are used to check the cleanliness of field handling methods. Because field conditions cannot be as rigorously controlled as they are in the laboratory, positive field blank values are not to be subtracted from sample results. It is not possible to set rules for treatment of field blank results which show a degree of contamination. This is the responsibility of the project

manager and the ASC manager, and they will decide to qualify or reject data taking into consideration all factors in a sampling and analysis project. It is possible to design blanks to monitor each and every stage of a sampling exercise: bottle cleaning, sample equipment cleaning, sample collection, transfer to bottles, bottle decontamination, packing, and shipping. Usually, only two types of blanks are used: the transport blank and the field equipment blank (sometimes called the transfer blank or rinsate blank). Field staff may add blanks if field circumstances are such that they consider normal procedures are not sufficient to prevent or control sample contamination, or at the direction of the project manager. Rigorous documentation of all blanks in the site logbooks is mandatory.

Transport Blanks

Transport blanks are blank samples designed to demonstrate that the transport of sample bottles to and from the field does not result in sample contamination. One of each type of the prepared bottles to be used during sample collection is filled with pure water, capped, and labelled. The project manager may or may not inform the laboratory that this sample is a blank. If the laboratory is not informed, it is permissible to put false identifying information on the label. If this is done, then the project manager must be responsible for preparation of the final report to the client or agency so that the information on that blank does not show up as a mysterious additional sample. Full documentation must be made in the site logbook.

The blank sample is transported to the site, unpacked, carried into the sampling area, labelled, decontaminated, packed, and shipped back to the laboratory. As far as possible, it should receive the same treatment as a real sample except that the bottle is not opened at any time.

Field Equipment Blanks

Field equipment blanks are blank samples (sometimes called transfer blanks or rinsate blanks) designed to demonstrate that sampling equipment has been properly prepared and cleaned before field use, and that cleaning procedures between samples are sufficient to minimize cross contamination. If a sampling team is familiar with a

particular site, they may be able to predict which areas or samples are likely to have the highest concentration of contaminants. Unless other constraints apply, these samples should be taken last to avoid excessive contamination of sampling equipment.

Field equipment blanks can be taken before the sampling apparatus is used to collect any samples at the beginning of the day. In this case, the blanks are used to test the initial preparation of the sampling apparatus. The sampler (bailer, split spoon, coliwasa, etc.) is rinsed with pure water (or, in some cases, solvent) and the rinsate is collected and treated as any other sample. Alternatively, or in addition, field equipment blanks can be taken during a sampling run, in which case they serve to test the efficiency of the field cleaning procedures used to prevent cross contamination. The equipment is cleaned in the recommended way, then rinsed with water (or solvent), which is then collected. In either case, it is the responsibility of the project manager and the ASC manager to interpret the results and reject or qualify data accordingly.

Duplicate Samples

Approximately one in 10 samples will be taken in duplicate. Duplicate samples are identical samples (same place and time, or immediately consecutive) placed in identical containers and treated as normal samples. For the purpose of data reporting, one is arbitrarily designated the sample, the other as the duplicate. Both sets of results are reported (not averaged) to give an indication of the precision of the sampling and analytical methods.

The project manager decides which samples are to be duplicated and whether or not to inform the laboratory. If the project manager wishes to make an assessment of the laboratory's precision without the laboratory's knowledge, the duplicate sample can either be labelled simply "duplicate" or with some false identifying information (e.g., a non-existent monitoring well identification number). In this case it is the project manager's responsibility to assess data quality on the basis of the duplicate results.

8. DRILLING AND INSTALLATION OF GROUNDWATER MONITORING WELLS

8.1 DRILLING

E & E employs a wide range of soil and rock boring techniques, including those using drive casing; both solid- and hollow-stem augers; water, air, and mud rotary and reverse rotary drills; and cable tools. The data requirements for a given well dictate the size and depth of the well, the materials to be used in its construction, and, ultimately, the method of its installation. Table 8-1 lists some available drilling methods and their limitations.

E & E's approach to well drilling and boring design will depend on the specific nature of the past operation, the present data needs, the current environmental setting at each site, and any projected remedial actions. The drilling program will have detailed specifications of procedures and techniques for well and boring location, type, and design; sample collection, preservation, and transportation; analytical procedures; and chain-of-custody control. The use of such specifications will avoid the "hit-or-miss" approach that is typical of less sophisticated programs and will eliminate hidden costs.

Soil samples will be taken every 5 feet (unless otherwise specified by the Air Force) and at every change in strata by driving a 2-inch outside diameter, 2-foot-long split-spoon sampler. Samples will be inspected in the field by a qualified hydrogeologist who will establish site stratigraphy and geologic trends. All field data will be documented in a well log (Figure 8-1) that will be presented to the Air Force. The driller will be required to keep a similar log to serve as a cross-check of the accuracy of the field notes. Representative portions of each sample will be retained in labeled jars.

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Table 8-1

SOME AVAILABLE DRILLING
METHODS AND THEIR LIMITATIONS

Method	Assets and Limitations
Drive casing	Inexpensive and excellent for shallow, small-diameter wells. Vertical samples can be obtained by split-spoon and Shelby tube samplers with relative ease. Equipment is mobile and can be moved to virtually any location. Equipment can be obtained with coring capabilities. However, the method is relatively slow and is limited to about 100 to 150 feet in depth. A supply of drilling water is necessary. This water is introduced into the boring, thus creating potential cross-contamination or dilution problems. Trouble can be encountered with boulders and coarse gravel.
Hollow-stem auger	Inexpensive and particularly well-suited to shallow wells in unconsolidated formations. Drill rigs are highly mobile and easy to set up. No drilling fluid or washwater is required. Soil and water samples and bedrock cores can be taken through hollow-stem rigs. However, drilling depths are limited to 100 to 150 feet—often less in tight formations or coarse gravels. If boulders are encountered, it is usually necessary to abandon the hole.
Hydraulic rotary	Fast and well-suited to drilling larger-diameter wells in consolidated and unconsolidated formations. Much greater depths can be attained by this method. Core samples can be collected. The chief drawbacks are the expense, complexity of equipment operation, and difficulty in obtaining undisturbed soil samples. In addition, a supply of drilling water is necessary. This water is introduced into the boring, thus creating potential cross-contamination or dilution problems.
Air rotary	Similar to the hydraulic rotary, this method has the added advantage of not having to use drilling fluids while offering the versatility of being able to use a conventional roller cone bit and mud pump. Air rotary is probably the fastest drilling method available. However, the borehole size generally is limited to eight inches.
Cable tool	Relatively simple to operate and can be employed to drill large-diameter wells in consolidated and unconsolidated formations. Core samples can be collected. However, tends to be slow and drilling water may dilute formation water.

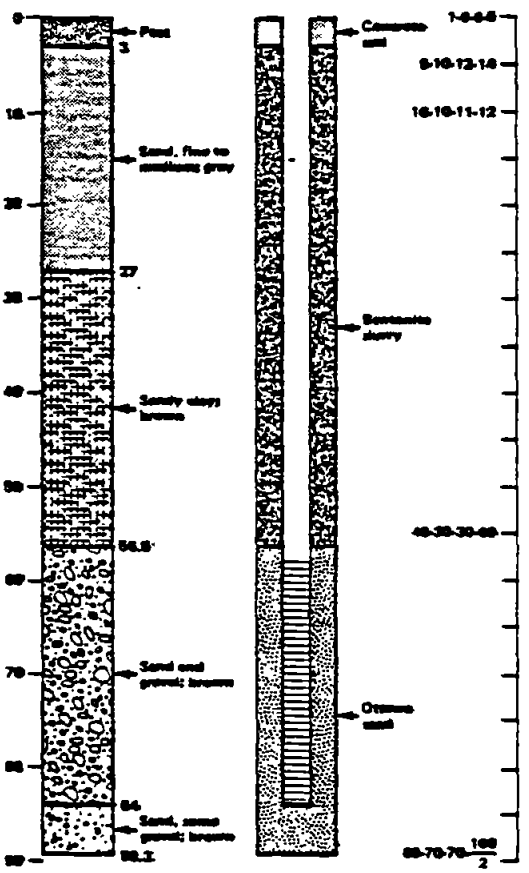
ECOLOGY AND ENVIRONMENT, INC.
MONITORING WELL LOG

Well Log Number .106.....
Project Name .....
Project Number .....

Sample

Date Prepared .3/11/83.....
Prepared by .....

DEPTH IN FEET | WELL INSTALLATION | BLOW COUNTS



Well Number (W. 420). S39...
Location .....
.....
Owner .....
Ground Elevation .45 feet....
Driller .....
Drilling Completed .1982.....
Type of Rig .....

WELL DATA

Hole Diameter .7 inches.....
Depth. .89.3 feet.....
Casing Diameter .2 inches....
Casing Depth .56.5 feet...
Screen Diameter .2 inches....
Screen Setting .84 feet.....
Screen Type .0.01 slot PVC.
Well Type .Water withdrawal

TEST DATA

Static Water Level .1 foot.....
Date Measured .3/4/83.....
Pumping Depth .....
Test Duration .....
Pumping Rate .....
Test Conn. .....
Test Type .....
Pump Setting .....
Specific Gravity .....
Final Pump Capacity .....
Final Pump Setting .....
Average Pumpage .....

WATER QUALITY

Samples Taken: Yes .X.. No ...
Number of Samples. .6.....
Type of Samples .....
....Priority scan.....
Date Sampled .1/29/83.....
Samplers .....
Will Be Analyzed for .129.....
.priority pollutants.
Split Samples to. .....
.....
Comments .....
.....

REMARKS

.....
.....
.....
.....
.....

Figure 8—1 SAMPLE MONITORING WELL LOG

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Bedrock cores are obtained by the use of diamond-tipped core barrels. All cores will be retained for future study, which may include microscopic examination of rock thin sections under a petrographic microscope to determine rock type, extent of microfracturing, and the like. Knowledge of these properties could aid team hydrogeologists in assessing the likelihood of the bedrock regime's acting as a conduit for off-site migration of contaminants. All drilling and boring will be conducted with strict adherence to ASTM standards, if applicable.

If drilling is conducted in areas suspected of being contaminated by volatile organics, samples of drilling spoils will be collected and placed in 50-mL vials with Teflon-coated septa. "Head-space" samples will be withdrawn and field-screened, using a Century Model 128 OVA, to estimate total volatile organic contamination. These data subsequently will be used to help delineate the vertical extent of contamination, establish the interval over which the well will be screened, and help characterize the contamination in order to determine the level of respiratory protection required on-site.

Stringent safety regulations will be adhered to by all E & E personnel and subcontractors. An in-depth description of the E & E corporate health and safety program, which will be followed by personnel working on Air Force projects, can be provided upon request.

8.2 SOIL SAMPLING

Soil samples will be taken at 5-foot intervals or, if warranted, on a continuous basis using split-spoon samplers. Shelby tube samples of undisturbed soil will be obtained for laboratory analysis of parameters such as hydraulic conductivity, shearing strength, and porosity. Bedrock will be obtained using diamond-tipped core barrels. The bedrock cores may be taken to the depth at which the well will be screened.

As soil samples are taken from the split spoon, an OVA will be used to "sniff" them for the presence of organic vapors. Samples will be forwarded to E & E's ASC for additional evaluation, either as composite or discrete samples.

All soils will be classified on-site by a geologist using the Unified Soil Classification Scheme.

Each containerized soil sample to be used in a composite will be sieved through a No. 8 mesh screen to remove stones and debris. Screening will be accomplished using a Teflon scraper to force material through the screen. This insures that the sample weight is not distorted by stones and debris with respect to any compound that may be present. The screened sample will then be weighed and returned to its original container for storage until all soil samples have been screened. The weight of the screened samples will be recorded for future use.

A portion of each screened sample will then be weighed to provide equal portions for the homogenization step. The weighed portions will be mixed thoroughly in a prepared 16-ounce sample bottle using a spatula. A homogeneous mixture will be attained by stirring the sample at least 10 to 15 times. The mixed sample will then be placed on a Teflon sheet and shaped into a rectangular form of even thickness. The rectangle will then be quartered: two diagonal quarters will be combined as the client composite; the alternate diagonal quarters will be combined as a storage composite. For storage, the composites will be placed in prepared containers, sealed, and accompanied by appropriate sample control records. The storage composites will be held at the ASC in a secured storage area until the project is complete.

The soil composites for volatile organic analysis will be prepared in the following manner. During field operations, a portion of each soil sample will be placed in a 40-mL borosilicate vial. Equal portions of soil will be removed from each vial and placed in the composite vial. The composite samples will then be mixed quickly and the vial sealed.

More detailed soil contamination data will be required if soils contaminated with hazardous materials are to be excavated and removed to approved disposal facilities. For this type of investigation, the surface of the disposal site will be surveyed and gridded into areas of approximately 1,000 square feet. (Grid size may vary, depending on the nature of the site and underlying soils.) A borehole will be installed at the center of each grid square; soil samples will be taken at the ground surface and at 5-foot intervals until the appropriate depth has been reached. This depth may vary from as

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little as 5 feet in areas underlain by compact clays to as much as 100 feet in areas underlain by coarse sand and gravel. The result of this type of study is a three-dimensional representation of the soil beneath the site to the appropriate depth, with contaminant data for each block.

Surface water drainage channel soil samples will be taken to a depth of 12 inches, typically at 50-foot intervals, to a distance of 150 feet from the site boundary along each channel.

8.3 MONITORING WELL CONSTRUCTION AND COMPLETION

Upon completion of the borehole, team hydrogeologists will supervise the installation of the monitoring well(s). The type of materials used in well construction will vary according to data requirements. For example, in a shallow, unconsolidated glacial aquifer contaminated by volatile organic contaminants, the project team normally would specify 2-inch diameter PVC pipe with threaded joints. If contamination by certain ketones or aromatic compounds is suspected, it may be necessary to specify stainless steel casing in order to eliminate potential chemical reactions that could occur if PVC were used. A Johnson-Keck submersible pump would be specified for purging and a Teflon bailer would be specified for sampling. Other variables could include the length of well screen, screen slot size, type of backfill to be used, type and length of seal or grout, and type of well security to be used. All variables will be considered carefully and the best design for the job will be presented to the USAF-OEHL project engineer for approval.

Figure 8-2 shows three alternative types of monitoring wells, each designed to address a different set of data requirements:

- Fully screened wells are used to enable the hydrogeologist to obtain a composite sample of groundwater to establish compliance points and detect the presence of any aquifer contamination. Their use also is recommended in conducting pumping tests to obtain accurate measurements of aquifer response.

- Bedrock wells enable selective sampling of the bedrock aquifer in order to measure groundwater quality and to evaluate the interaction between bedrock and unconsolidated aquifers.

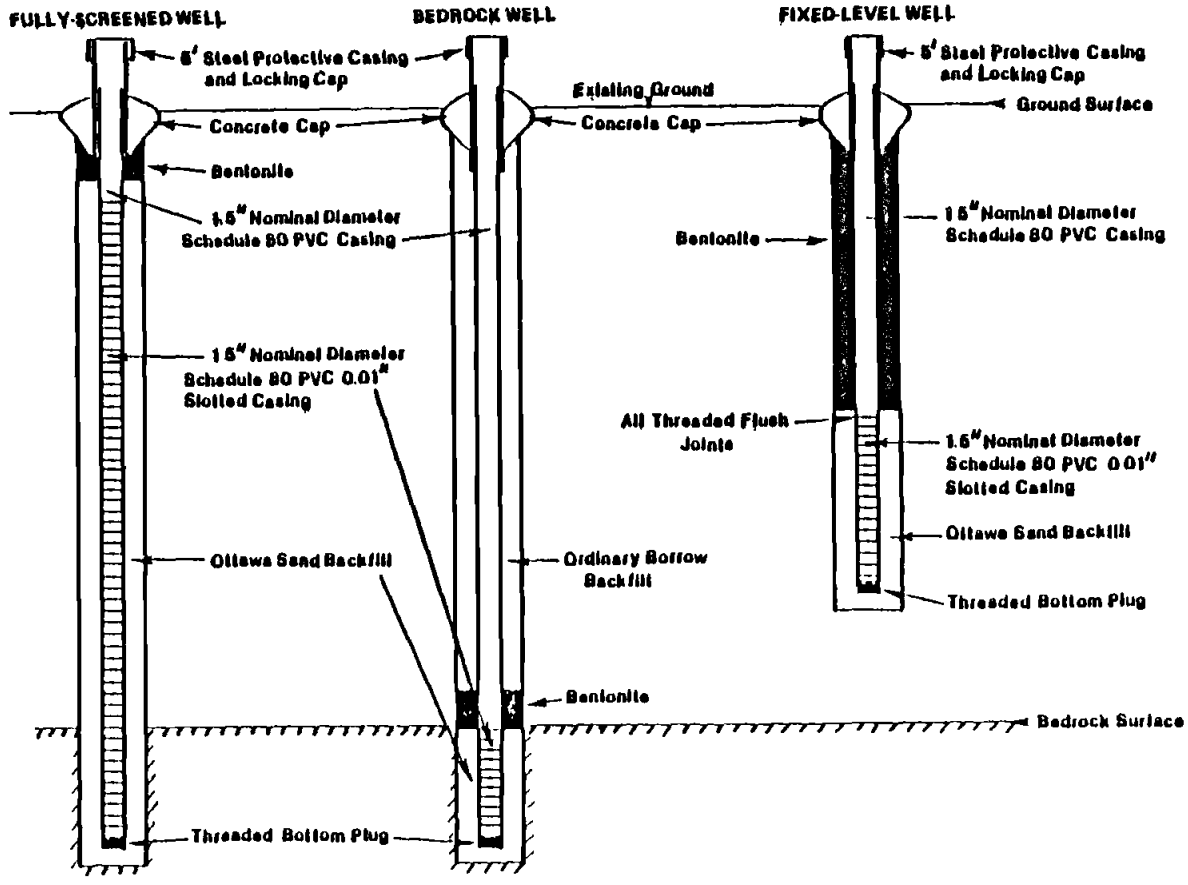

Figure 8–2 TYPICAL DETAIL OF MONITORING WELLS

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- Fixed-level wells are utilized to take isolated samples from individual strata suspected of containing contaminated groundwater. These wells also can provide an early warning system to detect the movement of contamination into isolated, pollutant-free aquifers. Great care will be taken to preclude the possibility of cross-contamination of aquifers by carefully reviewing geologic and geophysical data, conducting field analyses of soil samples for contamination, and the placing of grouting material at confining layers.

When drilling in a potentially contaminated environment, it will be necessary to collect and dispose of drilling spoils and washwater and to dispose of or properly decontaminate protective equipment. Furthermore, to prevent cross-contamination between wells, it will be imperative to decontaminate all drilling equipment between wells (see Section 11.1). This may necessitate steam cleaning the equipment, rinsing it with a solvent, and then subjecting it to a second steam cleaning. Subject to all pertinent local, state, and federal regulations, decontamination wastes will be containerized and all contaminated wastes generated on-site subsequently will be removed to an approved disposal facility by a licensed hazardous waste hauler.

Unless otherwise specified, E & E will design all wells as permanent sampling locations. Therefore, care will be taken to locate the wells so that they may be incorporated into future monitoring and remedial operations. Concrete caps and protective, lockable steel casings will be installed around each well, thus reducing the possibility of vandalism while insuring sample integrity.

All well casing top elevations will be surveyed to an accuracy of ± 0.01 feet, thus enabling static water level measurements to be used to determine groundwater flow directions.

All drilling operations, installation procedures, sampling data, and waste disposal operations will be fully documented in bound field books to assure that the highest degree of care has been taken in completing all required work.

8.4 WELL DEVELOPMENT

At least 48 hours after internal mortar placement, the monitoring wells will be developed according to procedures prescribed below. Well development will be conducted using either a submersible pump, airlift methods, or a bottom discharge bailer, with or without a surge block. The wells will be drilled without the use of drilling fluid and a minimum of five times the amount of the standing water volume in the well, including the well screen, casing, and saturated annulus (assuming 30% porosity), will be removed. Wells will be developed until the well water is clear to the unaided eye, the sediment thickness remaining in the well is less than 5% of the screen length, and the five well volumes (described above) have been removed.

Well development also will include washing the entire well cap and the interior of the well casing above the water table using only water from that well. The result of this operation will be a well casing that is free of extraneous material (grout, bentonite, sand, etc.) inside the riser, well cap, and blank casing between the top of the well casing and the water table. This washing will be conducted before and/or during development, not after development.

The following data will be recorded as part of well development:

- Well designation;
- Date(s) of well installation;
- Date(s) and time of well development;
- Static water level from top of well casing before 24 hours after development;
- Quantity of water lost:
  - During drilling and
  - During fluid purging;

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- Quantity of fluid in well prior to development

  - Static water level and

  - Contained in saturated annulus;

- Field measurement of pH before, twice during, and after development;

- Field measurement of specific conductance before, twice during, and after development;

- Depth from top of well casing to bottom of well (from diagram);

- Screen length (from diagram);

- Depth from top of well casing to top of sediment inside well, before and after development;

- Physical characteristics of removed water, including changes during development in clarity, color, and particulates;

- Type and size/capacity of pump and/or bailer used;

- Description of surge technique, if used;

- Height of well casing above ground surface; and

- Quantity of fluid/water removed and time of removal.

The water removed from a well during development will be stored on-site in bulk containers or drums for proper disposal if the water is contaminated.

8.5 GEOPHYSICAL LOGGING

All boreholes for monitoring wells will be geophysically logged for the purpose of cataloging and correlating lithology and stratigraphy. Because the boreholes will be drilled without the use of drilling fluids, it is recommended that calibrated nuclear logs, such as neutron and gamma-gamma, along with natural gamma logs, be used. Electric logs, such as spontaneous potential and resistivity, cannot be run due to the lack of drilling mud and, although there may be some water in the drill hole, it is not anticipated that the water height will be sufficient to allow meaningful surveys to be performed. Nuclear logs will supply information pertaining to lithology, stratigraphy, total porosity or bulk density, and moisture content. The advantage of these logs is that they can be used in either cased or uncased boreholes. As a cost-saving benefit, E & E recommends that all geophysical logging be performed upon completion of all well construction, to minimize standby costs.

Table 8-2 contains a summary of log applications that may be used for this project, and the types of information that may be obtained from each.

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Table 8-2

SUMMARY OF LOG APPLICATIONS

Required Information	Widely Available Logging Techniques that Might be Used
Lithology and stratigraphic correlation of aquifers and associated rocks	Electric, sonic, and caliper logs in open holes; nuclear logs in open or cased holes
Total porosity or bulk density	Calibrated sonic logs in open holes; calibrated neutron and gamma-gamma logs in open or cased holes
Location of water level or saturated zones	Electric, temperature, and fluid conductivity in open holes or inside casings; neutron and gamma-gamma logs in open holes or outside casings

9. AQUIFER TESTING

The movement of groundwater and any associated contaminant plume through an aquifer is controlled by the physical characteristics of the medium and the hydraulic head gradient. Changes in the potentiometric surface caused by the pumping of local wells can be evaluated to determine formation permeabilities, specific yield, drawdown, and extent of cones of depression. All of these properties are important in assessing the potential impact of a contaminant plume on local groundwater quality. Artificial changes in the hydraulic head caused by withdrawing water from the aquifer can locally distort the potentiometric surface and alter the flow direction of a contaminant plume. Proper placement of a pumping well may locally lower the water table, effectively isolating a potential source of contamination from contact with the groundwater. A pumping well situated in a contaminant plume can be incorporated into a remedial action plan to remove the contaminated water for treatment purposes. A pumping well also can be used as a diagnostic tool to determine the hydraulic connection between adjacent aquifers in order to aid in the siting of proposed landfills, lagoons, and waste storage sites.

By interpreting the aquifer response to any of a variety of field tests, E & E hydrogeologists infer data pertaining to transmissivity, storativity, and boundary conditions, as well as data pertinent to the movement and extent of contaminant plumes.

Existing wells will be used whenever possible to reduce project costs. Generally, a well diameter of at least four inches will be needed. Three or more observation wells usually will be specified.

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The wells will provide the water table data for varying distances from the pumping well, which will be used to determine the size and shape of the cone of depression and the aquifer transmissivity.

E & E will supervise the design and installation of suitable wells. Pumping wells will be of sufficient size to accommodate standard submersible pumps and generally will be screened over the entire saturated thickness of the aquifer. Observation wells will be sited to provide the data thought to be necessary and will be screened in the proper strata to accurately gage the aquifer response to pumping.

Normally, a pumping test will be conducted as a 72-hour step-drawdown test. E & E personnel will monitor the wells for the full duration of the test (discharge rates will be measured by a free discharge pipe orifice or by a commercially available flow meter). Hydrogeologists will evaluate the data using type curves for both time-drawdown and distance-drawdown solutions. The methodologies pioneered by C.V. Theis in 1935 will be used to analyze confined aquifer situations; the methodologies developed by S.P. Neuman in 1975 will be used to analyze unconfined aquifer systems.

When pumping tests are conducted in contaminated environments, periodic sampling will be conducted to enable E & E hydrogeologists to assess changes in pollutant content and to determine the effects of pumpage on the contaminant plume. The discharge of contaminated groundwater generated by a pumping test may need to be contained or may require a National/State Pollutant Discharge Elimination System permit from the appropriate regulatory agency if it is discharged to a sewer or to a body of surface water. E & E will assist in the acquisition of any required permits.

On a smaller scale, individual piezometer wells can be used to conduct in-situ permeability tests. Such tests involve creating an instantaneous head change in the piezometer and then recording head recovery versus time as the water level gradually returns to its static condition. In-situ permeability tests are of two types: "slug" tests, in which a volume of water is instantaneously added, and "bail" or "pump" tests, in which a volume of water is instantaneously removed. The method that E & E most commonly uses to interpret these

data and derive a permeability number is the method of Hvorslev*, which uses time/head-change data to graphically calculate a factor, T_0, "basic time lag." Then, for a piezometer screen length of L, a sandpack radius of R, and a well casing radius of r, the permeability, K, is defined as:

$$K = \frac{r^2 \text{in } (L/R)}{2L\ T_0}$$

The computation of K for each piezometer allows a hydrogeologist to compute the actual rate at which the groundwater (and thus contaminants) leaves the site by applying the following version of the common Darcy equation for groundwater flow:

$$Q = KiA,$$

where Q is groundwater discharge; K is permeability; i is hydraulic gradient (derived from piezometer water levels); and A is cross-sectional area perpendicular to flow.

A typical aquifer test will include collection of background data for siting purposes, installation of a discharge well and three observation wells, monitoring to establish background conditions, performance of a 72-hour pump test, and interpretation of the results.

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*Hvorslev, M.J., 1951, "Time Lag and Soil Permeability in Groundwater Observations," United States Army Corps of Engineers, Waterways Experiment Station Bulletin 36, Vicksburg, Mississippi.

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10. GROUNDWATER MONITORING AND SAMPLING

10.1 GROUNDWATER LEVEL MEASUREMENT

Water levels will be measured at all monitoring wells and surface water staff gaging stations on a monthly basis. Work will be performed in accordance with established safety requirements by either contractor or subcontractor personnel. All measurements will be taken to within 0.01 foot.

The top of the interior casing of all monitoring wells will be marked at one point, which will be surveyed to determine its elevation. The depth of the water table below the top of the casing will be determined by a steel tape or electric water level indicator. All equipment will be decontaminated between wells to prevent cross- contamination.

10.2 SURVEYING OF WELLS

Following completion of the installation of the final well, each installed well location will be surveyed to determine map coordinates (Univeral Transverse Mercator, State Planar, or latitude/longitude) to within one meter and entered onto a site map. Elevations of both the ground surface and the top of the well riser will be surveyed to within 0.01 foot (± 0.005 foot if possible) using the National Geodata Vertical Datum of 1929. These data will become part of the permanent site file.

10.3 ON-SITE ANALYSIS

Groundwater sampling and analysis will involve the following steps:

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- Measurement of the static water level;
- Purging of several well volumes;
- Acquisition of the sample;
- On-site analysis; and
- Off-site analysis (see Section 10.4).

Before any water is drawn from a well, the static water level depth from the top of the casing is measured, then the well is purged. If the well can be completely dewatered, the purging process consists of removing a volume equivalent to twice the volume of the standing water originally contained within the monitoring well plus the surrounding sand or gravel pack, if present. If the well cannot be dewatered (because the specific yield is relatively large), the purging consists of the removal of at least five standing volumes (possibly more, depending on the results of pH and specific conductivity testing conducted on the purge water in time series). The values are time plotted and the purging process is considered complete when the values have stabilized. In most cases, a submersible pump is used to accomplish this purging. The most versatile pump of this type is the small-diameter stainless steel Johnson-Keck pump, which is battery operated and small enough to fit into two-inch diameter wells.

To avoid sample cross-contamination, E & E uses bailers constructed of Teflon, PVC, or stainless steel. Each bailer is thoroughly decontaminated before it is used in the next well. Bailer size depends on the requirements of each project. The bailers are constructed of Teflon-extruded, heavy wall tubing and are plugged at the bottom with a short length of Teflon-extruded rod (no glue is used). Water enters the bailer both from the open top and from the bottom through a 3/4-inch hole. It is prevented from flowing out of the hole by a one-inch glass marble, which rests in a conical seat machined into the top of the plug.

On-site analysis is generally restricted to pH, conductivity, and surveys for organic vapors. pH and conductivity are routinely checked during purging operations to determine steady-state conditions between the water within the well column and the existing groundwater. In areas of potential contamination, a flame ionization or photoionization instrument is routinely used to survey the groundwater during

purging and the water samples for organic vapors in order to determine the potential health hazards.

10.4 SAMPLING FOR OFF-SITE ANALYSIS

Sampling of groundwater for off-site analysis is conducted in the same manner as sampling for on-site analysis as described in Section 10.3, with the addition that the water samples are containerized and shipped to an outside laboratory for analysis as described in Sections 12 and 13.

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11. DECONTAMINATION PROCEDURES

Decontamination of personnel and equipment is an important element of site safety operations. Proper decontamination prevents sample cross-contamination and contamination of personnel, vehicles, and the public; moreover, it supports quality control. Decontamination at the site involves the use of field decontamination stations for personnel, equipment, and clothing.

The decontamination process is designed to control the spread of contaminants to clean areas by physically removing or chemically neutralizing the contaminants. The following subsections delineate the basic decontamination processes for various pieces of field equipment and describe a sample personnel decontamination set-up for a Level B or C site. The actual decontamination layout is generally site-specific but would include most, if not all, of the described stations. A Level D site would involve less protective clothing and fewer stations.

Decontamination procedures normally take place in the contamination reduction area (see Figure 11-1). In this area, all equipment which entered the site is cleaned prior to moving off-site and outside of the contamination control line. Table 11-1 identifies various decontamination wash solutions which can be used depending on the site-specific hazards encountered.

11.1 DRILLING, SOIL SAMPLING, AND MONITORING WELL INSTALLATION

Prior to use in the field, and between sampling locations, all equipment, including the full auger rig and all auger flights, will be

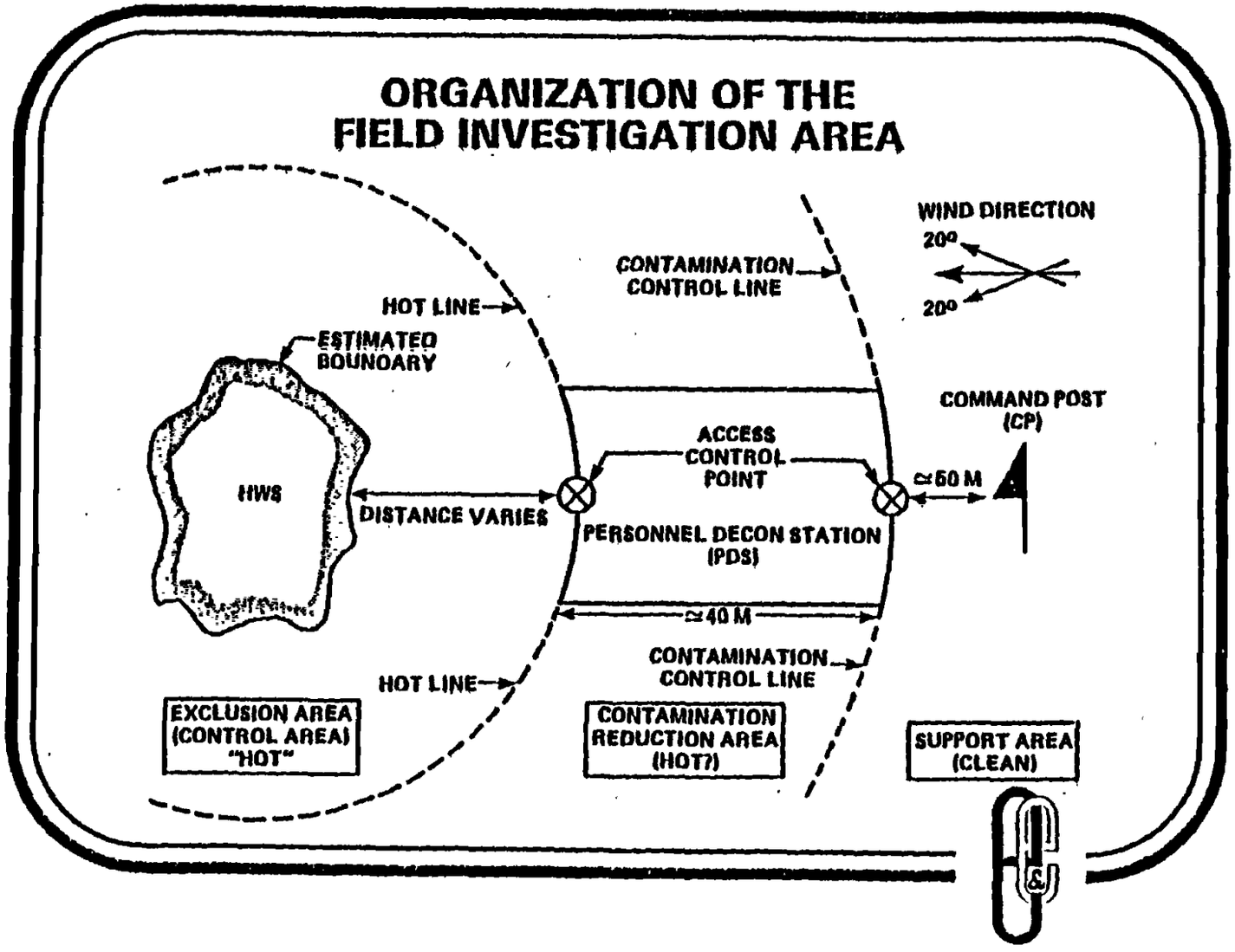

Figure 11–1 ORGANIZATION OF THE FIELD INVESTIGATION AREA

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Table 11-1

USE OF GENERAL PURPOSE DECONTAMINATION SOLUTIONS

Decon Solution	Mixing Solutions	Uses/Remarks
A. An aqueous solution containing a low-sudsing detergent	Follow the mixing instructions written on the particular product label	Generally has the widest range of use; best choice on sites where contaminant is unknown or a wide range of contaminants exists
B. An aqueous solution containing 5% sodium carbonate (Na_2CO_3) washing soda	To 10 gallons of water, add four pounds of sodium carbonate	Decon solution of choice for base labile compounds such as the organophosphate pesticides; effective in neutralizing inorganic acids; since sodium carbonate is a water softening agent, this characteristic is an aid in physical removal of contaminants.
C. An aqueous solution containing 5% sodium bicarbonate ($NaHCO_3$) baking soda	To 10 gallons of water, add four pounds of sodium bicarbonate	Sodium bicarbonate is amphoteric and can be used to neutralize either base or acid contaminants; good decon for base labile compounds
D. An aqueous solution containing 2% trisodium phosphate (Na_3PO_4) (TSP)	To 10 gallons of water, add approximately two pounds of trisodium phosphate	See uses/remarks for decon solution B above
E. An aqueous solution containing 10% calcium hypochlorite ($CaCl_2O_2$) (HTH)	To 10 gallons of water, add eight pounds of calcium hypochlorite	Cyanide salts
F. Ethylenediaminetetra-acetic acid (EDTA, versene, sesquestrene)	Commercial product; follow product label	EDTA is a chelating agent and is the decon solution of choice for heavy metal contaminants
G. An aqueous solution containing 3 to 5% citric, tartaric, oxalic acids or their respective sodium salts	To 10 gallons of water, add four pounds citric, tartaric, or oxalic acid	These compounds are chelating agents and are the decon solution of choice for heavy metal contaminants

decontaminated using the following cleaning procedures. At least 200 feet of auger will be dedicated to the rig prior to the initiation of drilling. Drilling will be carried out on a plastic tarp pad, nominally 20 by 20 feet. Drill cuttings will be collected on the pad during drilling. Once a hole has been completed, the used augers will be fully cleaned on the pad and the washings will be collected in the cuttings on the pad. The cleaned augers will be returned to the working rig.

The equipment washing procedure is as follows:

- The auger flight will be steam-cleaned.
- The auger flight will be fully rinsed with methanol, an organic solvent that is easily volatilized, is not a priority pollutant, and therefore cannot introduce extraneous contamination to the site.
- The auger will be thoroughly rinsed with distilled water and allowed to air-dry.

All soil sampling equipment including split spoons, stainless steel spatulas, screens, and pans will be decontaminated by washing in laboratory-grade detergent, rinsing three times with tap water, rinsing with either pesticide-grade acetone or methanol, and then rinsing with ASTM Type I water. The equipment will be air-dried prior to repeated use. If weather conditions or other factors prohibit air-drying, the equipment will be dried in an oven at 105°C for 15 minutes and allowed to return to room temperature prior to use.

11.2 WELL DEVELOPMENT AND AQUIFER TESTING

All equipment used during well development and aquifer testing will either be cleaned/decontaminated or new prior to placement into the well. Equipment such as submersible pumps will be thoroughly decontaminated using the procedures identified in Section 11.1 Several items such as monofilament line, rope, and tubing purchased new will be rinsed with ASTM Type I water.

Following completion of well development and aquifer testing at each well, the equipment removed from the well will be considered as contaminated and subject to the same decontamination process or discarded prior to use in another well.

11.3 WATER LEVEL MEASUREMENTS

Water level measurements will generally be taken using a steel tape or electronic water level indicator. All equipment entering the well will be washed and rinsed prior to insertion into the well according to the procedures specified in Section 11.1. Upon completion of the measurement at each well, the equipment will be subjected to the same decontamination process prior to use on any additional wells in order to prevent cross-contamination.

11.4 WATER SAMPLING

Water sampling equipment (pumps, bailers, glass sampling jars, etc.) will be cleaned prior to use in any sampling work according to the procedures described in Section 11.1. Following completion of sampling at a specific point, all equipment will be subjected to the same decontamination process to prevent cross-contamination between sampling points.

11.5 SEDIMENT SAMPLING

Sediment sampling equipment such as stainless steel scoops, sieves, augers, split spoons, and dredges will be subjected to the same decontamination procedures as other field equipment both prior to and immediately following use at each sampling site.

11.6 PERSONNEL DECONTAMINATION

Avoidance of contamination is the first and best method for preventing the spread of contamination from a hazardous site. Every effort should be made to prevent direct contact with the contaminant. Careful planning, knowledge of the contaminant, and attention to where one puts one's hands and feet are all important. Simple common-sense rules of contamination avoidance include not sitting down, not leaning against drums or debris, and not putting equipment on the ground.

No one should enter a site alone, though all tasks should be accomplished with as few team members as possible. Thus, exposure is limited to a minimum number of team members, and the ultimate process of decontamination is simplified.

The first step in the decontamination process may well take place while the team is still on or just off the hazardous site but still in the exclusion area. This is especially true if there is known heavy ground contamination. In areas of spills or heavy leachate runoff, the protective boots will become heavily contaminated. As the team leaves these areas en route to the personnel decontamination station (PDS), a boot rinse with a detergent solution (from a pre-positioned container) will significantly reduce the spread of contamination along the egress route.

The PDS will be established within the contamination reduction area upwind of the hazardous substance site. The PDS will be located between the hot line (upwind boundary of the exclusion area) and the support (clean) area boundary. Figure 11-1 illustrates the organization of the field operations area.

The PDS provides a controlled decontamination and undressing system designed to avoid the transfer of chemical contamination from protective clothing or equipment to the individual. It must be established before the team enters the contaminated area so that members can immediately and safely cope with an emergency. Team members must be briefed on decontamination procedures prior to entering the contaminated area. When the team leaves the area, extreme care must be taken to insure that proper decontamination is performed. Failure to observe these procedures could result in personal injury.

11.6.1 Organization and Operation of the Personnel Decontamination Station (PDS)

The project team leader must exercise professional judgment in determining how the PDS will be organized and what decontaminants will be used. Factors he must consider include:

- The extent and type of hazard expected;
- Explosive potential;
- Meteorological conditions;

- Topography;
- Levels of protection selected; and
- Availability of equipment and supplies.

This section describes the layout of a PDS for personnel dressed in Levels B and C protection.

Set-up for Levels B and C Decontamination

Figure 11-2 illustrates a PDS designed to support personnel working in Level B or Level C protection. The following is a description of the PDS layout by station.

- Station A - Equipment Drop: A plastic ground sheet on which field equipment is placed by returning members of the work party.

- Station B - Decontamination of Outer Garments: A wash tub filled with the appropriate decontamination solution.

- Station C - Rinse of Outer Garments: A wash tub filled with a water rinse.

- Station D - Boot Removal: A bench or stool for personnel to sit on during removal of the boot covers; and a plastic-lined container for disposal of booties.

- Station E - Glove Decontamination and Rinse: A portable table containing a small bucket of decontamination solution and water rinse.

- Station F - Boot Decontamination and Rinse: A small bench or stool for personnel to sit on during decontamination; a wash tub containing the appropriate decontamination solution; a wash tub containing a water rinse; and a small can for disposal of masking tape.

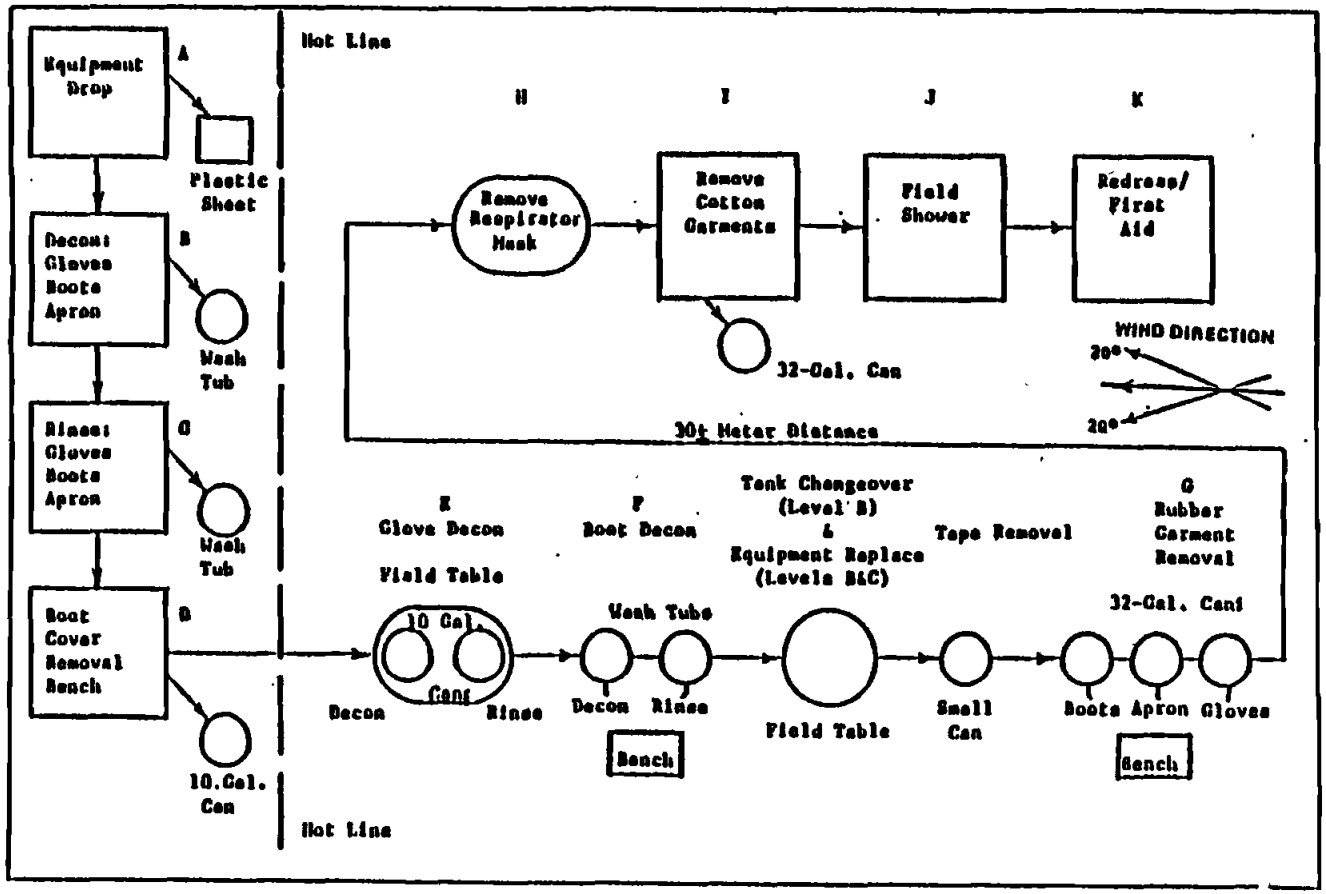

Figure 11–2 TYPICAL LAYOUT OF PDS FOR LEVEL B AND C PROTECTION

- Station G - Boot and Outer Garment Removal: A bench or stool to sit on during removal of boots, aprons, and gloves; and three 32-gallon plastic-lined containers for segregating boots, aprons, and gloves.

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- Station H - Removal of Respirator: A portable table approximately 30 meters upwind from Station G on which the self- contained breathing apparatus or air-purifying respirators are placed.

- Station I - Removal of Cotton Garments: A 32-gallon plastic-lined container for disposal of all cotton garments.

- Station J - Field Shower (Optional): A field shower set-up. If impractical or not available, a wash point (container of water, soap, and paper towels) should be provided.

- Station K - Redress and First Aid (Optional): A location to redress and render first aid as necessary. This station separates the contamination reduction area from the support (clean) area.

Levels B and C Decontamination Equipment and Procedures

Station A. Equipment such as instrumentation, sample jars, and sampling devices removed from the hazardous site should be placed on the equipment drop at this station. The plastic sheet used for this purpose is positioned on the downwind side of the hot line just inside the exclusion area. Equipment should be decontaminated by PDS operators only after all work party members have been processed through the PDS. Gross contamination can be removed from equipment either by carefully stripping off protective covers such as plastic bags or through a wash process using an appropriate decontamination solution and water. Protective covers which are removed from the equipment can be placed in the same container as the disposable booties at Station D. Equipment should be thoroughly decontaminated before taking it across the hot line.

Station B. This station is the initial and most critical step in the personnel decontamination process. The individual being decontaminated should be directed to stand in the wash tub while the PDS operator, using long-handled brushes, carefully decontaminates all outer rubber garments. Care should be exercised when decontaminating personnel wearing Level B and Level C protection to avoid splashing with decontamination solution.

Station C. This station is a rinse station. Again, the individual being decontaminated should be directed to stand in the wash tub. Care again must be exercised in rinsing the rubber garments.

Station D. Prior to crossing the hot line, the work party member should remove disposable booties and place them in the receptacle located at this station.

Station E. At this station, work party members will decontaminate and rinse their gloves. A field table is recommended to elevate the decontamination and rinse solution to waist height.

Station F. Work party members will sit on the bench provided while PDS operators will sequentially decontaminate and rinse the boots. The small container located between Stations F and G is used to dispose of all used masking tape.

Station G. Work party members will sit on the bench provided and sequentially remove their boots, apron, and gloves.

Station I. The individual will remove all cloth undergarments such as coveralls, socks, and underwear, and place them in the container provided.

Station J. This station is a field shower facility. If a shower is not available, personnel should as a minimum wash their hands and faces before leaving the site. Personnel should be instructed that a shower is required to complete the decontamination process.

Station K. After showering, work party members will redress into clean clothes and receive first aid (e.g., treatment of minor cuts and bruises), if required. The individual then leaves the PDS and moves into the support area.

11.6.2 Preparation of Decontamination Solutions

Ideally, the decontamination solution used should react with and chemically neutralize the contaminants found at a hazardous substance site. However, since the contaminants on a particular site will be unknown in most cases, a decontaminant is more often chosen based on its ability to physically remove (dissolve or suspend) the contaminant in question.

In all decontamination operations water is a recommended solvent. Organic solvents dry the skin and are often more toxic than the hazard one is trying to eliminate. These solvents also accelerate the deterioration and penetration of protective clothing. Water, on the other hand, does not damage protective clothing and does not contribute to secondary contamination.

It must be recognized that there are no universal decontaminants and the project team leader will often be required to make a professional judgment regarding this matter. Table 11-1 lists chemical mixtures suggested as readily available general-purpose decontaminants. Their application and instructions for preparation are also presented in the table.

11.6.3 Closure of the PDS

When the PDS is no longer needed, it should be closed down by the PDS operators. All disposable clothing and plastic sheeting used during the operation should be double-bagged and either contained on-site or removed to an approved off-site disposal facility. Decon and rinse solution could be discarded on-site or also removed to an approved disposal facility. Reusable rubber clothing should be dried and prepared for future use. (If gross contamination has occurred, additional decontamination of these items may be required.) Cloth items should be bagged and removed from the site for final cleaning. All wash tubs, pails, containers, etc., should be thoroughly washed, rinsed, and dried prior to removal from the site.

12. SAMPLE HANDLING AND PACKING

12.1 SPLIT SAMPLE PROCEDURES

When split samples are requested, identical sample tags will be attached by E & E personnel to the two (or more) containers. The E & E sample will be clearly marked as such and treated in accordance with normal procedures. Any other split samples will remain subject to chain-of-custody procedures until they are relinquished to the person requesting them. E & E personnel also may be required to comply with the custodial procedures preferred by the person requesting the split samples; these procedures will be complied with on a case-by-case basis. All split samples will be documented in the site logbook.

12.2 SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

In order to preserve sample integrity either for physical, chemical, or biological analyses as well as to have a sufficient volume of each sample for analysis, all samples will be collected in the appropriate containers, preserved when required, and stored at the appropriate temperature. Various sample containers (e.g., glass, plastic) and container sizes will be used, depending on the specific analyses required. Table 12-1 lists the sample containers, preservatives, and holding times to be used to analyze for the priority pollutants listed in 40 Code of Federal Regulations (CFR) Part 136. Table 12-2 lists the sample bottles to be used, the volumes, the preservatives, and the holding times for biological parameters, physical parameters, metals, inorganic and nonmetallic compounds, and organic compounds. All of the listed sample containers, preservatives, and holding times in the tables are approved and/or recommended by EPA.

Table 12-1

RECOMMENDED SAMPLE STORAGE, PRESERVATION, AND HOLDING TIMES OF PRIORITY POLLUTANTS: EPA 40 CFR 136

Parameter	Container*	Preservative	Holding Time
Purgeable halocarbons	A	4°C	7 days
Purgeable aromatics	A	4°C	7 days
Acrolein acrylonitrile	A	4°C	7 days
Phenols	B	4°C	**
Benzidines	B	4°C	**
Phthalate esters	B	4°C	**
Nitrosamines	B	4°C	**
Organochlorine pesticides and polychlorinated biphenlys (PCBs)	B	4°C	**
Nitroaromatics and isophorone	B	4°C	**
Polynuclear aromatic hydrocarbons	B	4°C	**
Haloethers	B	4°C	**
Chlorinated halocarbons	B	4°C	**
2,3,7,8-tetrachloro-dibenzo-p-dioxin	B	4°C	**
Purgeables	A	4°C	7 days
Base/neutrals, acids, and pesticides	B	4°C	**
EPA 40 CFR 141: Trihalomethanes (THM) (Drinking Water)			
Tap water***	A	4°C	14 days
Open body	A	4°C	14 days

Key:

A = 40-mL clear screw-cap septum vials plus caps with 22-mm Tuf-Bond Teflon silicone discs.
B = 1/2-gallon amber glass bottle with Teflon-lined cap.

*The bottles, vials, caps, and discs listed here are those listed in EPA 40 CFR 136 (Federal Register, December 3, 1979, revised October 26, 1984) and EPA 40 CFR 141 (Federal Register, November 29, 1979).
**Extracted within seven days and analyzed within 30 days.
***If the tap water is chlorinated, 2.5 to 3.0 mg of sodium sulfite ($NA_2S_2O_3$) per 40 mL of water sample is used unless maximum trihalomethane concentration is to be determined.

Table 12-2

RECOMMENDED SAMPLE STORAGE, PRESERVATION, AND HOLDING TIMES ACCORDING TO MEASUREMENT[1]

Parameter	Minimum Volume Required (mL)	Container[2]	Preservative	Holding Time[3]
Biological Parameters				
Fecal coliform	100	Autoclaved P,G	Cool, 4°C	6 hours
Total coliform	100	P,G	Cool, 4°C	6 hours
Fecal streptococci	100	P,G	Cool, 4°C	6 hours
Standard plate count	100	P,G	Cool, 4°C	6 hours
Benthos (macrobenthic invertebrates)	--	P,G	Formalin/ Glycerine	6 months
Chlorophyll-a	1,000	P,G	Filter on-site Freeze immediately	3 months
Phytoplankton	250	P,G	2 mL Lugol's Solution	6 months (darkness)
Zooplankton	250	P,G	Formalin/ Glycerine	4 months
Physical Parameters				
Color	50	P,G	Cool, 4°C	24 hours
Conductance	100	P,G	Cool, 4°C	24 hours[4]
Hardness	100	P,G	Cool, 4°C HNO_3 to pH <2	6 months[5]
Odor	200	G only	Cool, 4°C	24 hours
pH	25	P,G	*In situ*	6 hours
Residue				
Filterable	100	P,G	Cool, 4°C	7 days
Nonfilterable	100	P,G	Cool, 4°C	7 days
Total	100	P,G	Cool, 4°C	7 days
Volatile	100	P,G	Cool, 4°C	7 days
Settleable matter	1,000	P,G	None required	2 days
Temperature	1,000	P,G	*In situ*	No holding
Turbidity	100	P,G	Cool, 4°C	48 hours

Table 12-2 (Cont.)

Parameter	Minimum Volume Required (mL)	Container[2]	Preservative	Holding Time[3]
Metals				
Dissolved	200	P,G	Filter on-site HNO_3 to pH <2	6 months[5]
Suspended	200		Filter on-site	6 months
Total	100	P,G	HNO_3 to pH <2	6 months[5]
Mercury				
Dissolved	100	P,G	Filter on-site HNO_3 to pH <2	38 days (glass) 28 days (hard plastic)
Total	100	P,G	HNO_3 to pH <2	38 days (glass) 28 days (hard plastic)
Inorganics, Nonmetallics				
Acidity	100	P,G	None required	24 hours
Alkalinity	100	P,G	Cool, 4°C	24 hours
Bromide	100	P,G	Cool, 4°C	24 hours
Chloride	50	P,G	None required	7 days
Chlorine	200	P,G	Determined on site	No holding
Cyanides	500	P,G	Cool, 4°C NaOH (sodium hydroxide) to pH 12 and Ascorbic Acid-Treat with Cd if Sulfide is present	24 hours
Dissolved oxygen				
Probe	300	G only	*In situ*	No holding
Winkler	300	G only	Fix on-site	4-8 hours
Fluoride	300	P,G	None required	7 days
Iodide	100	P,G	Cool, 4°C	24 hours
Nitrogen				
Ammonia	400	P,G	Cool, 4°C H_2SO_4 to pH <2	24 hours
Kjeldahl, total	500	P,G	Cool, 4°C H_2SO_4 to pH <2	24 hours[6]

Table 12-2 (Cont.)

Parameter	Minimum Volume Required (mL)	Container[2]	Preservative	Holding Time[3]
Inorganics, Nonmetallics (Cont.)				
Nitrate plus nitrite	100	P,G	Cool, 4°C H_2SO_4 to pH <2	24 hours[6]
Nitrate	100	P,G	Cool, 4°C	24 hours
Nitrite	50	P,G	Cool, 4°C	48 hours
Phosphorus, ortho-phosphate, dissolved	50	P,G	Filter on-site Cool, 4°C	24 hours
Hydrolyzable	50	P,G	Cool, 4°C H_2SO_4 to pH <2	24 hours[6]
Total	50	P,G	Cool, 4°C H_2SO_4 to pH <2	24 hours[6]
Total dissolved	50	P,G	Filter on-site Cool, 4°C H_2SO_4 to pH <2	24 hours[6]
Silica	50	P only	Cool, 4°C	7 days
Sulfate	50	P,G	Cool, 4°C	7 days
Sulfide	500	P,G	2 mL zinc acetate & NaOH	7 days
Sulfite	50	P,G	Determined on-site	No holding
Organics				
BOD	1,000	P,G	Cool, 4°C	24 hours
COD	50	P,G	H_2SO_4 to pH <2	7 days[6]
Methylene blue active substance (MBAS)	250	P,G	Cool, 4°C	24 hours
Nitrilotriacetic acid (NTA)	50	P,G	Cool, 4°C	24 hours
Oil and grease	1,000	G only	Cool, 4°C H_2SO_4 or HCl to pH <2	24 hours
Organic carbon	25	P,G	Cool, 4°C H_2SO_4 or HCl to pH <2	24 hours
Phenolics	500	G only	Cool, 4°C H_2SO_4 to pH <4 1.0 g $CuSO_4$/l	24 hours

Key:

1. More specific instructions for preservation and sampling are found with each procedure as detailed in E & E's methods manual. A general discussion on sampling of water and industrial wastewater may be found in American Society for Testing and Materials (ASTM), Part 31, p. 72-82 (1976) Method D-3370.

2. Plastic (P) or Glass (G). For metals, polyethylene with a polypropylene cap (no liner) is preferred.

3. The listed holding times are recommended for properly preserved samples based on currently available data. It is recognized that extension of these times may be possible for some sample types while, for other types, the times may be too long. When shipping regulations prevent the use of the proper preservation technique or when the holding time is exceeded, as in the case of a 24-hour composite, the final reported data for these samples should indicate the specific variance. If samples cannot be analyzed within the specified time intervals, the final reported data should indicate the actual holding time.

4. If the sample is stabilized by cooling, it should be warmed to 25°C for reading, or a temperature correction should be made and results reported at 25°C.

5. When HNO_3 cannot be used because of shipping restrictions, the sample may initially be preserved by icing and immediately shipped to the laboratory. Upon receipt at the laboratory, the sample must be acidified to a pH <2 with HNO_3 (normally 3 mL 1:1 HNO_3/liter is sufficient). At the time of analysis, the sample container should be thoroughly rinsed with 1:1 HNO_3 and the washings added to the sample (volume correction may be required).

6. Data obtained from National Enforcement Investigations Center, Denver, Colorado, support a four-week holding time for this parameter in sewerage systems (Standard Industrial Code 4952).

12.3 SAMPLE HANDLING AND DECONTAMINATION

E & E will identify all samples using a sample tag or other appropriate identification attached to or folded around the sample. The tag will provide the sample identification number; the date, time, and location of collection; designation of the sample as a grab or composite; notation of the type of sample and preservative; any remarks; and the signature of the sampler. E & E also will record this information in the appropriate logbook, along with any pertinent on-site measurement data and field observations.

After collection and identification, the sample will be preserved and maintained under the chain-of-custody procedures discussed below. In a similar fashion, all tags on blank or duplicate samples will be marked "Blank" or "Duplicate," respectively. Field blind duplicates will be coded and identified as such only in the field logbook.

Chain-of-Custody Procedures

Air Force chain-of-custody requirements for this program will be clarified and incorporated in E & E's standard operating procedures. E & E will require that the possession of samples be traceable from the time the samples are collected until they are disposed of through established chain-of-custody procedures. The major elements of these E & E procedures include the following.

Sample Custody. A sample will be considered in custody if:

- It is in the individual's actual possession; or
- It is in the individual's view, after being in his/her physical possession; or
- It was in the individual's physical possession and then he/she locked it up to prevent tampering; or
- It is in a designated secure area.

Field Custody Procedures. E & E will collect only the number needed to provide a fair representation of the media being sampled. The quantity and types of samples and sample locations will be determined prior to the actual fieldwork. As few people as possible will handle the samples. The field sampler will be personally responsible for the care and custody of the collected samples until they are transferred or properly dispatched. Sample tags will be completed for each sample using waterproof ink.

Transfer of Custody and Shipment. Samples will be accompanied by a chain-of-custody record. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record will document the transfer of custody of the samples from the sampler to another person, or to an analytical laboratory.

The samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate record prepared for each laboratory. The "Courier to Airport" space on the chain-of-custody record will be dated and signed, if necessary.

All packages will be accompanied by the chain-of-custody record showing identification of the contents. The original record will accompany the shipment and a copy will be retained by E & E.

Laboratory Custody Procedures. E & E will assure that the possession of samples is traceable from the time the samples are received. To maintain and document sample possession, E & E will follow chain-of-custody procedures. A sample custodian or a designated alternate will receive samples for the laboratory and will verify that the information on the sample tags matches that on the chain-of-custody record included with the shipment. The custodian will sign the custody record in the appropriate space. Couriers picking up samples at the airport, post office, etc., will sign in the appropriate space.

Samples forwarded to the laboratories for analysis will be retained after the analyses are completed. These samples may be disposed of only upon the orders of the program manager, and only after all tags have been removed for the permanent file.

Sample Decontamination

All sampler containers will be considered as contaminated and subject to standard decontamination procedures prior to packaging in preparation for storage and/or shipment to laboratories for analysis. Decontamination procedures will include washing the container in a cleaning solution containing Alconox on TSP, followed by a thorough rinse with clean water. The samples will be immediately placed into a protective plastic wrap to prevent further possible contamination.

12.4 PROCEDURES FOR PACKING LOW CONCENTRATION SAMPLES

All samples must be packaged carefully to avoid breakage or contamination and must be shipped to the laboratory at proper temperatures. The following sample packaging requirements must be followed:

- Sample bottle lids are never to be mixed. All sample lids must stay with the original containers. Custody seals must be affixed.

- The sample volume level can be marked by placing the top of the label at the appropriate sample height, or with grease pencil. This procedure will help the laboratory to determine if any leakage occurred during shipment. The label should not cover any bottle preparation QA/QC marks.

- Unless otherwise specified, all sample bottles must be secured with a custody seal and placed in a plastic bag to minimize the potential for vermiculite contamination.

- Shipping coolers must be filled initially with approximately three inches of vermiculite or zonolite.

- The secured sample bottles must be placed in the cooler in such a way as to ensure that they do not touch one another.

- Low hazard samples (i.e., defined as environmental or less than 10 ppm of any single constituent) are to be cooled.

recycled paper

"Blue ice" or some other artificial icing material is preferred. If unavoidable, ice may be used provided that it is placed in 3-mil plastic bags. Ice is not to be used as a substitute for packing material.

- Any remaining space in the cooler should be filled in with inert packing material. Under no circumstances will locally obtained material (sawdust, sand, etc.) be used.

- The duplicate custody record must be placed in a plastic bag and taped to the bottom of the cooler lid.

12.5 PROCEDURES FOR PACKING MEDIUM CONCENTRATION SAMPLES

The procedures for packing medium concentration samples (defined as containing between 10 and 150,000 ppm of any constituent, or direct but diluted contamination, or material from previous spills, or discolored solid matrices or turbid liquids) are similar to those discussed in Section 12.4 with two notable exceptions. All medium hazard samples must first be placed in paint cans containing sufficient vermiculite or zonolite inert materials to cushion the sample containers and absorb spills. These paint cans are sealed, properly labelled, and then placed in the cooler or other appropriate shipping container, as described in Section 13.6. Medium hazard samples are not to be cooled with ice or some other artificial icing materials.

13. SAMPLE CUSTODY AND DOCUMENTATION

13.1 SAMPLE IDENTIFICATION DOCUMENTS

All field personnel must verify the sampling methods to be used during sample collection by making proper reference to the project plans. Prior to sampling, the field sampling personnel must ensure that all sample containers are in his physical possession or in his view at all times, or ensure that the containers are stored in a locked place at all times, so as to maintain proper custody. All sample gathering activities must be recorded in the site logbook; all sample transfers must be documented in the chain-of-custody record; all samples are to be identified with sample tags, labels, or other appropriate means of identification (hereinafter referred to as sample tags); and all sample bottles are to be sealed with custody seals. All information is to be recorded in waterproof ink. All E & E field personnel are personally responsible for sample collection and the care and custody of collected samples until the samples are transferred or properly dispatched.

13.2 CHAIN-OF-CUSTODY RECORDS

The custody record must be fully completed in duplicate, using black carbon paper where possible, by the field technician who has been designated by the project manager as being responsible for sample shipment to the appropriate laboratory for analysis. The information specified on the chain-of-custody record will contain the same level of detail found in the site logbook, with the exception that the on-site measurement data need not be recorded. The custody record

will include, among other things, the following information: name of person collecting the samples; date samples were collected; type of sampling conducted (composite/grab); location of sampling station; number and type of containers used; and signature of the E & E person relinquishing samples to a non-E & E person, such as a Federal Express agent, with the date and time of transfer noted. In addition, if samples are known to require rapid turnaround in the laboratory because of project time constraints or analytical concerns (e.g., extraction time or sample retention period limitations, etc.), the person completing the chain-of-custody record should note these constraints in the remarks section of the custody record.

If it is is not practicable to seal all containers at a Federal Express office, they should be sealed beforehand. The duplicate custody record will therefore have the signature of the relinquishing field technician and a statement of intent such as "To Federal Express (Baltimore office) p.m. 6/31/84." The duplicate custody record is then placed in a plastic bag, taped to the underside of the box lid, and the box closed. The container is to be tightly bound with filament tape, and if required, at the discretion of the project manager, may be padlocked. Finally, at least two custody seals are to be signed by the individual relinquishing custody and affixed in such a way that the box cannot be opened without breaking them.

At the shipping agent's office, the relinquishing individual will put all the specific shipping data (airway bill number, office, time, and date) on the original custody record which is to be transmitted to the project manager (by mail or by hand as appropriate). The original and duplicate custody records and the airway bill or delivery note together constitute a complete record and it is the project manager's responsibility to ensure that all are consistent and they are made part of the permanent job file maintained at the ASC.

At the laboratory, the sample custodian will open the package, retrieve the duplicate record, and complete the "Received for Laboratory by" box by affixing his signature. The custodian also is to fill in the "Method of Shipment" box with the shipper's name (e.g., Federal Express) and airway bill number.

13.3 FIELD LOG BOOKS

Site logbook(s) must be maintained for each project. All site logbooks must be bound, contain numbered pages, and be waterproof. The following documentation is to be recorded in the site logbooks: sampling locations, station numbers, dates, times, sampler's name, designation of the sample as a grab or composite, notation of the type of sample (e.g., groundwater, soil boring, etc.), preservatives used, on-site measurement data, and other field observations and remarks. Each series of site logbook entries for a particular sampling effort must be initialed by the person recording the information and, where appropriate, summary entries that organize and/or clarify data presented in the logbook are to be prepared by the person recording the information. After reviewing the entries, the field team leader must sign each page of the site logbook on the top and the bottom.

As with all data logbooks, no pages will be removed for any reason. If corrections are necessary, these must be made by drawing a single line through the original entry (in such a manner that the original entry can still be read) and writing the corrected entry alongside. The correction must be initialed and dated. Most corrected errors will require a footnote explaining the correction.

The site logbook is the prime repository of information of actual site conditions and as such is an important link in the analytical chain. Any details which may be relevant to the analysis or integrity of samples must be recorded. Preliminary sample descriptions are helpful. Any unusual circumstances should be noted, e.g., heavy rain or difficulty in pH meter calibration. At the completion of the sampling exercise, the logbook must be retained by and/or returned to the project manager and is to be made part of the permanent project file. To the extent that any information contained in the logbook is relevant to sample analysis to be performed, such data are to be made available to the laboratory performing said analyses by the project manager.

13.4 CORRECTIONS TO DOCUMENTATION

As with data logbooks, if corrections to any site documentation are necessary, these must be made by drawing a single line through the original entry (in such a manner that the original entry can still be

read) and writing the corrected entry alongside. The correction must be initialed and dated. Most corrected errors will require a footnote explaining the correction.

When completing any of the laboratory logs, all crossouts and/or changes in logbook entries must be made with a single line and initialed by the same custodian who is responsible for the original entry; corrections also may be supplemented by a footnoted explanation, so long as the footnote is initialed by the same custodian responsible for the original entry. This general rule may be relaxed only if the ASC director or manager authorizes such a deviation from the rule and initials the change together with the other custodian making the correction.

13.5 TRAFFIC REPORTS, SAMPLE LABELS, AND CUSTODY SEALS

Traffic Reports

The documentation system provides the means to individually identify, track, and monitor each sample from the point of collection through final data reporting based on the use of sample traffic reports, each printed with a unique sample identification number. One traffic report and identification number is assigned by the sampler to each sample taken. Then, regardless of where a sample was collected or analyzed, the sample can always be identified and tracked by use of the assigned number. Traffic reports are used in conjunction with chain-of-custody and other document requirements.

To provide a permanent record for each sample collected, the sampler completes the traffic report in triplicate at the time the sample is taken. Data required include the project identification number, site location and number, dates and times when samples were taken, shipping information, name of laboratory preforming analysis, and estimated and sample concentration. The top copy becomes the sampler's file copy. The bottom two copies are sent with the samples to the designated laboratory. Upon receipt of the samples, the laboratory completes the required information concerning sample conditions and documentation. The laboratory then returns one copy to the project manager and retains a copy for their files.

Sample Tags

E & E field personnel will properly identify all samples taken in the field by using a sample tag attached to or affixed around the sample container. The sample tag must contain the field identification number; the date, time, and location of sample collection; designation of the sample as a grab or composite; notation of the type of sample (e.g., groundwater, soil boring, etc.); identification of preservatives used; any remarks; and the signature of the sampler. The sample tags are to be placed on the bottles so as not to obscure any QA/QC data on the bottles. Sample information must be printed in a legible manner using waterproof ink. Field identification must be sufficient to enable cross-reference with the site logbook.

Custody Seals

Custody seals are preprinted adhesive-backed seals with security slots designed to break if they are disturbed. Individual sample bottles are sealed over the cap by the sampling technician. Sample shipping containers (coolers, cardboard boxes, etc., as appropriate) are sealed in as many places as necessary to ensure security. Seals are signed and dated before use. On receipt at the laboratory, the custodian will check (and certify, by completing logbook entries) that seals on boxes and bottles are intact.

13.6 SHIPPING OF SAMPLES

Environmental and hazardous samples will be properly packaged and labelled for shipment and dispatched to the appropriate laboratory for analysis. A separate chain-of-custody record must be prepared for each laboratory. The following requirements for shipping containers must be followed:

- United States Department of Transportation (DOT) regulations covering the transport of hazardous materials are contained in 49 CFR Parts 170-179.

- Shipping containers must be padlocked or custody-sealed for shipment, as appropriate. The package custody seal is to consist of filament tape wrapped around the package at least

twice and a custody seal affixed at appropriate access points. In this way, access to the package can be gained only by cutting the filament tape and breaking the seal.

- All of the shipping coolers/package containers must be secured by field personnel with a proper custody seal, marked with indelible pen or ink, and addressed to Ecology and Environment, Inc., Analytical Services Center, 4285 Genesee Street, Buffalo, NY 14225, or another laboratory as appropriate.

- Field personnel must make arrangements for transportation of samples to the ASC. When custody is relinquished to a shipper, E & E field personnel must telephone the ASC custodian (716/631-0360) to inform him of the expected time of arrival of the sample shipment and to advise him of any existing time constraints on sample analysis.

14. SITE CLEAN-UP

The objective of site clean-up is to leave the areas of investigation essentially as they were found, except of course for the physical addition of monitoring wells and guard posts. Site clean-up also includes close coordination with base personnel to insure that clean-up operations are in accordance with overall management of base operations.

E & E has responsibility for assuring the safe and proper conduct of subcontractors in this work and the associated equipment. Decontamination procedures will be conducted to insure that potential contamination remains on-site. General cleanup of equipment and vehicles will be conducted consistent with accepted facility practices and in close coordination with the Base Engineer (BE).

Drill cuttings and investigation-derived wastes (e.g., expendables such as Tyvek over-suits) become the property of the facility. These materials will be labeled and staged in the secure area (with assistance from the BE) pending the results of analyses that will determine whether these wastes can be generally disposed or must be disposed as contaminated or hazardous waste.

15. FIELD TEAM ORGANIZATION AND RESPONSIBILITIES

Once the strategy and objectives of the work plan have been developed, a team must be organized to implement the plan. The specific techniques described in the work plan are likely to include: environmental sampling, sampling of hazardous substances, drilling operations, mapping, hazardous substance inventory, etc.

Hazardous substance sites present many hazards, physical conditions, and situations that require a wide variety of expertise and scientific support to insure safe entry and data collection. It is impractical to design a standard site entry team given the significant differences among sites. Therefore, each site requires a team tailored to the potential hazards and objectives of each specific site. The field investigation team will likely consist of individuals with various technical backgrounds, i.e., chemist, engineer, hydrogeologist, who will also fill field positions such as site safety officer or command post supervisor.

A team entering a hazardous substance site is organized for mutual support and safety. Hazardous site investigations require a complete respect for safety by all team members to prevent injury or loss of life.

15.1 ORGANIZATION AND RESPONSIBILITIES

There are eight roles which may be required for a field investigation team. These roles are dictated by the potential site hazards. Dual role assignments are not encouraged but may be acceptable when

hazardous substances and physical conditions at a site are well documented.

The following addresses the duties and responsibilities of the eight roles:

- Project team leader;
- Field team leader;
- Site safety officer;
- Personnel decontamination station (PDS) operator/equipment specialist;
- Command post supervisor;
- Initial entry party;
- Work party; and
- Emergency response team.

Project Team Leader

The project team leader is primarily an administrator when not participating in the field investigation as field team leader or command post supervisor. The project team leader is responsible for:

- All the team does or fails to do. Some of this responsibility may be passed on to the field team leader and site safety officer;
- Preparation and organization of all project work;
- Selection of team personnel and briefing them on specific assignments;
- Obtaining permission to enter the site from the owner;

- Coordinating with the field team leader to complete the work plan;

- Completing final reports and preparation of the evidentiary file; and

- Insuring that safety and equipment requirements are complete.

Field Team Leader

The field team leader is responsible for the overall operation and safety of the field team. As mentioned, this role can be filled by the project team leader or his designated representative. The field team leader may join the work party. He is responsible for:

- Safety and safety procedure enforcement;

- Field operations management;

- Public relations/state and federal liaison;

- Site control;

- Compliance of field documentation and sampling methods with evidence collection procedures;

- Execution of the site work plan; and

- Determination of the level of personal protection required (in conjunction with the site safety officer).

Site Safety Officer

The site safety officer has primary responsibility for all safety procedures and operations on-site. Ideally, the site safety officer will report to the person responsible for safety in the organization rather than to the field team leader or project team leader. This allows two separate lines of authority. It also allows decisions based on safety to be represented on an equal basis with decisions

based on the pressures for accomplishing the investigation according to schedule.

The site safety officer remains half-dressed in the appropriate level of protective equipment to respond to emergencies. He stays on the clean side of the exclusion area while monitoring the work party and site activities. The site safety officer is also responsible for:

- Updating equipment or procedures based on new information gathered during the site inspection;
- Upgrading the levels of protection based on site observations;
- Enforcing the "buddy system";
- Determining and posting locations and routes to medical facilities, including poison control centers; arranging for emergency transportation to medical facilities;
- Notifying local public emergency officers, i.e., police and fire department, of the nature of the team's operations, and posting their telephone numbers;
- Controlling entry (if possible) of unauthorized persons to the site;
- Entering the exclusion area in emergencies when at least one other member of the field team is available to stay behind and notify emergency services, or after he has notified emergency services;
- Examining work party members for symptoms of exposure or stress;
- Determining the suitability of a team member for work in the exclusion area, based on the team member's physical profile determined by the health and safety program and the team member's current physical condition; and

- Providing emergency medical care and first aid as necessary on-site. The site safety officer has the ultimate responsibility to stop any operation that threatens the health or safety of the team or surrounding populace.

PDS Operator/Equipment Specialist

The PDS operator/equipment specialist functions in two roles that do not require concurrent attention. As the equipment specialist, he is charged with:

- Insuring that all equipment is poperly maintained and operating;
- Inspecting all equipment before and after use;
- Insuring that all required equipment is available; and
- Decontaminating all personnel, samples, and equipment returning from the exclusion area.

The PDS operator/equipment specialist is responsible for design and setup of the PDS and for preparing the necessary decontamination solutions to insure that chemical contamination is not transported into the clean area by inspection equipment, samples, protective clothing, or personnel. Failure to properly execute these duties reduces the effectiveness of the protective equipment and threatens the rest of the field team. The PDS operator/equipment specialist also manages the mechanics of removing contaminated clothing from the work party and the proper disposal of discarded contaminated clothing and decontamination solutions.

Command Post Supervisor

The command post supervisor functions as the clearinghouse for communications. He does not enter the exclusion area to assist the work party except for certain emergency situations. Should an emergency arise, the command post supervisor notifies emergency support personnel by phone, radio, etc., to respond to the situation.

Depending on the team size and the nature of the emergency, the command post supervisor may in extreme situations assist the site safety officer in effecting a rescue. Usually, the command post supervisor may be called upon to assist the PDS operator/equipment specialist in operating the PDS during an emergency, and assist the site safety officer in emergency medical measures. The field team leader may assume the position of command post supervisor.

The command post supervisor is also responsible for:

- Maintaining a log of communications and site activities such as duration of work periods with respirators;
- Sustaining communication and line-of-sight contact with the work party;
- Maintaining public relations in the absence of the field team leader; and
- Assisting the site safety officer and PDS operator/equipment specialist as required.

Initial Entry Party

The initial entry party enters the site first, employing specialized instrumentation to characterize site hazards. Usually the field team leader should be a part of the initial entry party to familiarize himself with conditions and dangers associated with the site. The major purpose of this team is to measure existing hazards and survey the site to ascertain if the level of personal protection determined from preliminary assessment and site inspection must be adjusted.

The initial entry party can consist of as few as two people if a wheelbarrow or other device is used to transport all the instrumentation. Three or four people are able to do the job more efficiently.

Work Party

The work party performs the on-site tasks necessary to fulfill the objectives of the investigation, e.g., obtaining samples or determining locations for monitoring wells. No team member should enter or

exit the exclusion area alone. The work party consists of a minimum of two individuals, and any work party should follow this buddy system. Besides the safety considerations, it is much easier for two persons dressed in protective clothing to perform such tasks as note-taking, photographing, and sampling.

Emergency Response Team

Extensive assignments requiring long hours and large work parties (more than five) necessitate the use of a standby emergency response team. The emergency response team is half-dressed in protective gear so that it can quickly enter the exclusion area in the event of an emergency. This team is particularly valuable at dangerous sites where protective equipment produces stress and heat loads on the work party.

15.2 TEAM SIZE

The size of a team employed in an investigation is determined by two sometimes contradictory requirements: the need for a team large enough to maximize safety versus the desire for economy. Team size is dependent upon site organization, levels of protection, work objectives, and site hazards. Additional team members can always be added according to the roles required.

Two-Person Team

The two-person team is the minimum for a hazardous substance site investigation, but is very limited. Such a team should never enter an inactive hazardous substance site. The two-person team is best suited for off-site surveys and inspections or obtaining environmental (non-hazardous, off-site) samples. Ground truthing of aerial photographic surveys, inspection of files, or interviews can all be accomplished by the two-person team.

Three-Person Team

The three-person team can be employed on sites requiring Level C protection and, in some cases, on sites requiring Level B protection. This team is composed of field team leader; an individual fulfilling the combined functions of PDS operator/equipment specialist, site

safety officer, and command post supervisor; and another individual to enter the site with the field team leader.

The three-person team is used where extensive PDS procedures are not required and where the likelihood of emergency rescue is low. This field investigation team is best utilized in non-IDLH (immediately dangerous to life and health) atmospheres where the primary objective is to map, photograph, or inventory. Its use assumes that at no time will the work party be exposed to hazardous situations.

Considerable care and thought are necessary before a three-person team is employed on a site because each individual has numerous responsibilities. In the event of an accident, the third member does not enter the site to offer emergency assistance until he has summoned outside assistance, and even then, only when he feels rescue will not endanger his own life.

Four-Person Team

Most Level B operations can be conducted with a four-person team. These operations would include work on active sites where facility personnel are present or on inactive sites with potentially IDLH atmospheres. The objectives of a four-person team at a site requiring Level B protection might include sampling of ponds, soils, or open containers and inspections at sites known for poor housekeeping, i.e., spills, leaks, etc.

The team consists of the standard two-person work party, a combination site safety officer and PDS operator/equipment specialist, and a command post supervisor who may assist in the PDS operation. Because life-threatening hazards are assumed or known to be present at a Level B site, it is essential that all personnel be fully acquainted with their duties. During an emergency, the command post supervisor stays in the support area to maintain communication while the site safety officer/PDS operator/equipment specialist enters the exclusion area to aid the work party. Once the work party is in the contamination reduction area, the command post supervisor can then offer assistance on the PDS or provide fresh equipment from the support area.

Five-Person Team

The five-person team is the minimum size for most Level B operations or when known percutaneous hazards exist or there is an absence

of historical information. The site hazards that require Level B protection, combined with the limitations and stresses placed on personnel by wearing Level B protection, generally necessitate a full-time PDS operator/equipment specialist who can also serve in emergency response. In the event of a serious emergency such as a fire, explosion, or acutely toxic release, both the site safety officer and PDS operator/equipment specialist may need to enter the exclusion area dressed in Level B gear. The command post supervisor remains in the support area to direct outside help to the site and then assume the functions of PDS operator/equipment specialist.

Teams of Seven or More

Certain hazardous substance sites requiring sampling operations necessitate larger or alternating work parties and additional support personnel in the contamination reduction area. The seven-person team employs the basic five-person structure plus an additional work party for alternating work loads. The eight-person team includes an additional PDS operator/equipment specialist to assist in the continuous decontamination tasks involved with alternating work parties, and to decontaminate and pack samples as they are received.

It is not unusual to employ larger teams where such tasks as drum opening may require three work parties downrange working concurrently or may require a team to work under rigorous safety procedures. Larger teams can be designed with additional work parties and support personnel to safely gather the site data and insure communication and site control.

15.3 TRAINING

Although trained and experienced personnel are assigned, training is essential to successful project completion.

Mobilization Meeting

Before mobilization begins, a team training meeting is held to discuss assignments and the needs of the work, including equipment and health and safety requirements.

On-Site Start-Up Meeting

During site start-up, a team training meeting and site tour are conducted to review the health and safety plan, particular protocols for the project, and the project objectives. In keeping with E & E corporate health and safety policies, every site worker must complete this orientation regardless of when they begin initial site work on the project. Records are maintained of this meeting and the topics covered.

Daily Briefings and De-Briefings

Each morning a short briefing is held for all team members to outline the objectives for the day and allow health and safety monitoring. Instrument calibration checks usually occur during this time also. On sites with high potential for chemical exposure, a site survey tour would be made with monitoring instruments before fieldwork is allowed to begin. Based on current knowledge, this daily survey team is not needed for the work at Richards-Gebaur AFB.

At the end of each work day, a short de-briefing meeting is held to review accomplishment vs. objectives and to identify objectives for the next day's work. Data evaluation, planning, and sample management and shipping often follow this meeting.

16. SCHEDULE

A project milestone chart is presented in Table 16-1 to illustrate the sequence of tasks as approximated at the beginning of the project. Field conditions may impose minor variations in the schedule.

Table 16-1

FIELDWORK MILESTONE CHART

Time (weeks from start)	Site	Activity
0-2	All	Project start-up tasks: prepare work plan and site safety plan; secure drilling subcontract equipment and supplies.
2-3	1,2,3,4	Perform geophysical surveys; soil gas analysis; sediment and water sampling.
3-5	1,2,5,6	Perform soil boring and install monitoring wells.
4-5	3,6,7	Perform soil boring and install monitoring wells; demobilize
5-18	All	Prepare draft final report (due 18 March 1987).

APPENDIX A

SITE SAFETY PLAN

HAZARDOUS AND TOXIC MATERIALS TEAM
SITE SAFETY PLAN

A. GENERAL INFORMATION

SITE: Richards-Gebaur Job No.: DF-4000

LOCATION: Belton, MO near Kansas City

PLAN PREPARED BY: Paul Kopsick DATE:

APPROVED BY: William Kopke DATE: 9-12-86

OBJECTIVE(S): Phase II Stage 2 Field Investigation
Soil, sediment surface water and groundwater sampling.

PROPOSED DATE OF INVESTIGATION: September 1986 - December 1986

BACKGROUND REVIEW: Complete: X Preliminary: ____

DOCUMENTATION/SUMMARY: Overall Hazard: Serious: ____ Moderate: ____
Low: X Unknown: ____

B. SITE/WASTE CHARACTERISTICS

WASTE TYPE(S): Liquid X Solid X Sludge ____ Gas ____
Corrosive ____ Ignitable ____ Radioactive ____ Volatile ____
Toxic ____ Reactive ____ Unknown ____ Other (Name) ____

FACILITY DESCRIPTION: Air Force Base with areas of Aircraft and Vehicle maintenance and onsite landfill of municipal refuse. Storage of pesticedes and solvents associated with normal operations.

Principal Disposal Method (type and location): Landfills drum storage areas

Unusual Features (dike integrity, power lines, terrain, etc.): NONE

Status: (active, inactive, unknown) In-active - active

History: (injuries: complaints: previous agency action): No significant history of environmental problems. Phase I report contains history of individual site.

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C. HAZARD EVALUATION
(Use Supplemental Sheets if Necessary)

Summary (attach copy of available chemical information from Saxs, Merck, Index, Chmtads, etc.): Non-specific organic compounds

General industrial solvents: Trichloroethylene
Perchloroethylene

Heavy Metals: Lead
Mercury

Non-specific herbicide (Containing Mercury circa 1971)

See attachments for hazard evaluation and data sheets

D. SITE SAFETY WORK PLAN

PERIMETER ESTABLISHMENT: Map/Sketch Attached? Yes Site Secured? Yes

Perimeter Identified? NO Zone(s) of Contamination Identified? NO

This task will identify the perimeters and extent of contamination. Borings to be made outside of contaminated material.

PERSONAL PROTECTION:

Level of Protection: A ____ B ____ C X D X

Modifications: Upgrade to Level C for samples with positive HNU readings. Level C for monitoring all drilling.

Surveillance Equipment and Materials: HNU with 10.2 eV probe.
(tape) TLD Badge
Rad mini particle counter

CH2M HILL

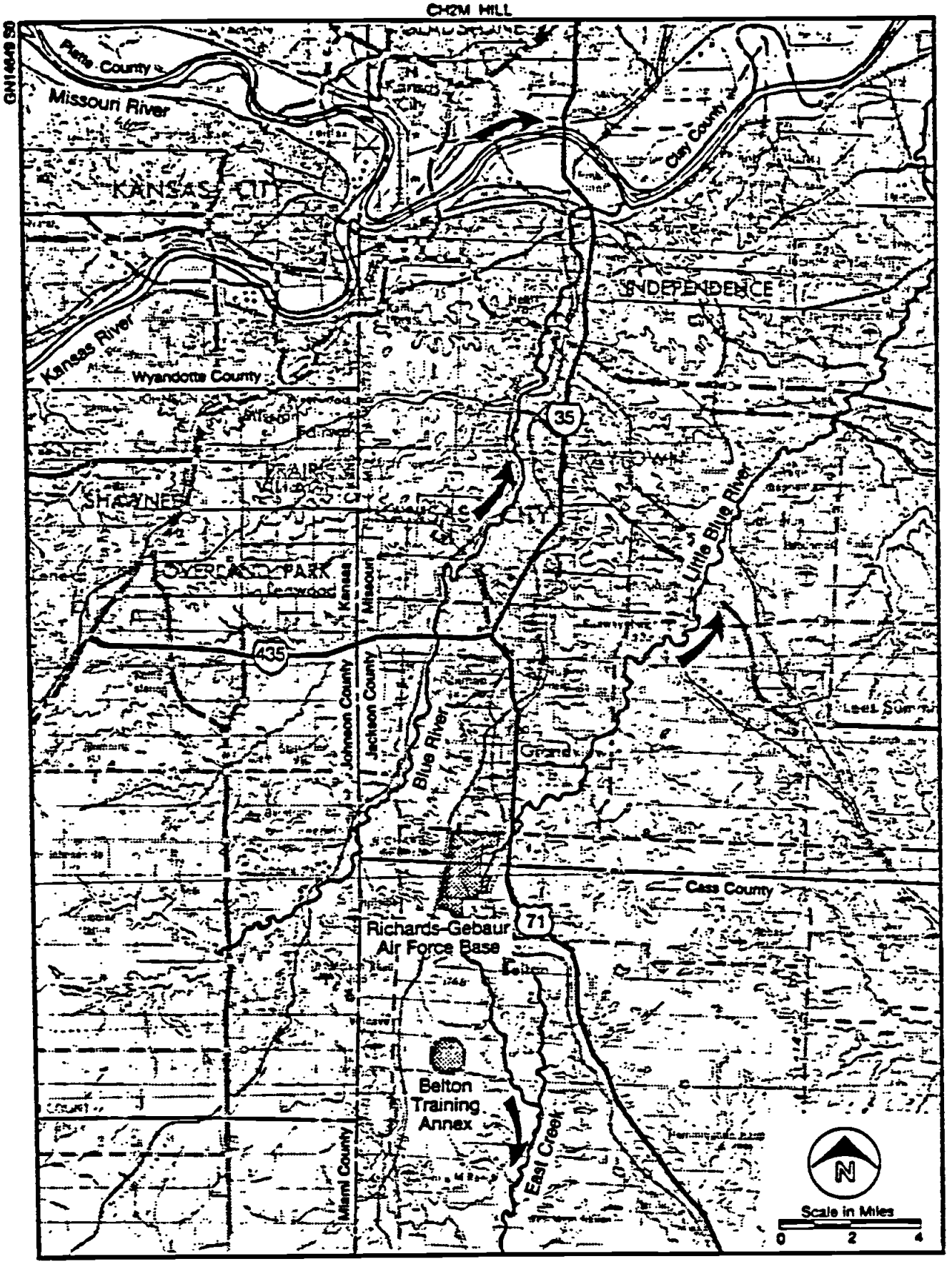

FIGURE 2. Location map of Richards-Gebaur AFB, Missouri.

SPECIAL SITE CONSIDERATIONS: See Hazard Evaluation for specific areas of site and the associated hazards.

DECONTAMINATION PROCEDURES:

Personal: Wash boot and gloves with soap and water. Launder coveralls upon return from the field. All Personnel should shower immediately upon return home.

Equipment: Detergent wash, water rinse

INVESTIGATION - DERIVED MATERIAL DISPOSAL: (Note - If material is proposed to be left on site, written authorization is to be received by the Project Team Leader prior to the initiation of on site activities): Disposable material will be double bagged and left on the base. Suspected contaminated soils will be drummed and stored at the base.

SITE ENTRY PROCEDURES: Coordination with base security.
Safety meeting each morning.
No special proceedures required.

Team Member	Responsibility
Paul Kopsick	Co-Project Mgr./Team Leader
James Jackson	Co-Project Mgr./Admin.
Mark Mayo	Field Tech./SSC
Joe Chandler	Field Tech./SSC
Mila Michalowski	Field Tech.
John Cook	Field Tech.
Sharon Martin	Geophysics

7/84 Revised [illegible]

E. EMERGENCY INFORMATION

(Use Supplemental Sheets if Necessary)

EMERGENCY PRECAUTIONS

Acute Exposure Symptoms	First Aid
Irritation of eyes, nose & throat.	
Headache, nausea.	
*Environmental concentrations normally give no acute exposure symptoms.	

LOCAL RESOURCES
(Name, Address and Phone Number)

Ambulance 911

Hospital Emergency Room 942-4400 - St. Joseph Hospital

Poison Control Center 1-234-3000 - Childrens Mercy Hospital

Police (incl. Local, County Sheriff, State) 911

Fire Department 911

Airport Richards Gebaurs AFB

Explosives Unit N/A

Agency Contact (EPA, State, Local, USCG, etc.) Diana Bailey 236-2856

Local Laboratory NONE

UPS/Federal Express 6600 College Blvd. - (across from Black & Veatch) East of Metcalf

Client Contact Cpt. Patrick Johnson, OEHL TX 1-800-821-4528

SITE RESOURCES

Water Supply Base Civil Engineer John Hurd

Telephone 816-348-2076

Radio

Other

Attachment 3:
Site Safety Briefing Forms

ecology and environment, inc.

ON-SITE SAFETY MEETING

Project _____

Date _____ Time _____ Job No. _____

Address _____

Specific Location _____

Type of Work _____

SAFETY TOPICS PRESENTED

Protective Clothing/Equipment _____

Chemical Hazards _____

Physical Hazards _____

Emergency Procedures _____

Hospital/Clinic _____ Phone _____

Hospital Address _____

Special Equipment _____

Other _____

ATTENDEES

Name Printed	Signature

Meeting Conducted By: _____ _____

Name Printed Signature

Site Safety Officer _____ Team Leader _____

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Emergency Contacts

1. Mr. Raymond Harbison (University of Arkansas) ..... (501) 661-5766 or 661-5767
   (501) 370-8263 (24 hour)

2. Ecology and Environment, Inc., Safety Coordinator/
   Dr. Paul Johnmaire ..... (716) 632-4491 (office)
   (716) 655-1260 (Home)

Medtox Hotline

1. Twenty-four hour answering service - (501) 370-8263

   What to Report:

   - o State: "This is an emergency."
   - o Your name, region, and site.
   - o Telephone number to reach you.
   - o Your location.
   - o Name of person injured or exposed.
   - o Nature of emergency.
   - o Action taken.

2. One of three toxicologists (Drs. Raymond Harbison, Richard Freeman, or Robert James) will contact you. Repeat the information given to the answering service.

3. If a toxicologist does not return your call within 15 minutes, call the following persons in order until contact is made:

   E & E Corporate Headquarters (EST 0830-1700) - (716) 632-4491

   a. Twenty-four hour line - (716) 631-9530
   b. Corporate Safety Director - Paul Johnmaire - 716/655-1260 (Home)
   c. Assistant Corporate Safety Officer - Steve Sherman (home - (716) 688-3084)

Emergency Routes

Directions to Hospital (incl. MAP) Andrews Rd. to Outer Belt Road. Outer Belt Road to St. Joseph's Hospital. Hospital is on South side of road.

Other _____

F. EQUIPMENT CHECKLIST

PROTECTIVE GEAR

LEVEL A		LEVEL B	
SCBA	___	SCBA	___
SPARE AIR TANKS	___	SPARE AIR TANKS	___
ENCAPSULATED SUIT	___	CHEMICAL RESISTANT COVERALLS	___
SURGICAL GLOVES	___	PROTECTIVE COVERALL (TYPE ___)	___
NEOPRENE SAFETY BOOTS	___	RAIN SUIT	___
BOOTIES	___	BUTYL APRON	___
GLOVES (TYPE ___)	___	SURGICAL GLOVES	___
OUTER WORK GLOVES	___	GLOVES (TYPE ___)	___
HARD HAT	___	OUTER WORK GLOVES	___
CASCADE SYSTEM	___	NEOPRENE SAFETY BOOTS	
___	___	BOOTIES	
___	___	HARD HAT WITH FACE SHIELD	___
___	___	CASCADE SYSTEM	___
___	___	MANIFOLD SYSTEM	___

LEVEL C		LEVEL D	
ULTRATWIN RESPIRATOR	X	ULTRA-TWIN RESPIRATOR (AVAILABLE)	X
POWER AIR PURIFYING RESPIRATOR	___	CARTRIDGES (TYPE GMC-H)	X
CARTRIDGES (TYPE GMC-H)	X	ROBERTSHAW ESCAPE MASK (AVAILABLE)	___
ROBERTSHAW ESCAPE MASK	___	CHEMICAL RESISTANT COVERALLS	X
CHEMICAL RESISTANT COVERALLS	X	PROTECTIVE COVERALL (TYPE Tyvek/Saranex)	X
PROTECTIVE COVERALL (TYPE Tyvek/Saranex)	X	RAIN SUIT	___
RAIN SUIT	___	NEOPRENE SAFETY BOOTS	X
BUTYL APRON	___	BOOTIES	X
SURGICAL GLOVES	X	WORK GLOVES	___
GLOVES (TYPE Nitrile/Butyl)	X	HARD HAT WITH FACE SHIELD	X
OUTER WORK GLOVES	___	SAFETY GLASSES	X
NEOPRENE SAFETY BOOTS	X	___	___
HARD HAT WITH FACE SHIELD	X	___	___
Booties	X		

recycled paper

INSTRUMENTATION		DECON EQUIPMENT (CONT.)	
OVA		PLASTIC SHEETING	
THERMAL DESORBER		TARPS	
O2/EXPLOSIMETER		TRASH BAGS	X
EXPLOSIMETER CALIBRATION KIT		TRASH CANS	
HNU	X	MASKING TAPE	
~~VICTOREEN 471~~ Rad Mini	X	DUCT TAPE	X
MAGNETOMETER		PAPER TOWELS	
PIPE LOCATOR		FACE MASK	X
WEATHER STATION		FACE MASK SANITIZER	X
DRAEGER PUMP		FOLDING CHAIRS	
BRUNTON COMPASS		STEP LADDERS	

FIRST AID EQUIPMENT		SAMPLING EQUIPMENT	
FIRST AID KIT	X	Drill Rig (Subcontract)	X
OXYGEN ADMINISTRATOR			
STRECHER			
PORTABLE EYE WASH			
BLOOD PRESSURE MONITOR			
RADIATION BADGES	X		
FIRE EXTINGUISHER	X		

DECON EQUIPMENT	
WASH TUBS	X
BUCKETS	
SCRUB BRUSHES	X
PRESSURIZED SPRAYER	X
DETERGENT (TYPE Alconox)	X
SOLVENT (TYPE Hexane or 1,1,1 TCE	X

7/84 Revised CLD

APPENDIX A
STATEMENT OF MEDICAL FITNESS

This is to confirm that the following employees may be engaged in field activities at _____ in connection with the Subcontract Agreement between E & E and _____, dated _____, 19__, and that all of said employees are medically fit both to perform required field activities and to utilize respiratory equipment in accordance with 29 CFR, Part 1910 and "USEPA Standard Operating Safety Guides," 1984.

(name of site)

_____

_____

_____

_____

_____

_____
Authorized Subcontractor
Representative

EXPOSURES/INJURIES

ONSITE EXPOSURES OR INJURIES:

* should be given appropriate medical attention. Hospital care for chemical exposures must be coordinated with Doctor Harbison (501) 370-2863 (24 hrs)

* injuries without exposures should be given appropriate medical attention

* all exposures/injuries must be reported to the regional office within twenty-four hours (24 hrs)

OFFSITE INJURIES

I. IF AN INJURY OCCURS WHILE YOU ARE "OUT OF TOWN" FOR THE PURPOSES OF SITE WORK, the injury is given appropriate medical attention and reported to the Region Office within 24 hours .

II. IF AN INJURY OCCURS WHILE USING EQUIPMENT OWNED OR OPERATED FOR E&E, the injury should be treated and reported within 24 hours.

II. IF THE INJURY OCCURRED ON YOUR OWN TIME, AND HAS NOTHING TO DO WITH E&E PROPERTY OR EQUIPMENT, report the injury to the Regional Program Manager (Jim Buchanan or his designeee Bill Kwoka) if:

* Medication is being taken
* The injury may adversely affect job performance including your ability to work in the field, at the garage, driving, etc.

Medtox Hotline

1. Twenty-four hour answering service - (501) 370-8263

What to Report:

- State: "This is an emergency."
- Your name, region, and site.
- Telephone number to reach you.
- Your location.
- Name of person injured or exposed.
- Nature of emergency.
- Action taken.

15 557

One of three toxicologists (Drs. Raymond Harbison, Richard Freeman, or Robert James) will contact you. Repeat the information given to the answering service.

If a toxicologist does not return your call within 15 minutes, call the following persons in order until contact is made:

E & E Corporate Headquarters (EST 0830-1700) - (716) 632-4491

a. Twenty-four hour line - (716) 631-9530

b. Corporate Safety Director - Paul Johnmaire (home - (716) 655-1260)

c. Assistant Corporate Safety Officer - Steve Sherman (home - (716) 688-0084)

recycled paper

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* injuries without exposures should be given appropriate medical attention

* all exposures/injuries must be reported to the regional office within twenty-four hours (24 hrs)

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* The injury may adversely affect job performance including your ability to work in the field, at the garage, driving, etc.

FIELD SAFETY DATA SHEET

15 569

Chemical Name: Mercury Compounds (Inorganic)

(1)CAS NO: 7439-97-6 M.W.: _____ Phys. State Solids

(* 1)TLV 0.05 Mg/m3 (ppm or MG/M3)(*)Ceiling Limit _____ (ppm or MG/M3)

APPEARANCE:

(*)Pure: _____

(*)Soil: _____

(*)Water: _____

ODOR:

(*)Odor Threshold _____ (ppm or MG/M3)

(*)Odor Description No odor expected

DETECTION:

(*)HNU Detection Efficiency: 0 (10.2 EV Probe) Assumed

(*)OVA Detection Effiency: 0 Assumed

(*)Other Detection Methods: Minicam particle counter for sites

COMMENTS: where Environmental concentrations are less than 15,000 PPM

PROTECTIVE EQUIPMENT: Mg/m3

(*) 0 TO 0.005 Level-D

(*) .005 TO 0.05 Level-C (Cartridge GMC-H) AP-3

(*) ____ TO ____ Level-B

(*) Above ____ Level-A

Action Levels can be Changed by the RSC to reflect the maximum anticipated concentrations

ROUTES OF EXPOSURE: Inhalation, Absorption, Ingestion

(* 2)Acute Effects: Kidney damage anorexia, Muscle tremors, Neurotic disorders

(* 2)Chronic Effects: Digestive & Nervous System Ailments, Gingivitis

Other Hazards: Ignit no Flam no Oxid no Corr Yes

Explosive Possible Toxic YES Carcin NO Radio NO

Terat _____ Repro _____ Muta _____

(*)Vapor Density >air (*) B.P. _____ (*) LEL NA

(*)Soluble (H20) YES (*) Specif. Grav. _____ (*) UEL NA

DECONTAMINATION: _____

(*) FIRST AID: _____

REFERENCE SECTION:

1). ACGIH TLVs 1983-1984

2). ILO, Encyclopedia of Occupational Health & Safety

3).

4).

5).

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9).

10).

FIELD SAFETY DATA SHEET

15 560

Chemical Name: Lead and its Compounds (inorganic only)

(*1)CAS NO: 7439-92-1 M.W.: _____ Phys. State solid

(*1)TLV 0.15 (ppm or MG/M3)(*)Ceiling Limit 0.45 (ppm or MG/M3)

TWA 0.05 mg/M3 (*)IDLH _____

APPEARANCE:

(*2)Pure: various solids

(*2)Soil: indistinguishable except at high concentrations

(*2)Water: indistinguishable except at high concentrations.

ODOR:

(*)Odor Threshold _____ (ppm or MG/M3)

(*2)Odor Description none- metallic taste at high conc.

(* 2) Vapor Pressure insignificant except at high temp.

DETECTION:

(*)HNU Detection Efficiency: 0 (10.2 EV Probe)

(*2)OVA Detection Effiency: 0

(*)Other Detection Methods: Atomic absorption or ICAP

COMMENTS: Human Health Effects at blood Pb = 20 micrograms/dl (Rep) [hypertension]

mg/m3

PROTECTIVE EQUIPMENT:

(*3) 0 TO .002 Level-D

(*3) .002 TO .02 Level-C (Cartridge type-H) or GMC-H

(*3) .02 TO ____ Level-B

(*) Above _____ Level-A

ROUTES OF EXPOSURE: Inhalation, Absorption, Ingestion

(4)Acute Effects: Fatigue, sleep disturbance, headache, muscle aches alters blood forming tissues, impairs enzymes

(*4)Chronic Effects: nerve and brain damage

Other Hazards: Ignit no Flam no Oxid no Corr no

Explosive no Toxic no Carcin no Radio no

Terat _____ Repro _____ Muta _____

(* 4)Vapor Density ng (* 4) B.P. various (*) LEL NA

(*4)Soluble (H2O) varies (* 4) Specif. Grav. =11 (*) UEL NA

DECONTAMINATION: Soap & Water

(*) FIRST AID: _____

REFERENCE SECTION:

1). ACGIH. TLVS 1983-1984

2). Professional Judgement

3). Corporate Guidelines

4). ILO. Encyclopedia of Occupational Health & Safety

5). Environmental Reporter 5/31/85 p197

6).

7).

8).

9).

10).

FIELD SAFETY DATA SHEET

15 561

Chemical Name: ORGANIC VAPORS NOS

(*)CAS NO: N/a M.W.: Phys. State
(*)TLV (ppm or MG/M3)(*)Ceiling Limit (ppm or MG/M3)

APPEARANCE:
(*)Pure:
(*)Soil:
(*)Water:

ODOR:
(*)Odor Threshold (ppm or MG/M3)
(*)Odor Description

DETECTION:
(*)HNU Detection Efficiency: 30-50% assumed (10.2 EV Probe)
(*)OVA Detection Effiency: 50% assumed
(*)Other Detection Methods:

COMMENTS:

PROTECTIVE EQUIPMENT:
(*1) 0 TO 1 ppm Level-D
(*1) 1 TO 5 ppm Level-C (Cartridge combination organic/ high efficiency filter
(*) TO ppm Level-B
(*) Above ppm Level-A

ROUTES OF EXPOSURE: Inhalation, Absorption, Ingestion

(2)Acute Effects: nausea unknown, headache, eye, nose & throat irritation
(*)Chronic Effects:

Other Hazards: Ignit yes Flam yes Oxid no Corr no
Explosive no Toxic yes Carcin yes Radio no
Terat yes Repro yes Muta yes

(*)Vapor Density (*) B.P. (*) LEL
(*)Soluble (H20) (*) Specif. Grav. (*) UEL

DECONTAMINATION: Soap & water wash, water rinse. Assumes properties similar to the most common solvents.

(*) FIRST AID: no special actions.

REFERENCE SECTION:
1). Corporate guidelines
2). other values are assumed based upon the solvent properties
3). most often encountered in field work.
4).
5).
6).
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9).
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HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE (TLV) AND SOURCE
50 ppm TWA 150ppm STEL ACGIH 1982

15 562

EFFECTS OF OVEREXPOSURE Inhalation f TCE above the TLV can irritate nose & throat, with dizziness, dr wsiness, headache, nausea, unconsciousness, & even death resulting from excessive exposure. Eye irritation and lacrymation can result from exposure to vapor & liquid. Skin contact causes irritation and, when prolonged or repeated, dermatitis.

EMERGENCY FIRST AID PROCEDURES Eye Contact: Wash immediately with plenty of running water. Continue washing to minimize discomfort. Get prompt medical attention. Skin Contact: Remove contaminated clothing. Wash with soap & warm water. Inhalation: Remove to fresh air; restore breathing if required. Keep at rest & warm. Immediately contact physician; advise him not to give adrenalin. Ingestion: Get immediate medical help. Do not induce vomiting unless directed by a physician. (Authorities differ; professional decision required).

VIII REACTIVITY DATA

☐ UNSTABLE ☒ STABLE

CONDITIONS TO AVOID

INCOMPATIBILITY (MATERIALS TO AVOID) Reacts with NaOH, KOH, or other strong alkali to form explosive mixtures of chloroacetylenes.

HAZARDOUS DECOMPOSITION PRODUCTS Requires stabilization against oxidation, degradation & polymerization. When exposed to high temperatures, hydrogen chloride & phosgene (highly toxic).

HAZARDOUS POLYMERIZATION ☒ MAY OCCUR ☐ WILL NOT OCCUR

CONDITIONS TO AVOID

IX SPILL OR LEAK PROCEDURES

PROCEDURES TO CONTAIN AND CLEAN UP LEAKS AND SPILLS Clean up personnel should use respiratory & liquid contact protection. Provide ventilation. Confine spill to as small an area as possible. Do not allow run off to the sewer. Pick up spill with vacuum or on an absorbent & store in closed container for disposal.

REPORTING PROCEDURE

WASTE DISPOSAL METHOD Waste can be processed to recover TCE, or it can be burned in an appropriately equipped, high temperature incinerator. Disposal through a licensed waste disposal company should also be considered. Follow Federal, State & local regulations.

X PROTECTION INFORMATION

RESPIRATORY PROTECTION (SPECIFY TYPE) Use self-contained breathing equipment above 1000 ppm; canister respirators for limited exposures

VENTILATION	LOCAL EXHAUST	SPECIAL
	MECHANICAL (GENERAL)	OTHER

PROTECTIVE GLOVES Neoprene gloves, aprons, etc.

EYE PROTECTION Gas-tight goggles should be used by maintenance & emergency personnel.

OTHER PROTECTIVE EQUIPMENT AND CLOTHING An eyewash station should be available where splashing is probable.

XI SPECIAL PRECAUTIONS

HANDLING AND STORAGE CONDITIONS Store in a cool, well-ventilated area & use with adequate ventilation, including floor level ventilation. No smoking in use or storage areas. Avoid collecting aluminum fines or chips in vapor degreaser. Regularly monitor TCE stabilizer level. Only trained personnel should operate vapor degreaser.

OTHER

XII INFORMATION SUBMITTED BY

NAME	DATE 2/83
COMPANY	SOURCES OSHA

CONTINUATION/NOTES

*Ingestion irritates the digestive tract & may cause nausea & rapid drowsiness partial paralysis, unconsciousness & kidney failure can result in severe cases.

CHEMSAFE™

15 563

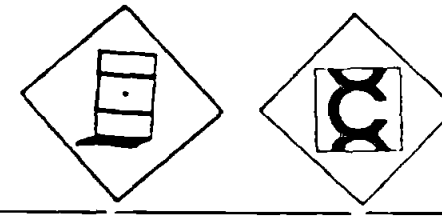
MATERIAL SAFETY DATA SHEET

I IDENTIFICATION

MANUFACTURER'S NAME	EMERGENCY TELEPHONE NO
ADDRESS (Number Street City State and ZIP Code)	CAS NUMBER 000 079 016
CHEMICAL NAME AND SYNONYMS Trichloroethylene	TRADE NAME AND SYNONYMS
CHEMICAL FAMILY Chlorinated Alkene	FORMULA $ClHCCCl_2$

II CHEMSAFE™ INSTRUCTIONAL* CLASSIFICATION

Affix Appropriate Chemsafe™ Instructional Classification Label



*Refer to CHEMSAFE™ instructional booklets for data regarding the properties appropriate safe use and storage and emergency response for this class of substance

III HAZARDOUS INGREDIENTS

INGREDIENT NAME	%	TLV AND SOURCE (units)	INGREDIENT NAME	%	TLV AND SOURCE (units)
1 Trichloroethylene	100	50 ppm TWA	4		
2		ACGIH	5		
3		1982	6		

IV PHYSICAL DATA

Boiling Point at 760 mm Hg 1 atm, deg F (C)	188 (87)	Specific Gravity (H_2O = 1) 20 C	1.45-1.47*
Vapor Pressure (mm Hg at 20 ° C) mm Hg	58	Percent Volatile By Volume (%)	ca 100
Vapor Density (Air = 1)	4.54	Evaporation Rate (Butyl Acetate = 1) (CCl_4=1)	-0.69
Solubility In Water (% by Weight) @ 25°C, %	0.1	Melting Point (°F)	NA

Appearance and Odor: Colorless, mobile liquid with a characteristic, sweet, ether-like odor whose recognition threshold is 21.4 ppm in air (unfatigued, 100% of test panel). *Depends on stabilizer & level used.

V FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used)	Flammable Limits in Air (% by Volume)	Lower (LEL)	Upper (UEL)
None			

Extinguishing Media: Use that which is appropriate for surrounding fire. Trichloroethylene is normally considered noncombustible. However, when 15% vapor in air at 33C is exposed to intense heat (electric arc) or to ordinary flame at vapor-air temps. exceeding 50C, it can be made to burn mildly. Combustibility increases in O_2 enriched air.

Fire Fighting Procedures: Self-contained breathing apparatus should be used for protection against TCE vapors & their toxic & corrosive decomposition products in a fire situation.

Fire and Explosion Hazards

VI LOCATIONS USED AND STORED (Completed By User)

Locations Used

Locations Stored

While Springborn Regulatory Services Inc (SRS) believes that the data contained herein are factual and believes that the opinions expressed are those of qualified experts, the data are not to be taken as a warranty or representation for which SRS assumes legal responsibility. They are offered solely for your consideration, investigation, and verification. Any use of this data and information must be determined by the user to be in accordance with applicable federal, state and local laws and regulations.

CHEMSAFE™ FORM 32

(Continued on reverse side)

SPRINGBORN REGULATORY SERVICES, INC
THIRTY SPRINGBORN CENTER
ENFIELD, CONNECTICUT 06082

FIELD SAFETY DATA SHEET

Chemical Name: P rchloroethyl ne syn. tetrachloroethyl 15# 564

(*1)CAS NO: 127-18-4 M.W.: 166 Phys. State liquid
(*1)TLV 50 PPM (ppm or MG/M3)(*)Ceiling Limit 200 PPM(ppm or MG/M3)
IDLH 500 PPM (ref 4)

APPEARANCE:
(*)Pure: colorless to pale yellow liquid
(*)Soil:
(*)Water:

ODOR:
(*)Odor Threshold (ppm or MG/M3)
(*4)Odor Description similar to chloroform

DETECTION:
(*2)HNU Detection Efficiency: (10.2 EV Probe) I.P. 9.32
(*2)OVA Detection Effiency: 70%
(*2)Other Detection Methods: Drager tubes, Gas Chromatography

COMMENTS:

PROTECTIVE EQUIPMENT:
(*3) 0 TO 5 ppm Level-D
(*3) 5 TO 50 ppm Level-C (Cartridge Combination: Organic High efficiency filter
(*) TO ppm Level-B
(*) Above ppm Level-A

ROUTES OF EXPOSURE: Inhalation, Absorption, Ingestion

(*4)Acute Effects: irritation of eyes, nose throat, CNS depressant
(*4)Chronic Effects: liver and kidney damage

Other Hazards: Ignit no Flam no Oxid no Corr no
Explosive no Toxic yes Carcin Radio no
Terat Repro Muta

( )Vapor Density (* 4) B.P. 250°F (*) LEL na
(*4)Soluble (H20) 1,500 (* 5) Specif. Grav. 1.62 (*) UEL na

DECONTAMINATION: soap and water wash, water rinse

(*) FIRST AID: Take victim to fresh air and remove contaminated clothing. Give artificial respiration if necessary.

REFERENCE SECTION:
1). ACGIH, TLVs 1984-1985
2). Manufacturer's Literature
3). Corporate Guidelines
4). Niosh / Osha Pocket Guide to Chemical Hazards 1980 revision
5).
6).
7).
8).
9).
10).

HAZARD EVALUATION:

This project has several phases. The phases include surface soil sampling, subsurface soil sampling, sediment sampling , surface water sampling and groundwater sampling. The subsurface sampling efforts will include subcontractors to drill borings and/or install monitoring wells.

Hazards Present:
volatile organic compounds: Inhalation hazard
- paint thinners and solvents
  - generally a mixture of aliphatic organics and aromatic compounds
- degreaser and solvents for the removal of paint
  - generally chlorinated volatile organic compounds such as trichloroethene, methylene chloride, 1,1,1-trichloroethane.

Non-volatile organics:
- direct contact hazard
  - generally petroleum products for vehicle fuels, lubrication although they can be considered to be direct contact hazards, they generally have low toxicity.

Pesticides: direct contact hazard
- The pesticides which are reported to have been disposed of on this site are limited to a mercury containing compound which was used as a herbicide. No other description of the herbicide was made. It is assumed that the compound will be toxic by direct contact only and will probably not be an acetocholinesterase inhibitor since the mercury compounds are not associated with organophosphate or organocarbamate pesticides.

  Other pesticides are in use on the air base at the present time but are not believed to be in the landfill areas. The present pesticides include several of the acetanilide derivatives, and organophosphates and organochlorine compounds. One of the named compounds was Silvex. Silvex is a 2,4,5-T formulation and has the potential for TCDD contamination.

  At this time, no PCBs or Dioxins are known to be or thought to be on the site in the areas of investigation.

Physical hazards:
- The physical hazards associated with this site will be greatest around the drill rig operation. All utility lines pipes etc. will be located prior to the start of drilling. At least two people will be present at the drill rig while it is in operation. The route to the nearest hospital will be explained to the drillers and/or an E&E person familiar with the route will be present.
- constant monitoring of the breathing zone will be performed during the drilling operations. Additional monitoring will be done to detect potentially high concentrations which could reach the breathing zone.

The overall hazards consist of the following:

Inhalation: volatile organic compounds (including carcinogens)
Heavy metals (particulates)
Pesticides

Direct ContacT:
Volatile Organics
Carcinogens: chlorinated organics (volatile)
Pesticides
Mercury (from pesticide)
Lead (from Paint)

- Level-C protection is recommended for those activities which disturb the subsurface soils and for the collection of soil samples which have the potential for contamination with the mercury containing herbicide or carcinogens. GMC-H cartridges.
- Skin protection should include disposable outerwear to protect against particulates. Since the drillers will not drill into the fill material, no direct contact with concentrated chemicals is anticipated.

ACTION LEVELS:

If the HNU/OVA measures organic vapor concentrations in excess of five parts per million above background, the team is to withdraw from the site. Site work is not to continue until the respiratory protection is increased or enough information is provided to the Regional Safety Coordinator for him to determine that level-C respiratory protection is still appropriate. Level-B operation requires the approval of the RSC.

If above background levels of radiation are detected in any of the areas, the work is to stop for that area until the hazard is evaluated and approval is granted.

Subcontracts:

As of 9-12-86 the subcontract has not been finalized. The Statements of medical fittness must be recieved for this safety plan to be valid for subcontract work. The subcontractors must also be informed to the hazards and monitoring . . . anticipated to be present/done.

Site Number one:

The only anticipated wastes which are hazardous are:
paints
paint thinner
  alcohol
  aliphatic organics
  turpentine
Strippers
  chlorinated hydrocarbons such as
    TCE
    Carbon tetrachloride
    1,1,1-Trichloroethane

15 567

The quantities are reportedly very small. This is partly due to the practise of burning the solvents rather than just landfilling them.

ACTION LEVELS:
1 PPM organic vapors goto Level-c protection
5 PPM organic vapors withdraw from the site area
Above Background Radiation: Withdraw from the area and report the situation to the RSO.

Site Number 2 (The Northeast Landfill)

Hazardous wastes are present in very small quantities. The volatiles which were disposed of were not containerized. Waste paint and thinners were spread on the ground surface until 1978. Since no concentrated wastes are known to be containerized in the disposal area, high concentrations of vapors are very unlikely.

Action Levels: Same as for site NO.1

Note: Over 400 55-gallon drums are stored at the site. Most of the drums are empty, but some of the drums have unknown contents. If the wind direction places the site downgradient of the drums, there is potential for exposures through leakage and other releases. Inform the team/drillers of that potential and withdraw if unexpected odors occur or if there is irritation of mucus membranes such as in the nose or throat. Eye irritation or headaches are also common signs of exposure.

Site Number 5, The South Burn Pit: 15 568

This site was used to burn oil and solvents during training exercises for firefighting personnel. Although there is potential for volatile organics to be present here, the quantities are anticipated to be small due the history.

Level-D respiratory protection is recommended unless the organic vapor concentrations exceed 1 PPM.above background.

Site Number 6: The North Burn Pit:

Hazardous wastes:
- -Waste oils
- -Solvents
- -Fuels: only JP-4 fuel similar to kerosene

History is the same as for site 5. Use the same respiratory guidelines.

Site Number 8, The Herbicide Burial Site:

Hazardous Wastes:
- -four cases of mercury containing herbicide estimated to be less than 50 pounds total
- - no description of the chemical or its trade name.

It will be assumed that the bottles are intact or that they have been broken by their burial. Since the herbicide is in pint bottles, it is unlikely that the borings will break more than one or two. Visual observation is very important if the perimeter is not well defined. If the perimeter is well defined, there is no chance of striking the bottles.

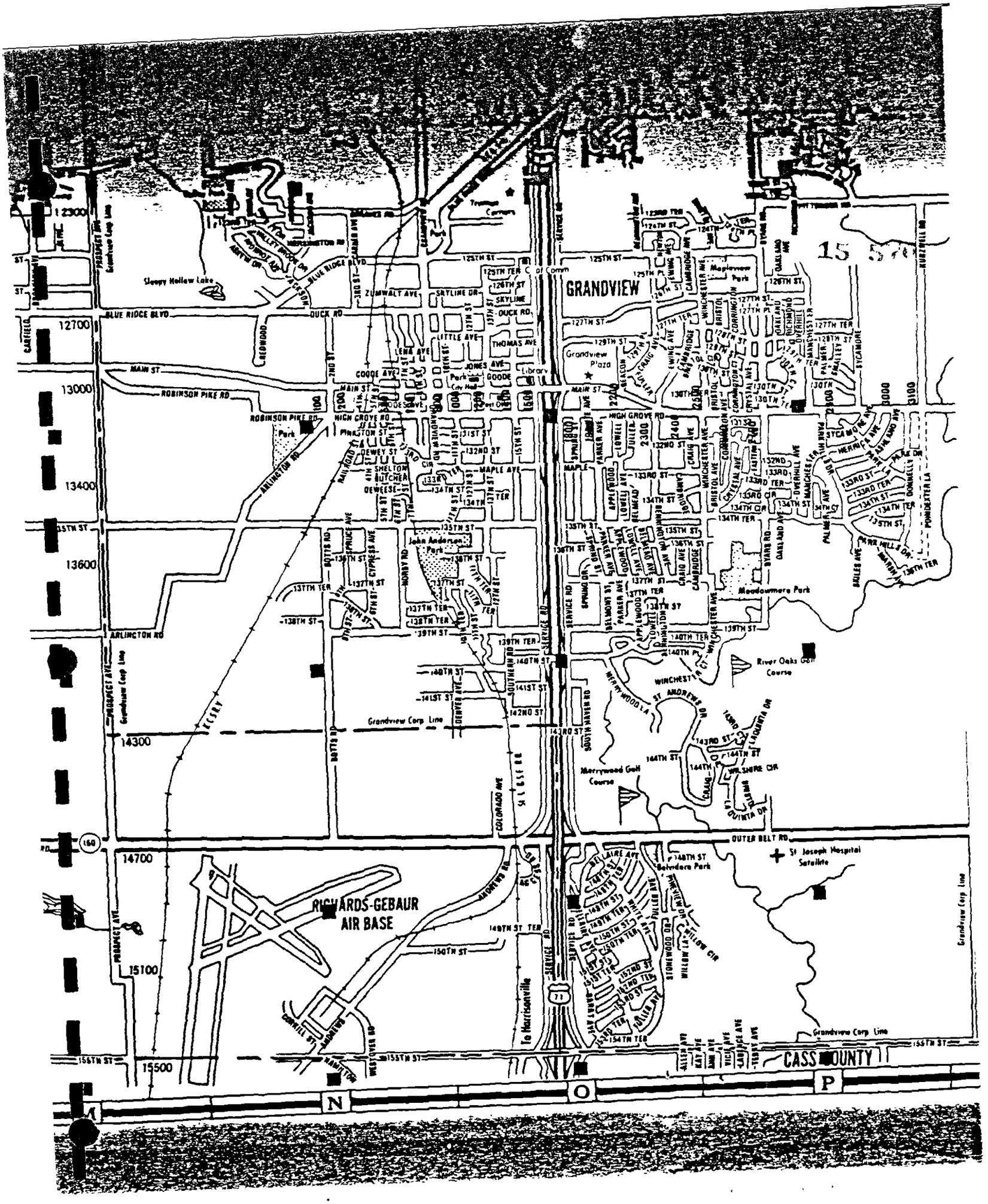
In the event that the perimeter is poorly defined, the drillers and monitoring personnel should take particular care to examine soil cuttings for signs of organics. The signs could include a sheen on the water/soil, odors like solvents, fragments of broken glass, etc. Since the characteristics of the herbicide are not defined it is not known if the HNU or OVA will respond to it. For the purposes of this safety plan, we are assuming that both instruments will not detedt the pesticide. You are to assume that herbicide is present.

Hand protection will consist of surgical gloves under nitrile or butyl gloves. Foot protection will be a minimum of rubber boots (safety). Outerwear should be disposable coveralls such as tyvek or saranex suits.

Site Number 9, An Oil Saturated Area

An oil contaminated area is located in an area which was previously used for storage of petroleum products such as fuels, oils and greases.

This area is reported to have been heavily contaminated by relatively non-toxic materials. Due to the nature of the contaminants, and the fact that the site is in an open area, respiratory protection will not be required. Respiratory protection is optional at organic vapor concentrations which reach 5 PPM.


GRANDVIEW
RICHARDS-GEBAUR AIR BASE
Sleepy Hollow Lake
Grandview Plaza
Maplevew Park
John Anderson Park
Meadowmere Park
River Oaks Golf Course
Merrywood Golf Course
St Joseph Hospital Satellite
Belvidere Park
Grandview Corp Line
To Harrisonville
CASS COUNTY
BLUE RIDGE BLVD
DUCK RD
MAIN ST
ROBINSON PIKE RD
HIGH GROVE RD
ARLINGTON RD
OUTER BELT RD
SERVICE RD
SOUTHERN RD
BOTTS RD
PROSPECT AVE
12300
12700
13000
13400
13600
14300
14700
15100
15500
N
O
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15 571

APPENDIX B

CONTRACT DESCRIPTION OF WORK

17 JUN 1986

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INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION (STAGE 2)
RICHARDS-GEBAUR AFB MO

I. DESCRIPTION OF WORK

The overall objective of the Installation Restoration Program (IRP) Phase II investigation is to assess potential contamination at past hazardous waste disposal and spill sites on Air Force installations. A series of staged field investigations may be required to meet this objective.

The intention of this staged investigation is to undertake a field and laboratory study at Richards-Gebaur AFB MO to: (1) confirm the presence or absence of contamination within the specified areas of investigation; (2) if possible, determine the extent and degree of contamination and the potential for migration of those contaminants in the various environmental media; (3) identify public health and environmental hazards of migrating pollutants based on state or Federal standards for those contaminants; and (4) delineate additional investigations required beyond this stage to reach the Phase II objectives.

The IRP Phase I Report and Phase II Stage 1 Report (mailed under separate cover) incorporate the background and description of the sites/zones for this task. To accomplish this survey effort, the contractor shall take the following actions:

A. General Requirements

1. Conduct a literature search of local hydrogeologic conditions to complement the Phase I and Phase II Reports (mailed under separate cover). Include the pertinent literature search information in an appendix of the Final Report. Develop the literature search data using the following guideline:

a. Topographic data

b. Geologic data

(1) Structure

(2) Stratigraphy

(3) Lithology

c. Hydrogeologic data

(1) Location of all existing and abandoned wells, observation wells, springs, ponds (natural and artificial) and seepages, that occur on or off the installation within a one-mile radius of sites to be investigated

(2) Groundwater table and piezometric contours

(3) Depth to groundwater

(4) Surface and groundwater quality

(5) Delineated areas of recharge, discharge and contributing areas

(6) Geologic setting, yield data and hydrographs of springs and natural seepages

d. Data on all existing and abandoned wells, including uncased boreholes, on or off the installation and within a one-mile radius of sites to be investigated

(1) Location, depth, diameter, well type, and lithologic logs associated with the well

(2) Static and pumping water levels, well hydrographs, yield, specific capacity, and related data

(3) Existing and projected groundwater development and use

(4) Well and screen corrosion, crustation, and similar operation and maintenance problems

(5) Observation and monitoring well networks, pumping influences, barrier and recharge boundaries, and related hydraulic interferences influencing aquifer behavior.

(6) Existing water sampling sites

e. Aquifer data

(1) Type, i.e., unconfined, artesian, or perched

(2) Thickness, depth to aquifer, and formational designation

(3) Barrier and recharge boundaries

(4) Transmissivity, storativity, and permeability (gpd/ft^2)

(5) Specific retention

(6) Delineation of discharge and recharge areas

(7) Ground and surface water relationships

(8) Aquifer models

f. Climatic data

(1) Precipitation (total and net)

(2) Evapotranspiration

2. Determine the areal extent of the sites by reviewing historical and current panchromatic and infrared aerial photography.

B. Technical Operations Plan

Immediately after the Notice To Proceed (NTP) for the delivery order, develop a Technical Operations Plan (TOP) based on the technical requirements specified in this task description. (See Sequence No. 19, Item VI below). Follow the TOP format (mailed under separate cover). Provide the TOP to the USAFOEHL within two weeks of the NTP.

C. Health and Safety

Comply with USAF, OSHA, EPA, state and local health and safety regulations regarding the proposed work effort. Use EPA guidelines for designating the appropriate levels of protection needed at the study sites. Prepare a written Health and Safety Plan for the proposed work effort and coordinate it directly with applicable regulatory agencies prior to commencing field operations. Provide an information copy of the Health and Safety Plan to the USAFOEHL after coordination with regulatory agencies. The Health and Safety Plan is specified in Sequence No. 7, Item VI below.

D. Drilling and Soils Work

1. Determine the exact location of all monitor wells, soil borings, and test pits during the planning/mobilization phase of the field investigation. Consult with base personnel to minimize disruption of base activities, to properly position wells with respect to exact site locations, and to avoid underground utilities. Direct the drilling and sampling and maintain a detailed log of the conditions and materials penetrated during the course of the work. Do not drill boreholes into or position wells in actual landfill areas, install wells at the landfill perimeter.

2. Monitor the ambient air during all well drilling, soil boring and test pit work with a photoionization meter or equivalent organic vapor detector to identify the generation of potentially hazardous and/or toxic vapors or gases. Include air monitoring results in the boring logs. If soil encountered during borehole drilling or test pit work is suspected to be hazardous because of abnormal discoloration, odor or air monitoring levels, containerize the soil cuttings in new, unused drums. Enter into the boring logs the depth(s) from which suspected contaminated soil cuttings were collected for containerization. Collect a maximum of 10 composite samples, one from the contents of each drum. Test each composite sample for EP Toxicity (metals). Use RCRA criteria to determine if soil cuttings must be classified as hazardous waste (40 CFR 261.24).

3. Groundwater Monitoring Wells

a. Installation of Groundwater Monitoring Wells

(1) Comply with U.S. EPA Publication 330/9-S1-002, NEIC Manual for Ground Water/Subsurface Investigations at Hazard Waste Sites for monitoring well installation.

(2) All well drilling, development, purging, sampling methods, and other activity pertaining to this effort must conform to state and other applicable regulatory agency requirements. Cite references in an appendix to the Final Report.

(3) Install wells at a sufficient depth to collect samples representative of aquifer quality and to intercept contaminants if they are present.

(4) Avoid, when possible, installing wells in depressions or areas subject to frequent flooding and standing water. If wells must be installed in such areas, design the wells such that standing water does not leak into the top of the casing or cascade down the annular space.

(5) Drill all monitoring wells using the following specifications:

(a) Drill wells using hollow-stem auger techniques. A center stem, plug, and bit attached to the stem may be inserted into the auger for use while drilling. This will prevent material from entering into the hollow stem of the auger.

(b) Take lithologic samples at five-foot intervals and prepare borehole log descriptions. Include pilot boring logs and well completion summaries in the Final Report (Item VI, below).

(c) Drill a maximum of 6 wells. Total footage for all wells in this task shall not exceed 200 linear feet. Refer to the site specific details in Section I.H.

(d) Construct each well with four-inch inside diameter (I.D.) Schedule 80 PVC casing. Use threaded screw-type joints, glued fittings are not permitted. Flush thread all connections. Screen each well using four-inch I.D. casing having up to 0.020 inch slots; slot size may be smaller based upon borehole geology. Screen material must be the same as that of the casing. Cap the bottom of the screen.

(e) Screen all wells so as to collect floating contaminants and to allow for yearly fluctuations of the water table. Screen all shallow wells a minimum of ten feet.

(6) Complete all monitoring wells using the following specifications:

(a) Once the casing is installed, allow the soil formation to collapse around the well screen. Supplement the natural gravel-pack with washed and bagged rounded silica sand or gravel with a grain size distribution compatible with the screen and soil formation. Place the pack from the bottom of the borehole to two feet above the top of the screen. Tremie a five foot bentonite seal (granulated or pellets) above the sand/gravel pack. Ensure the bentonite forms a complete seal. Grout the remainder of the annulus to the land surface with a Type I Portland cement/bentonite slurry.

(b) Check with the Base point of contact (POC) to determine whether wells shall be completed flush or project above the ground surface.

1 If well stick-up is of concern in an area, complete the well flush with the land surface. Cut the casing two to three inches below land surface, and install a protective locking lid consisting of a cast-iron valve box assembly. Center the lid assembly in a three foot diameter concrete pad sloped away from the valve box. Ensure that free drainage is maintained within the valve box. Also, provide a screw-type casing cap to prevent infiltration of surface water. Maintain a minimum of one foot clearance between the casing top and the bottom of the valve box. Clearly mark the well number on the valve box lid.

2 If an above-ground-surface completion is used, extend the well casing two or three feet above land surface. Provide an end-plug or casing cap for each well. Shield the extended casing with a steel guard pipe which is placed over the casing and cap, and seated in a two-foot by two-foot by four-inch concrete surface pad. Slope the pad away from the well sleeve. Install a lockable cap or lid on the guard pipe. Install three, three-inch diameter steel guard posts if the Base POC determines the well is in an area which needs such protection. The guard posts shall be five feet in total length and installed radially from each wellhead. Recess the guard posts approximately two feet into the ground. Do not install the guard posts in the concrete pad placed at the well base. Paint the protective steel sleeve and clearly number the well on the sleeve exterior.

3 Provide locks for both flush and above-ground well assemblies. Turn over the lock keys to the Base POC following completion of the field effort.

(c) Develop each well as soon as practical after completion with a submersible pump, bailer, and/or airlift method. Continue well development until the discharge water is clear and free of sediment to the fullest extent possible. Measure the rate of water produced, the pH, specific conductance and water temperature during well development and include this information in the Final Report.

(d) Determine by survey the elevation of all newly installed monitoring wells to an accuracy of 0.01 foot. Notch the top of the

riser casing where well elevations are established. Horizontally locate the new wells to an accuracy of 1.0 foot and record the position on both project and site-specific maps. Bench marks used must have previously been established from and are traceable to a USCGS or USGS survey marker.

(e) Measure water levels at all monitoring wells as feet below the ground surface or below the top of casing elevation to the nearest 0.01 foot. Report as mean sea level (MSL). Measure static water levels in wells prior to well development and before all well purging which precedes sampling events.

b. Recommend a candidate well abandonment method(s) or technique(s) which is applicable to the type of monitoring wells installed and geological conditions. Consider that these wells will be abandoned at some future date after the study objectives have been met and there is no longer a need for the wells. The actual process of well abandonment is not a part of this task order. Assure that the recommended method(s) meets state and/or local well abandonment guidelines or regulations.

c. Complete permits, applications, and other documents which may be required by local and/or state regulatory agencies for the installation of monitoring wells. File these documents with appropriate agencies and pay all permitting and filing fees.

4. Soil Borings

a. Conduct a maximum of 12 soil borings not to exceed a total of 250 linear feet. Accomplish the borings using hollow stem auger techniques. Obtain split-spoon samples at five foot intervals, using ASTM Method D-1586. Refer to Section I.H. for collection details of soil samples requiring laboratory analysis. Where sample collection depths are not specified, take samples in zones of suspected contamination as determined by abnormal soil discoloration, odor or air monitoring levels.

b. Scan all split-spoon soil cores with a photoionization meter or equivalent organic vapor detector. Include monitoring results in the boring logs.

c. During the boring operations, describe lithologies encountered and prepare stratigraphic logs. Place special emphasis on field identification of contaminated soils encountered.

d. Whenever possible, measure water levels in all boreholes after the water level has stabilized. Examine the water surface for the presence of hydrocarbons. Include this information in the boring logs.

e. Tremie-grout all boreholes to the surface with bentonite. It is especially important to insure that they be adequately resealed to preclude future migration of contaminants.

f. Permanently mark each location where soil borings are drilled. Record the location on a project map for each specific site or zone, whichever is applicable.

g. Perform a maximum of three shallow soil augerings using a hand auger. Total footage shall not exceed 50 feet.

5. Well and Borehole Cleanup

Remove all well/borehole cuttings and clean the general area following the completion of each well/borehole. Containerize and store cuttings suspected to be contaminated according to paragraph I.D.2. of this task order. Transport these drums to a location within the installation boundary designated by the Base POC. The base is responsible for ultimate disposal of contaminated soils using base resources.

E. Decontamination Procedures

1. Decontaminate all sampling equipment, including internal components, prior to use and between samples to avoid cross-contamination. Wash equipment with a laboratory-grade detergent followed by drinking quality water, solvent (methanol), and distilled water rinses. Allow sufficient time for the solvent to evaporate and the equipment to dry completely before reuse.

2. Dedicate for each well the monofilament line or steel wire used to lower sampling equipment into the well; do not use a line in more than one well. Decontaminate the calibrated water level probe for measuring well volume and water level elevation before use in each well.

3. Thoroughly clean and decontaminate the drilling rig and tools before initial use and after each borehole completion. As a minimum, steam clean drill bits after each borehole is installed. Drill from the "least" to the "most" contaminated sites, if possible.

F. Field Sampling

1. Strictly comply with the sampling techniques, maximum holding times, and sample preservation as specified in the following references: Standard Methods for the Examination of Water and Wastewater, 16th Edition (1985), pages 37-44; ASTM, Section 11, Water and Environmental Technology; Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 2nd Edition (USEPA, 1984); Methods for Chemical Analysis of Waters and Wastes, EPA Manual 600/4-79-020, pages xiii to xix (1983); and the Handbook for Sampling and Sample Preservation of Water and Wastewater, EPA Document 600/4-82-029 (1982).

2. Groundwater Monitoring Wells

a. After development, allow wells to stabilize for a minimum of seven days before sampling.

b. Prior to purging the wells, examine the surface of the water table for the presence of hydrocarbons and take water level measurements to the nearest 0.01 foot with respect to the established survey point on top of the well casing. If applicable, measure the thickness of the hydrocarbon layer.

c. Purge the well using a submersible pump, bailer, or other pertinent method. Purge until a minimum of three well volumes (based on borehole diameter) of water has been displaced and the pH, temperature, specific conductance, color, and odor of the discharge have stabilized using the following criteria: pH ± 0.1 unit, temperature ± 0.5°C, and specific conductance ± 10 µmhos. Include the final measurements in the Results section of the report.

d. Collect water samples with a Teflon bailer. However, to collect representative aquifer samples where floating hydrocarbons are present, use a "thief sampler" or similar device to minimize the influence of the free product.

e. If the well(s) cannot be sampled due to well development, well characteristics, or other reason(s), indicate the reason(s) in the report as specified in Item VI below.

f. Remeasure water levels after sampling and the wells have stablized.

3. For surface water/sediment samples, collect samples so as not to cause cross-contamination; obtain downstream samples first. Measure, on site, the pH, temperature, and specific conductance for all water samples.

4. Permanently mark the location where surface water or sediment samples are collected. Record the location on a project map for each specific site or zone, whichever applies.

5. Split all water and soil samples. Analyze one set and immediately deliver the other set (the same collection day) to the Base POC. The Base POC will select 10% of the split samples, package the selections with appropriate forms, and deliver them to the contractor within 24 hours of receipt. Supply all packing and shipping materials to the Base POC for packaging the split samples. Immediately ship (within 24 hours) the POC-selected samples through overnight delivery to:

USAFOEHL/SA
Bldg 140
Brooks AFB TX 78235-5501

For all split samples sent to the USAFOEHL, complete an AF Form 2752A "Environmental Sampling Data" and/or an AF Form 2752B "Environmental Sampling Data - Trace Organics", (working copies will be provided under separate cover) with the following information:

a. Date and time collected

b. Purpose of sample (analyte and sample group)

c. Installation name (base)

d. Sample number

e. Source/location and depth of sample

f. Contract Task Numbers and Title of Project

g. Method of collection (bailer, suction pump, air-lift pump, etc.)

h. Volumes removed before sample taken (well samples only)

i. Special conditions (use of surrogate standard, etc.)

j. Preservatives used

k. Collector's name or initials

In addition, label each sample container with a permanent ink pen (water-proof laundry marker) to reflect the data in a, b, c, d, j and k above.

6. For every 10 field samples collected, take at least one additional sample (a field duplicate) for quality control purposes. Table 1 provides a 10% allowance for these additional analyses. Duplicates shall be indistinguishable from other analytical samples so that personnel performing the analyses are not able to determine which samples are duplicates.

7. For every 20 field water samples collected, prepare and submit for analysis one field blank for all parameters analyzed in water. A minimum of one field blank for each parameter is required. Allowances for these additional analyses are included in Table 1.

8. Maintain chain-of-custody records for all samples, field blanks, and quality control samples.

G. Chemical Analyses

1. Analyze water and soil samples collected as specified in Section H below, Specific Site Work. The analytical parameters are summarized in Table 1 along with the required methods.

2. All analyses shall meet the required limits of detection for the applicable method identified in Table 1.

3. For those methods which employ gas chromatography (GC) as the analytical technique (SW8010, SW8020, E601, E602, E604, etc.) positive confirmation of identity is required for all analytes having concentrations higher than the Method Detection Limit (MDL). Conduct positive confirmation by second-column GC; however, gas chromatography/mass spectroscopy (GC/MS) can be used for positive confirmation if the quantity of each analyte to be confirmed is above the detection level of the GC/MS instrument. Analytes which cannot be confirmed will be reported as "Not Detected" in the body of

the report, but results of all second-column GC or GC/MS confirmational analyses are to be included in the report appendix along with other raw analytical data. Base the quantification of confirmed analytes on the first-column analysis. The maximum number of second-column confirmational analyses shall not exceed fifty percent (50%) of the actual number of field samples (to include duplicates). The total number of samples for each GC method listed in Table 1 includes this allowance. If GC/MS, or a combination of second-column GC and GC/MS, is used, the total cost of all such analyses for a particular parameter shall not exceed the funding allowed for positive confirmation using only second-column GC.

4. All chemical/physical analyses shall conform to state and other applicable Federal and local regulatory agency legal requirements. If a regulatory agency specifies that a type of analysis be performed in a certified laboratory, assure compliance with the requirement and furnish documentation showing laboratory certification with the first analytical data supplied to the USAFOEHL/TS.

5. Archive all raw data, including QA/QC and standards data, for not less than five years after project completion. Supply these data to the USAFOEHL/TS upon request.

H. Specific Site Work

In addition to items delineated in I.A. through I.G. above, conduct the following specific actions at the sites listed below:

1. South Landfill (Site 1)

a. Perform one soil boring to an approximate depth of 15 feet. Obtain a maximum of 3 soil samples from the boring. The selection of soil samples for chemical analysis shall be based on OVA or HNU meter readings, discoloration, odor, or other signs of contamination. Record the OVA/HNU readings and other observations with the soil boring logs. Take a water sample from the boring if groundwater is encountered.

b. Take a maximum of three soil or sediment samples along the perimeter of the landfill along Scope Creek. Take one background soil or sediment sample upstream of the landfill along the creek.

c. Take a maximum of three water samples from Scope Creek adjacent to the landfill or from any leachate seeps detected. Take one background water sample upstream along Scope Creek.

d. Analyze soil/sediment samples for petroleum hydrocarbons, aromatic volatile organics and halogenated volatile organics.

e. Analyze water samples for petroleum hydrocarbons, total dissolved solids (TDS), halogenated and aromatic volatile organics, 13 priority pollutant metals, extractable priority pollutants (GC/MS), common anions, and phenols.

2. Northeast Landfill (Site 2)

a. Locate and review any available new information dealing with the Northeast Landfill and nearby sewer lines. Locate and interpret any aerial photographs of the site when it was in operation.

b. Perform a magnetometer and an electromagnetic survey of the site.

c. Perform six soil borings each approximately 20 feet deep, three borings for the west trench and three borings for the double trench. Obtain a maximum of 3 soil samples per boring (a maximum of 18 total soil samples). Select the soil samples based on OVA or HNU meter readings, discoloration, odor or other signs of contamination. Obtain a water sample from each boring if water is encountered (a maximum of 5 water samples (Note: One boring will be coverted to a well).

d. Convert one boring into a monitoring well immediately downgradient of the newly discovered trench areas in the west part of the landfill. Install one background monitoring well immediately north of the landfill. Collect a water sample from each well.

e. Collect water samples from the three existing monitoring wells at the site.

f. Collect water samples from Scope Creek upgradient and downgradient of this landfill (2 samples).

g. Analyze soil samples for petroleum hydrocarbons, aromatic volatile organics, and halogenated volatile organics.

h. Analyze water samples for petroleum hydrocarbons, TDS, halogenated and aromatic volatile organics, 13 priority pollutant metals, extractable priority pollutants (GC/MS), common anions, and phenols.

3. North Burn Area (Site 6)

a. Perform soil gas analysis with a maximum of 30 holes/probes to characterize contamination from the site. Siting of borings and wells will be based on the results of the soil gas survey.

b. Perform three soil borings each approximately 15 feet deep along the perimeter of the pit. Obtain a maximum of 9 soil samples from the boreholes based on OVA/HNU meter readings, discoloration, odor, or other indications of contamination. Collect a water sample from each borehole if water is encountered for a maximum of three water samples.

c. Install 3 wells. Two of the wells shall be installed downgradient of the site and the other upgradient. Each well shall be sampled once for a total of three water samples.

d. Obtain six composite soil surface samples to a depth of 12 inches covering the area of overflow and along the surface drainage pathway.

e. Collect one surface water sample from any ponded water in the drainage pathways.

f. Analyze the soil samples for petroleum hydrocarbons, aromatic volatile organics and halogenated volatile organics.

g. Analyze water samples for petroleum hydrocarbons, aromatic and halogenated volatile organics.

4. Herbicide Burial Area (Site 8)

a. A maximum of four composite soil samples will be taken from areas of stressed vegetation. One water sample will be taken from the small pond which drains the site.

b. Analyze the soil samples for herbicides (EPA 8150), arsenic and mercury.

c. Analyze the water sample for pesticides (EPA 608, 509A, and 509B) arsenic, mercury, and TDS.

5. Oil Saturated Area (Site 9)

a. Perform 1 soil boring approximately 15 feet deep. Obtain a maximum of 3 split spoon soil samples for analysis based on OVA or HNU meter reading, discoloration, odor, or other indications of contamination. Collect a water sample from the borehole if water is encountered.

b. Collect a maximum of six composite surface soil samples from the area draining the oil saturated zone.

c. Collect a water sample from the surface water drainage pathway downgradient from the site.

d. Analyze the soil samples for petroleum hydrocarbons, lead and halogenated and aromatic volatile organics.

e. Analyze water samples for petroleum hydrocarbons, lead, TDS, and halogenated and aromatic volatile organics.

6. Hazardous Waste Drum Storage Area, Bldg 923 (Site 10)

a. Perform one soil boring inside the compound near the stained area approximately 15 feet deep. Obtain a maximum of 3 soil samples from the boring. Obtain a water sample from the borehole if water is encountered.

b. Collect six surface soil samples, one from the stained area, four downgradient, and one upgradient from the stained area.

c. Collect a maximum of two surface water samples from the surface drainage pathway, one upgradient and one downgradient from the stained area. The surface drainage pathway will only be sampled if water is present during fieldwork.

d. Analyze soil samples for petroleum hydrocarabons, EP toxicity (metals), and halogenated and aromatic volatile organics.

e. Analyze water samples for petroleum hydrocarbons, TDS, priority pollutant metals, barium, mercury and halogenated and aromatic volatile organics.

7. POL Storage Area (Site 12)

a. Hand auger three borings at locations selected in the field for a maximum of 30 feet of hand augering. Collect a maximum of 3 soil samples from each boring. Selection of samples will be based on indications of contamination detected in the field.

b. Install one downgradient well to an approximate depth of 20 feet. Collect one water sample from the well.

c. Collect two soil/sediment samples, one from each of the outfall drains from Bldg 953.

d. Collect three surface water samples, two from the stream draining the POL tank area and one from the drain outfall from Bldg 953.

e. Analyze the four water samples for petroleum hydrocarbons, TDS, and aromatic volatile organics.

f. Analyze soil samples for petroleum hydrocarbons and aromatic volatile organics.

I. Data Review

1. Tabulate field and analytical laboratory results, including field and laboratory parameters and QA/QC data, as they become available and incorporate them into the next monthly R&D Status Report (Sequence No.1, Item VI below) forwarded to the USAFOEHL. In addition to the results, report the following:

a. the time and dates of sample collection, extraction (if applicable) and analysis;

b. the method used and Method Detection Limits achieved;

c. the chain-of-custody forms;

d. a cross-reference of laboratory sample numbers and field sample numbers; and

e. a cross-reference of field sample numbers to wells, boreholes, sites, etc.

2. Upon completion of all analyses, tabulate and incorporate all results into an Informal Technical Information Report (Sequence No. 3, Item VI below) and forward the report to USAFOEHL for review a minimum of two weeks prior to submission of the draft report. Provide as a minimum the information specified in I.I.1 above.

3. Immediately report to the USAFOEHL Program Manager or his supervisor, via telephone, data/results generated during this investigation which indicate a potential health risk (for example, a contaminated drinking water aquifer). Follow the telephone notification with a written notice within three days; attach a copy of the laboratory raw data (e.g., chromatogram).

J. Reporting

1. Prepare a draft report delineating all findings of this field investigation and forward it to the USAFOEHL (as specified in Sequence No. 4, Item VI below) for Air Force review and comment. Strictly adhere to the USAFOEHL report format (mailed under separate cover). The format is an integral part of this delivery order. Draft reports are considered "drafts" only in the sense that they have not been reviewed and approved by Air Force officials. In all other respects, "drafts" must be complete, in the proper format, and free of grammatical and typographical errors. Include, as a minimum, discussion of the regional/site-specific hydrogeology, well and boring logs, data from water level surveys, groundwater surface and gradient maps, water quality and soil analysis results, available geohydrologic cross-sections, and laboratory and field QA/QC information. For states requiring the field work or technical effort be supervised by a state-registered geologist, engineering geologist or professional engineer, insert this information in the report to include registration numbers, certificates and seals (as appropriate).

2. Review the Results, Conclusions and Recommendations concerning the sites listed in this task which were investigated during a previous IRP Phase II staged work effort. Use this information and data from previous efforts to establish trends and develop conclusions and recommendations. Integrate all investigative work done at each site to date so the report reflects the total cumulative information for each site studied in this effort.

3. In the Results section, include water and soil analytical results and field quality control sample data. Report all internal laboratory quality control data (lab blanks, lab spikes and lab duplicates) and laboratory quality assurance information in an appendix of the report. Also provide second-column confirmation results and quantities, and include which columns were used, instrument operating conditions, and retention times. Summarize in the appendix the specific collection technique, analytical method (Standard Methods, EPA, etc.), holding time, and limit of detection for each analyte .

4. Make estimates of the magnitude, extent and direction which detected contaminants are moving. Identify potential environmental

consequences of the discovered contaminants based upon state or Federal standards.

5. Plot and map all field data collected for each site according to surveyed positions.

6. In the Recommendation section, address each site and list them by category:

a. Category I consists of sites where no further action (including remedial action) is required. Data for these sites are considered sufficient to rule out unacceptable public health or environmental hazards.

b. Category II sites are those requiring an additional Phase II effort to determine the direction, magnitude, rate of movement and extent of detected contaminants. Identify potential environmental consequences of discovered contamination.

c. Category III sites are those that will require remedial action (ready for IRP Phase IV). In the recommendations for Category III sites, include a discussion of any possible influence on sites in Categories I and/or II due to their connection with the same hydrological system. Clearly state any dependency between sites in different categories. Include a list of candidate remedial action alternatives, including long term monitoring (LTM) as remedial action, and the corresponding rationale that should be considered in selecting the remedial action for a given site. List all alternatives that could potentially bring the site into compliance with environmental standards. For contaminants that do not have standards, EPA-recommended safe levels for noncarcinogens (Health Advisory or Suggested-No-Adverse-Response Levels) and target levels for carcinogens (1×10^{-6} cancer risk level) may be used. Unless specifically requested, do not perform any cost analyses, or cost/benefit review for remedial action alternatives. However, in those situations where field survey data indicate immediate corrective action is necessary, present specific, detailed recommendations.

7. For each category above, summarize the results of field data, environmental or regulatory criteria, or other pertinent information supporting conclusions and recommendations. Reduce this summary information into a table (or tables) and insert it (them) into the text and the Executive Summary.

8. Provide cost estimates by line item for future efforts recommended for Category II sites and LTM Category III sites. Submit these estimates concurrently with the approved Final Report in a separate document. Only the cost requirements outlined in Sequence No. 2, Item VI, need be submitted.

a. For Category II sites, develop detailed site-specific estimates using prioritized costing format (i.e., cost of conducting the required work on: the highest priority site only; the first two highest priority sites only; the first three highest priority sites only; etc., until all required work is discretely costed) for the proposed work effort. The Air Force determines the priority of sites from contractor recommendations.

Consider the type of contaminants, their magnitude, the direction and rate of their migration, and their subsequent potential for environmental and health consequences when developing recommendations for site prioritization.

b. For Category III sites slated for long term monitoring, develop site specific estimates which detail the costs associated with: (1) permanent installation of monitoring wells; (2) ground water sampling interface equipment, including permanent installation of pumps and sampling lines; and (3) four quarterly (1 year period) sample collections and laboratory chemical analyses of groundwater, etc.

9. Provide an inventory of all on-base wells, to include production, irrigation, monitoring, etc. If the well has been abandoned, note the reason, and identify those wells which have been permanently plugged or sealed.

10. Reference in an appendix any local, state and/or Federal regulations which require specific well drilling techniques, materials, well development, purging, and sampling methods for work specified in this effort.

K. Meetings

The contractor's project leader shall attend three meeting(s) to take place at a time to be specified by the USAFOEHL. Each meeting shall take place at Richards-Gebaur AFB for a duration of one eight-hour day.

II. SITE LOCATION AND DATES:

Richards-Gebaur AFB MO
Date to be established

III. BASE SUPPORT:

A. The Base Point of Contact (POC) will receive from the contractor the split samples and then select 10% of them, package them, and then deliver them back to the contractor within 24 hours for subsequent overnight shipment to USAFOEHL/SA as stated in paragraph I.A.6.

B. Base personnel will assign the disposal points within the installation for all hazardous drill cuttings and contaminated groundwater. Assignment shall occur prior to drilling.

C. Base personnel will provide access to all sites. This may necessitate the clearance of small areas to permit set-up and operation of drilling rigs and equipment.

D. Base personnel will provide traffic control where/when necessary during geophysical surveys or well construction on or adjacent to road rights-of-way.

E. Base personnel will ensure rights of easement and any other required licenses are obtained across private properties so as to perform nondestructive geophysical explorations, the boring and construction of one or

more monitoring wells, and other investigations that may be required in performance of this investigation.

F. Base personnel will designate a staging area on base for the contractor's drilling equipment and supplies. An area will also be designated where the contractor can decontaminate his drilling equipment between wells.

IV. GOVERNMENT FURNISHED PROPERTY: None

V. GOVERNMENT POINTS OF CONTACT:

1. USAFOEHL Technical Program Manager
Capt PatrickN. Johnson
USAFOEHL/TSS
Brooks AFB TX 78235-5501
(512) 536-2158
AUTOVON 240-2158/2159
1-800-821-4528

2. Base Point of Contact (POC)
Ms Felipita B. Benson, R.N.
Occupational Health Nurse
442 Combat Support Group (AFRes)
Richards-Gebaur AFB MO 64030-5000
AUTOVON 463-2144
(816) 348-2144

3. MAJCOM Monitor
Lt Col Victor E. Hiatt
HQ AFRes/SGPB
Robins AFB GA 31098-6001
AUTOVON 468-6441
(912) 926-6441

4. Base Civil Engineer POC
Mr John Hurd
422 Combat Support Grup (AFRes)
Richards-Gebaur AFB MO 64030-5000
(816) 348-2076

VI. In addition to sequence numbers 1, 5 and 11 listed in Attachment 1 to the contract, which apply to all orders, the sequence numbers listed below are applicable to this order. Also shown are dates applicable to this order.

Sequence No.	Para No.	Block 10	Block 11	Block 12	Block 13	Block 14
19 (TOP)*	I.B.	OTIME	19SEP86	19SEP86		15
7 (Health & Safety)	I.C.	OTIME	19SEP86	19SEP86		3
3 (Prelim Data)	I.I.2	OTIME	**	**		3
4 (Tech. Rpt)	I.J.	ONE/R	4MAR87	18MAR87	16SEP87	***
2 (cost data)	I.J.8.	OTIME	2SEP87	16SEP87		****
14		MONTHLY	12SEP86	12SEP86	*****	3
15		MONTHLY	12SEP86	12SEP86	*****	3

*The Technical Operations Plans (TOP) required for this stage is due within two weeks of the Notice to Proceed.

**Upon completion of the total analytical effort and before submission of the first draft report.

***Two draft reports (25 copies of each) and one final report (50 copies plus the original camera ready copy) are required. Incorporate Air Force comments into the second draft and final reports as specified by the USAFOEHL. Supply the USAFOEHL with an advance copy of the first draft, second draft, and final reports for acceptance prior to distribution. Distribute the remaining 24 copies of each draft report and 49 copies of the final report as specified by the USAFOEHL.

****Submit cost estimates (five copies) in a separately bound document with the Final Report only. Provide estimates for only those sites recommended for additional Phase II work (Category II) or Phase IV, long term monitoring, (Category III).

*****Submit monthly hereafter.

Table 1

Analytical Methods, Detection Limits, and Number of Samples

Parameter	Method	Detection Limit	No. of Samples	QA	Total Samples
Halogenated Volatile Organics	SW5030/SW8010	a	58 soil	6 soil	96 soil[d]
	EPA 601	a	29 water	4 water	50 water[e]
Aromatic Volatile Organics	SW5030/8020	a	69 soil	7 soil	114 soil[f]
	EPA 602	a	33 water	5 water	57 water[g]
Extractable Priority Pollutants (GC/MS)	EPA 625	a	17 water	3 water	20 water
Phenols	E604	a	17 water	3 water	30 water[h]
Petroleum hydrocarbons	EPA 418.1 modified for soils	1 mg/Kg	69 soil	7 soil	76 soil
	EPA 418.1	1 mg/L, water	33 water	6 water	39 water
Total Dissolved Solids (TDS)	EPA 160.1	10 mg/L, water	34 water	6 water	40 water
Priority Pollutant Metals (13 ea)	EPA 200.7	a	20 water	3 water	23 water
	EPA 245.1(Hg)	1.0 µg/L	20 water	3 water	23 water
	EPA 206.2(As)	1.0 µg/L	20 water	3 water	23 water
	EPA 270.2(Se)	2.0 µg/L	20 water	3 water	23 water
Arsenic	EPA 206.2	1.0 µg/L	1 water	0 water	1 water
	SW 3050/SW7060	0.1 mg/Kg	4 soil	1 soil	5 soil
Barium	EPA 200.7	a	3 water	2 water	5 water
Lead	EPA 239.2	a	2 water	1 water	1 water
	SW3050/7420	a	9 soil	1 soil	10 soil
Mercury	EPA 245.1	1.0 µg/L	4 water	1 water	5 water
	SW 7471	0.1 mg/Kg	4 soil	1 soil	5 soil

Common Anions	A429	a	17 water	3 water	20 water
Pesticides	EPA 608	a	1 water	1 water	3 water
	A 509A	a	1 water	1 water	3 water
	A 509B	a	1 water	1 water	3 water[i]
	SW8150	a	4 soil	1 soil	8 soil[j]
pH (field test)			34 water		34 water
Temperature (field test			34 water		34 water
Conductance (field test)			34 water		34 water
EP Toxicity (metals)	SW Manual	b	19 soil	2 soil	21 soil

[a]Detection limits specified by the EPA or Standard Method

[b]

Metal	mg/L of leaching solution
As	0.002
Ba	0.1
Cd	0.005
Cr	0.05
Pb	0.1
Hg	0.0002
Se	0.002
Ag	0.01

[c]Not used.

[d]Total of 96 includes second column confirmation for 50% of the samples (32).

[e]Total of 50 includes second column confirmation for 50% of the samples (17).

[f]Total of 114 includes second column confirmation for 50% of the samples (38).

[g]Total of 57 includes second column confirmation for 50% of the samples (19).

[h]Total of 30 includes second confirmation for 50% of the samples (10).

[i]Total of 3 includes second column confirmation of 50% of the samples (1).

[j]Total of 8 includes second column confirmation for 50% of the samples (3).

ATTACHMENT 1
SAMPLING AND ANALYTICAL REQUIREMENTS

WATER

SITE	Halogenated Volatile Organics	Aromatic Volatile Organics	Pesticides As, Hg	Extractable Priority Pollutants (GC/MS)	Petroleum Hydrocarbons	Total Dissolved Solids	Priority Pollutant Metals (13 ea)	Lead	Phenols	Common Anions	Ba	Hg	pH	Temperature	Conductance
Site 1	5	5		5	5	5	5		5	5			5	5	5
Site 2	12	12		12	12	12	12		12	12			12	12	12
Site 6	7	7			7	7							7	7	7
Site 8			1			1							1	1	1
Site 9	2	2			2	2		2					2	2	2
Site 10	3	3			3	3	3				3	3	3	3	3
Site 12		4			4	4							4	4	4
	29	33	1	17	33	34	20	2	17	17	3	3	34	34	34

ATTACHMENT 1
SAMPLING AND ANALYTICAL REQUIREMENTS

SOIL

SITE	Halogenated Volatile Organics	Aromatic Volatile Organics	Nonhalogenated Volatile Organics	Extractable Priority Pollutants (GC/MS)	Petroleum Hydrocarbons	Total Dissolved Solids	Priority Pollutant Metals (13 ea)	Lead	Herbicide, As, Hg	EP Toxicity (Metals)				
Site 1	7	7			7									
Site 2	18	18			18									
Site 6	15	15			15									
Site 8									4					
Site 9	9	9			9			9						
Site 10	9	9			9					9				
Site 12		11			11									
	58	69			69			9	4	9				