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NAS CORPUS CHRISTI
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GROUNDWATER SAMPLING REPORT FORMER LIQUID WASTE DISPOSAL AREA SITES 1 AND 3 NAS CORPUS CHRISTI TX

6/1/1992

ENSAFE

00047

NAVAL AIR STATION
CORPUS CHRISTI, TEXAS

GROUNDWATER SAMPLING REPORT

Prepared for:

SOUTHERN DIVISION

Prepared by:

EnSafe/Allen and Hoshall
5720 Summer Trees Drive, Suite 8
Memphis, Tennessee 38184-1315
(901)383-9115

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1.0 INTRODUCTION

EnSafe/Allen & Hoshall conducted groundwater sampling at the former Defense Property Disposal Office (DPDO) Landfill and former Corpus Christi Army Depot (CCAD) Liquid Waste Disposal Area (Sites 1 and 3) at NAS Corpus Christi from March 30 through April 8, 1992. The purpose of the sampling was to collect necessary background or baseline information to plan an investigation of the two former waste units. The objectives of the sampling event were as follows:

- To measure water levels and sample monitoring wells that had been installed by different consultants during three separate, unintegrated studies of the area.

- To analyze groundwater samples from the monitoring wells and determine the current condition of groundwater at the site.

- To evaluate the integrity and field dimensions of existing monitoring wells to determine which are suitable for use in future investigations.

- To assess onsite conditions with respect to accessibility and health and safety considerations.

The sampling results presented in this report will be an essential element in planning the Facility Investigation Work Plan.

2.0 BACKGROUND INFORMATION

2.1 Location

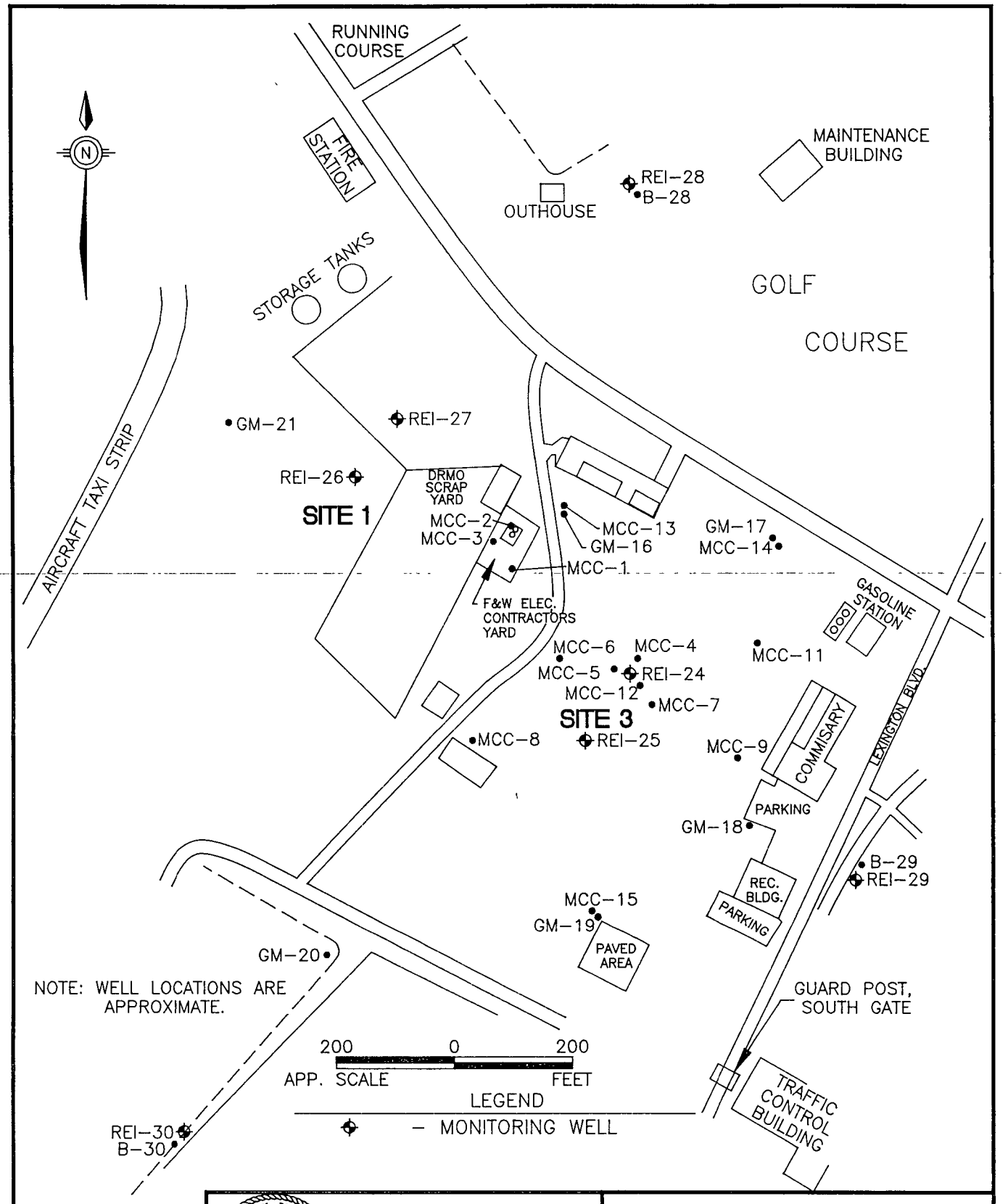
NAS Corpus Christi occupies 2,340 acres located 3 miles south of Corpus Christi, Texas, and is owned and operated by the United States Government (Figure 1). The town of Flour Bluff, Texas, is located adjacent to the southern perimeter of the Naval Air Station. The NAS occupies the northern limit of the Encinal Peninsula, a feature surrounded on three sides by water: Corpus Christi Bay, Cayo del Oso Bay, and Laguna Madre.

The former waste units of this study are located approximately 1000 to 2500 feet northwest of the south gate of the NAS (Figure 1). Locations of groundwater monitoring wells associated with these two units are shown in Figure 2.

2.2 History of the Waste Units and Investigations

The Site 1 DPDO Landfill was reportedly the disposal area for liquid wastes generated by overhaul operations at the CCAD and handled through the Defense Property Disposal Office (DPDO). Wastes were disposed of in the landfill from approximately 1949 to the early 1960s. Liquid wastes including organic solvents, acids, paint remover and thinner, and plating wastes were emptied from bowsers directly into four or five excavated seepage pits. Solid wastes were also disposed of in the landfill.

The Site 3 CCAD Waste Disposal Area was reportedly the major disposal area for liquid wastes generated by the CCAD from approximately 1960 to 1972. Liquid wastes including those mentioned for Site 1 were similarly emptied from bowsers directly into excavated seepage pits.



GROUNDWATER SAMPLING REPORT
CORPUS CHRISTI, TEXAS

FIGURE 2
SITES 1 AND 3
MONITORING WELL LOCATIONS
CORPUS CHRISTI N.A.S.

DATE: 06/17/92 | DWG NAME: CORPUS1

Monitoring wells have been installed and sampled by three consultants during separate field events:

- Geraghty and Miller (GM), 1985
- Resource Engineering, Inc. (REI), 1986
- Fugro-McClellan (MCC), 1988

The GM and REI studies involved the characterization of several sites. Volatile organics and base/neutral organics were found at elevated levels in groundwater samples from Sites 1 and 3. In addition, REI discovered a floating hydrocarbon layer in well REI-24 at the center of Site 3 which varied between 6 and 30 inches throughout the study. A sample of this hydrocarbon layer, sampled by the Texas Water Commission (TWC), yielded some PCB contamination.

The MCC study explored the feasibility of recovering the hydrocarbon layer under Site 3. In addition to the monitoring wells, a 12-inch diameter recovery well was installed. Sampling and analysis over a two-year period revealed elevated levels of volatile organics, chromium and lead. Low level detections of acid and base/neutral extractables and pesticides were also reported. Oil bailing recovery operations reportedly reduced the floating hydrocarbon layer to 0.04 ft. by December 1990.

3.0 INTEGRITY OF WELLS

During the present sampling event, the integrity of the 27 wells at Sites 1 and 3 were evaluated. All wells were locked and access into the wells was hampered by the multitude of various locks used and the consequent number of keys needed. Several locks were rusted closed due to the salty coastal environment and had to be opened with bolt cutters. Generally the surface seals, except for the GM wells, were concrete pads above ground which were often loose, undermined or broken. Most well bottoms were silty, and water purged from a submersible pump was often very muddy, becoming somewhat cleaner with successive volumes removed. Five wells had notably questionable integrity:

REI-28	Protector and cement pad bent. Cap hinge rusted, unable to close and lock (reported to Public Works)
GM-16	Thick decaying organic debris on water table.
MCC-13	Wells standing in a large seasonal pool of water.
GM-18	Well casing bent or broken, blocking access by bailer.
MCC-7	Cement seal pad broken to fragments, tilted.

4.0 PRESENT SAMPLING EVENT

The sampling conducted by EnSafe/Allen & Hoshall in March and April 1992 was carried out for screening purposes to determine present site conditions. The sampling was intended to coherently combine the previous site studies and establish a uniform baseline of groundwater information for all wells.

4.1 Water Level Measurement

Water levels were consecutively measured throughout Sites 1 and 3 on April 1, 1992. Vertical data were professionally surveyed by Shiner, Moseley and Associates. Figure 3 presents the subsequent groundwater table map produced from these data.

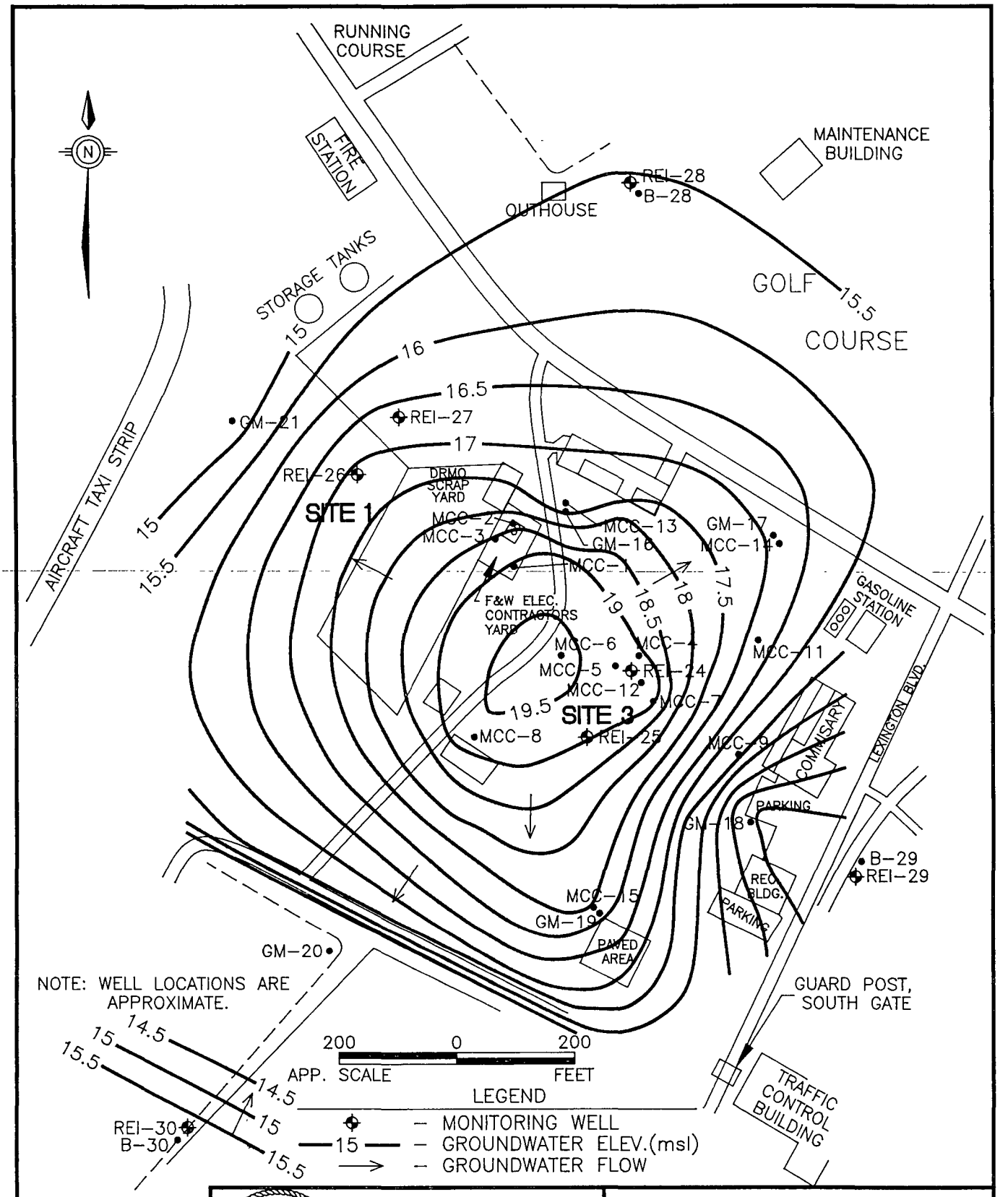
4.2 Sampling Scheme

Based upon a compilation of reported analytical results and upon the reported source and nature of the disposed wastes, four parameters were analyzed.

Sampling Parameters:

- volatile organic compounds (VOCs)
- base/neutral and acid extractables (BNAs)
- PCBs and pesticides
- total metals

Twenty-seven monitoring wells and one recovery sump were observed in the field. Of these, 21 monitoring wells were sampled, five were rejected and one was impenetrable to a bailer. Wells GM-16, GM-19 and MCC-14 were rejected because they were adjacent to another well of similar water level and total depth, making their sampling redundant. Clustered wells MCC-5 and REI-24 were rejected because each contained a floating hydrocarbon layer whereas nearby wells did not, thus avoiding the likelihood of equipment contamination and hazardous waste


RUNNING COURSE
FIRE STATION
MAINTENANCE BUILDING
OUTHOUSE
REI-28
B-28
STORAGE TANKS
GOLF COURSE
AIRCRAFT TAXI STRIP
GM-21
REI-27
REI-26
DRMO SCRAP YARD
SITE 1
MCC-2
MCC-3
MCC-13
GM-16
GM-17
MCC-14
F&W ELEC. CONTRACTORS YARD
MCC-6
MCC-4
MCC-5
REI-24
MCC-12
MCC-7
SITE 3
MCC-8
REI-25
MCC-11
GASOLINE STATION
600
LEXINGTON BLVD.
COMMISARY
PARKING
GM-18
MCC-9
B-29
REI-29
REC. BLDG.
PARKING
MCC-15
GM-19
PAVED AREA
GM-20
GUARD POST, SOUTH GATE
TRAFFIC CONTROL BUILDING
NOTE: WELL LOCATIONS ARE APPROXIMATE.
REI-30
B-30
14.5
15
15.5
16
16.5
17
18
18.5
19
19.5
17.5
200 0 200
APP. SCALE FEET
LEGEND
MONITORING WELL
GROUNDWATER ELEV.(msl)
GROUNDWATER FLOW
GROUNDWATER SAMPLING REPORT
CORPUS CHRISTI, TEXAS
FIGURE 3
SITES 1 AND 3
GROUND WATER FLOW DIAGRAM
CORPUS CHRISTI N.A.S.
DATE: 06/17/92
DWG NAME: CORPUS1

generation without the loss of analytical data for the well cluster. Well GM-18 was blocked to bailer access beneath the ground surface.

4.3 Sampling Procedure

Water level and well-bottom measurements were taken with a Solinst water level indicator. Wells suspected of containing a floating hydrocarbon layer were checked first with the tip of the water level indicator. When a hydrocarbon phase was found, an exploratory transparent bailer was lowered into the phase surface and retrieved to visually measure hydrocarbon thickness.

Four-inch diameter monitoring wells (REI, MCC) were purged with a Grundfos Rediflow-4 submersible pump and garden hose tubing, operated by a gasoline-powered portable generator. Most of the two-inch diameter wells (GM) were purged with new factory-packaged PVC bailers and nylon string; REI-28 was purged with a bailer because the bent riser would not allow the submersible pump to be lowered down the well. Purged volumes were measured in 5-gallon graduated buckets. Water quality parameters, pH, conductivity and temperature of purge waters were measured with a Horibameter after each purged well volume. Purging continued until a minimum of three well volumes were extracted and the water quality parameters stabilized.

Qualitative observations were noted for any unusual conditions of purged groundwater including high turbidity or siltiness, discoloration, odor or any visible surface sheen.

After purging was complete, the pump, where used, was immediately pulled out and the well was allowed to recover. Sampling was done with a disposable Teflon bailer and nylon string. Samples were poured by bottom-check valve or from the bailer top into containers that were provided and pre-preserved by Ortek Environmental Laboratory.

Samples (in order):	Size	Containers	Preservatives
Volatile Orgaic Compounds (VOCs)	50 cc	vials	HCl
Base and Acid/Neutral Extrablies (BNAs)	1 liter	amber bottles	—
PCBs/Pesticides	1 liter	amber bottles	—
Total Metals (unfiltered)	1 liter	polyethylene cubes	HNO_3

Care was taken to avoid agitation during sample decanting. When turbulent flow occurred while decanting VOC samples, the sample was thrown out and a new pre-preserved vial was filled. Some groundwaters reacted with the HCl preservative producing CO_2 bubbles. Because HCl is required under CLP, these samples were unavoidably containerized with gas bubbles.

QA/QC samples included:

Two Field Duplicates

Two Matrix Spike/Matrix Spike Duplicates

Two Equipment Rinsates

Because sampling equipment was new and manufacturer-wrapped, the equipment rinsates were taken for the Grundfos purging pump. After decontamination, ultra-pure ASTM Type II grade water was poured over the pump and collected. Groundwater and QA/QC samples were immediately labeled and stored with ice in coolers containing trip blanks and temperature blanks.

Water level indicator, pump and hose, and purge buckets were cleaned between wells with an Alconox-water solution and then rinsed with distilled water. The Horibameter was decontaminated between wells with distilled water, and was calibrated each morning and night with a manufacturer-supplied calibration solution.

Purged well waters were dispensed into a 55-gallon drum dedicated for each well. The drum was then sealed, marked with a grease pencil to denote the associated well number and date of collection. Each drum was labeled with a hazardous materials sticker and stationed next to the associated well, pending laboratory analysis of the groundwater samples.

5.0 DATA

5.1 Groundwater Flow

Water levels from the measuring event on April 1, 1992, well-bottom measurement taken during sampling, and surveyed vertical elevations of monitoring wells are presented in Table 1. A water table contour/groundwater flow diagram is presented in Figure 3. The results indicated that mounding conditions exist in the Site 3 area. The groundwater mound is centered around MCC-6 with flow radiating outward, and travelling across the Site 1 area in a northwesterly direction. A groundwater trough exists in the area between GM-20 and REI-30 in the southwestern portion of the study area coincident with a wetland.

5.2 Qualitative Groundwater Observations

Pertinent field observations of groundwater quality are presented in Table 2. Virtually all purge waters were silty. Turbidity varied from moderate to high with inconsistent and irregular concentrations of suspended solids from well to well. Most groundwater samples had a slight gray or yellow discoloration.

Petroleum hydrocarbon odors were noted from purged waters of the following 10 monitoring wells:

REI-25	MCC-02	MCC-08
REI-27	MCC-03	MCC-09
MCC-05	MCC-11	MCC-07
MCC-15		

A floating hydrocarbon phase was observed in two wells: REI-24 and MCC-12. Visually determined thickness in retrieved bailers were 2 inches and 1/4 inch, respectively.

Table 1 Water Level 4/1/92			
Well No.	Water Level Depth (from casing)	Elevation Top of Casing (msl)	Water Level Elevation (msl)
GM-16	1.23 ft	20.07	18.84
GM-17	1.40	18.32	16.92
GM-18	4.90	18.20	13.30
GM-19	5.30	22.96	17.66
GM-20	5.32	19.53	14.21
GM-21	4.83	19.56	14.73
REI-24	— *	24.88	— *
REI-25	5.21	24.31	19.10
REI-26	4.22	21.49	17.27
REI-27	5.51	22.04	16.53
REI-28	4.60	20.14	15.54
REI-29	5.01	18.22	13.21
REI-30	5.82	21.71	15.89
MCC-01	— **	22.24	— **
MCC-02	— **	19.38	— **
MCC-03	— **	18.87	— **
MCC-04	5.40	24.15	18.75
MCC-05	5.91	25.09	19.18
MCC-06	3.59	23.30	19.71
MCC-07	4.91	24.16	19.25
MCC-08	4.39	23.85	19.46
MCC-09	5.41	21.17	15.76
MCC-11	— ***	20.67	— ***
MCC-12	— *	26.35	— *
MCC-13	4.83	21.70	16.87
MCC-14	3.32	20.25	16.93
MCC-15	6.51	24.21	17.70

Notes: * Hydrocarbon layer no measurement
** Inaccessible in locked fenced area
*** Inaccessible, rusted lock uncut

Table 2
Field Observation of Groundwater Quality

Well No.	Turbidity	Siltiness	Discoloration, etc.*	Hydrocarbon Odor, Sheen, Layer	Reaction with HCl
GM-17	moderate	silty	—	—	rxn
GM-20	moderate	silty	—	—	—
GM-21	moderate	silty	—	—	—
REI-24	NA	NA	NA	hydc. layer	NA
REI-25	moderate	silty	—	strong odor, sheen	rxn
REI-26	low	silty	brown, grit,suds	—	rxn
REI-27	moderate-low	silty	—	odor	rxn
REI-28	high	silty	—	—	—
REI-29	high	silty	—	—	—
REI-30	moderate	minor silt	clear	—	—
MCC-01	moderate	silty	red-brown	—	—
MCC-02	moderate	silty	—	slgt. odor	—
MCC-03	moderate	silty	—	slgt. odor	—
MCC-04	high	silty	—	—	rxn
MCC-05	high	silty	—	slgt. odor	—
MCC-06	moderate	silty	—	—	—
MCC-07	high	silty	gray, dirty	odor	—
MCC-08	moderate	silty	—	odor	—
MCC-09	high	silty	—	odor	—
MCC-11	moderate	silty	—	slgt. odor	—
MCC-12	NA	NA	NA	hydc. layer	NA
MCC-13	high	silty	—	—	—
MCC-15	high	silty	—	odor	—

Note: * Most groundwater samples were slightly tinted yellow or gray

Apparent calcium-hard waters caused slow effervescent reactions with HCl preservative in the VOA vials encountered in five wells:

GM-17	REI-25	MCC-04
REI-26	REI-27	

5.3 Analytical Data

CLP deliverables were received from Ortek on May 4, 1992. Tables 3 through 6 present the analytical results for volatile organics, base/neutral and acid extractable, PCBs/pesticides, and inorganics of the 21 monitoring well groundwater samples.

Volatile Organic Compounds

General low level VOC contamination was observed in two thirds of the samples (Table 3). The persistence of methylene chloride and acetone throughout the samples and trip blanks very strongly indicate that those compounds are laboratory relics. Assuming this, seven groundwater samples were non-detect for VOCs:

• REI-28	MCC-02
• REI-29	MCC-06
• REI-30	MCC-08
	MCC-13

General VOC contamination consists of carbon disulfide, benzene, toluene, chlorobenzene and ethylbenzene; with benzene and chlorobenzene as the most persistent and concentrated in samples from wells near the centers of Sites 1 and 3. Vinyl chloride; 1,2-dichloroethene, trichloroethene and chloroethane were each detected only once; the first three detects occurred in MCC-03 unassociated with the more commonly reported sitewide compounds.

Federal MCLs were exceeded for benzene in seven wells, and for vinyl chloride and trichloroethene in MCC-03.

Base/Neutral and Acid Extractables

General low level BNA contamination was observed in almost all of the samples (Table 4). The persistence of bis(2 ethylhexyl) phthalate throughout many of the samples, and the association of this compound with laboratory bottle cap septa, suggest that this compound is a contaminant from laboratory procedures. Assuming this, three groundwater samples were non-detect for BNAs:

- GM-21
- REI-30
- MCC-06

Of the 18 samples yielding BNAs, 10 contained identified target compounds including 1,4-Dichlorobenzene, 1,2-Dichlorobenzene, Naphthalene, 2-Methyl Naphthalene and Di-n-butylphthalate. All 18 contained tentatively identified compounds (TICs).

PCBs/Pesticides

PCBs and pesticides were non-detects for all but one sample. MCC-03 contained the PCB Arochlor 1254 at 0.94 ppb. This is the same sample which contained the unique volatile organics not found elsewhere in the sampling event. The detected Arochlor concentration exceeds the federal MCL for PCBs (Table 5).

Inorganics

The reported level of inorganics found in the samples is generally high. Specifically, very high aluminum and iron concentrations indicate an excessive presence of suspended solids or colloids. Total metals analyses on the unfiltered, acidified samples, in conjunction with the high field-reported turbidities, corroborate the conclusion that high solids content in groundwater resulted in the high concentrations (Table 6).

Table 3
Volatile Organic Compounds

Well No.	Vinyl Chloride	Chloroethane	Methylene Chloride	Acetone	Carbon Disulfide	1,2-Dichloroethene (total)	Trichloroethene	Benzene	Toluene	Chlorobenzene	Ethylbenzene
GM-17	— ppb	— ppb	4+ ppb	— ppb	7 ppb	— ppb	— ppb	20* ppb	59 ppb	— ppb	— ppb
GM-20	—	—	11+	—	—	—	—	—	8	—	—
GM-21	—	—	3+	—	9	—	—	—	5	—	—
REI-25••	—	—	5+	32+	—	—	—	82*	—	—	3
REI-26	—	—	10+	—	—	—	—	14*	—	410	—
REI-27	—	6	4+	—	16	—	—	12*	—	360	—
REI-28	—	—	6+	9+	—	—	—	—	—	—	—
REI-29	—	—	13+	—	—	—	—	—	—	—	—
REI-30	—	—	15+	—	—	—	—	—	—	—	—
MCC-01	—	—	3+	9+	—	—	—	3	—	—	—
MCC-02	—	—	3+	—	—	—	—	—	—	—	—
MCC-03	27*	—	5+	—	—	50	97*	—	—	—	—
MCC-04	—	—	3+	27+	—	—	—	—	—	3	—
MCC-05••	—	—	4+	51+	—	—	—	13*	—	24	16
MCC-06	—	—	4+	—	—	—	—	—	—	—	—
MCC-07	—	—	2+	30+	—	—	—	8*	—	—	4
MCC-08	—	—	2+	—	—	—	—	—	—	—	—
MCC-09	—	—	3+	—	—	—	—	—	—	12	—
MCC-11••	—	—	3+	—	—	—	—	5	—	10	—
MCC-13	—	—	5+	16+	—	—	—	—	—	—	—
MCC-15	—	—	9+	—	—	—	—	39*	5	69	—
MCL						70/100	5	5	1000		700

Notes:
— undetected
\+ laboratory artifact
* exceeds MCL
•• tentatively identified compounds (TICs) also found.

Table 4
Base/Neutral and Acid Extractables

Well No.	1,4-Dichlorobenzene	1,2-Dichlorobenzene	Naphthalene	2-Methyl Naphthalene	bis (2 ethyhexyl) Phthalate	Di-n-butyl phthalate
GM-17••	6 ppb	2 ppb	6 ppb	— ppb	— ppb	— ppb
GM-20••	—	—	—	—	—	—
GM-21	—	—	—	—	—	—
REI-25••	—	—	360	70	—	—
REI-26••	17	7	2	—	170+	—
REI-27••	13	7	—	—	—	—
REI-28••	—	—	—	—	7+	—
REI-29••	—	—	—	—	—	—
REI-30	—	—	—	—	5+	—
MCC-01••	—	—	—	—	2+	—
MCC-02••	—	—	—	—	—	—
MCC-03••	—	—	—	—	—	—
MCC-04••	1	—	—	—	3+	—
MCC-05••	13	2	16	—	11+	—
MCC-06	—	—	—	—	—	—
MCC-07••	—	—	—	—	—	—
MCC-08••	—	—	—	—	3+	2
MCC-09••	8	—	3	—	—	—
MCC-11••	23	1	—	—	—	1
MCC-13••	—	—	—	—	—	—
MCC-15••	7	3	1	—	—	—
MCL	75	600	NA	NA	NA	NA

Notes: + laboratory artifact
— undetected
•• tentatively identified compounds (TICs) also found.

Federal MCLs were exceeded in seven samples for lead, two samples for antimony, and one for cadmium. Suggested MCLs were exceeded in 20 samples for aluminum, 20 samples for iron and 19 for manganese.

Table 5 PCBs and Pesticides	
Well No.	**Detected Compounds**
GM-17	—
GM-20	—
GM-21	—
REI-25	—
REI-26	—
REI-27	—
REI-28	—
REI-29	—
REI-30	—
MCC-01	—
MCC-02	—
MCC-03	Arochlor 1254, 0.94 ppb*
MCC-04	—
MCC-05	—
MCC-06	—
MCC-07	—
MCC-08	—
MCC-09	—
MCC-11	—
MCC-13	—
MCC-15	—

Notes: * exceeds MCL of 0.5 ppb
— no compounds detected

Table 6
Inorganics

Well No.	Aluminum	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Zinc
GM-17	1180* ppb	— ppb	— ppb	883 ppb	— ppb	— ppb	32.4 ppb	10500*ppb	— ppb	220* ppb	— ppb	11.6 ppb	71.5 ppb
GM-20	6950*	—	3.6	56.5	—	6.6	25.4	5970*	2.4	236*	—	—	49.8
GM-21	14800*	16.5*	1.3	140	—	11.5	29.0	9390*	5.8	248*	—	9.5	78.5
REI-25	1020*	—	13.0	361	—	21.5	5.7	24100*	34.9*	413*	—	10.7	215
REI-26	199*	—	2.4	565	—	27.4	38.2	7490*	1.2	849*	—	10.7	59.3
REI-27	389*	—	—	1210	—	25.6	19.8	2970*	2.9	654*	—	—	62.8
REI-28	709*	—	6.7	94.8	—	—	2.1	9980*	1.2	130*	—	—	20.1
REI-29	857*	—	25.1	220	—	—	28.4	25300*	—	85.2*	—	—	50.1
REI-30	31	—	—	—	—	—	—	281	—	1.5	—	—	10.5
MCC-01	664*	—	—	111	—	80.4	26.8	2610*	—	606*	—	57.3	49.4
MCC-02	2760*	—	7.5	47.9	—	5.7	28.8	3440*	14.1	36.2	—	8.8	74.2
MCC-03	10500*	—	6.4	118	—	8.5	35.0	7520*	38.4*	76*	—	13.7	68.5
MCC-04	560*	15.1*	—	714	7.4*	11.1	60.0	47200*	20.6*	5960*	0.34	27.5	39.5
MCC-05	325*	—	9.2	266	*	28.2	7.8	27200*	59.2*	1520*	—	17.4	37.6
MCC-06	5980*	—	10.3	423	—	9.4	34.6	39700*	22.7*	401*	—	—	82.4
MCC-07	3370*	—	3.2	193	—	8.0	34.6	7790*	22.9*	343*	—	9.8	56.9
MCC-08	6340*	—	4.8	106	2.2	51.2	5.9	11300*	27.6*	160*	—	—	198
MCC-09	7220*	—	—	212	—	7.8	26.2	24400*	10.2	160*	—	—	62.5
MCC-11	1350*	—	—	185	—	6.8	18.2	21400*	—	926*	—	—	44.8
MCC-13	5180*	—	7.8	334	—	6.4	24.2	17300*	10.5	238*	—	—	94.1
MCC-15	6750*	—	3.2	202	—	6.8	22.8	6170*	6.3	446*	—	—	66.0
Detection Limit		13.0	1.0	6.0	2.0	5.0	2.0		1.0		0.20	8.0	
MCL (maximum concentration level)	50 **	10	50	2000	5	100	1300 ***	300 **	15	50 **	2	100	5000 **

Notes: * exceeds MCL
— undetected
** suggested MCL
*** MCL goal

5.4 Quality Assurance/Quality Control

Laboratory Procedure

The groundwater samples collected, along with the QC samples (i.e. trip blanks, duplicates, equipment rinsate blanks), were analyzed by Ortek Environmental Laboratory in Green Bay, Wisconsin, in accordance with:

- *USEPA Contract Laboratory Program, Statement of Work for Organics Analysis (OLM01. January 1991)*
- *USEPA Contract Laboratory Program, Statement of Work for Inorganics Analysis (ILM01. July, 1988),*

- Naval Energy and Environmental Support Activity, (NEESA) *Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program, (NEESA 20.2-047B)*

Laboratory procedures for data review, reduction and reporting were conducted in accordance with the standard operating procedures as dictated by the requirements of NEESA 20.2 - 047B; Chapter 7 — Analytical Methods and Chapter 8 — Maintaining Laboratory Approval. The specific procedures for data review, reduction and reportables are those outlined under NEESA Level C QC.

As part of the analytical data deliverables package for NAS Corpus Christi, Ortek Environmental Laboratory provided a case narrative summary of QC issues encountered in the laboratory.

Data Quality and Validation

The field and analytical data were reviewed and validated by the E/A&H project QA/QC chemist The process of data validation was independent of the analytical laboratory, and was conducted by applying guidelines presented in the *EPA Laboratory Data Validation Functional Guidelines for Evaluating Organic and Inorganic Analysis* and by applying EPA precision and accuracy

statements for the analytical methods employed. In reviewing and validating the data acquired by this sampling event, E/A&H determined that the analytical data was acceptable for use in determining baseline conditions at Sites 1 and 3 of NAS Corpus Christi.

All collected samples were analyzed within the CLP specified technical holding times. Analytical performances and criteria were found in the validation process to be acceptable. In evaluating the matrix spike/matrix spike duplicate sample results and the initial/continuing calibration verification data, some poor responses were exhibited. However, only a small number of cases existed and the proper corrective action and/or qualification of the analytical data were applied, where necessary.

The pesticide/PCB analyses encountered erratic QC problems in the decachlorobiphenyl (DBC) surrogate recoveries. The difficulty, according to Ortek, was from the manufacturer of the DBC surrogate but a new batch of DBC has been acquired since. Another QC issue was found in the florisil cartridge check which indicated a complete breakdown of endrin and dieldrin. However, Ortek's QA manager assures the florisil cartridges were replaced to pass QC criteria.

Inorganic data analyses were achieved within the CLP Statement of Work criteria. QC problems encountered were mainly in the pre-digestion and post-digestion spike recoveries and the pre-digestion duplicate analyses. Analytes involved were evaluated and qualification was handled accordingly and appropriately.

In summation, laboratory flaws were identified and corrected where possible, and proper qualification of the analytical data was applied. Overall data quality objectives were found to be within compliance of NEESA Level C QC and hence analytical data was deemed valid and acceptable for assessment purposes.

Assessment of Field Procedure

All field work was supervised and/or conducted by E/A&H personnel to ensure proper procedures were followed. Field records are kept as accountable documents and are properly maintained and retained as part of the project files at the E/A&H office at Memphis, Tennessee.

Analytical results of the equipment rinsates indicate that thorough decontamination of the Grundfos submersible pump and hose was not achieved. This may be due to the construction materials of the pump and hose, or areas inaccessible to cleaning beneath clamps and fittings or inside the pump intake. High aluminum concentrations and organics relative to the previously sampled wells suggest that surfaces on or inside the purging equipment may preferentially capture and retain contaminants.

In considering the likelihood of cross contamination by the pump, it must be indicated that the cleaned pump, once lowered into a well, removed three to four well volumes, generally around 25 to 30 gallons, prior to sampling. Initial remnant contamination would have been flushed out from on and inside the pump. Due to the high purging flow rate, any initial escaping contamination into the surrounding water would have evacuated very quickly rather than mix with subsequent well volumes. Finally, the pump was used solely as a purging device while sampling was accomplished with Teflon bailers.

6.0 DISCUSSION

The groundwater flow diagram (Figure 3) indicates that mounding conditions exist in the Site 3 area. The groundwater mound is centered around MCC-6 with flow radiating outward across the Site 1 area in a northwesterly direction. A groundwater trough exists in the area between GM-20 and REI-30 in southwestern portion of the study area. The cause of these conditions is unknown at this time.

Interpretation of the field data indicates a widespread petroleum hydrocarbon odor within and between Sites 1 and 3. A persistent floating hydrocarbons phase remains beneath the center of Site 3, although apparently limited in extent and thickness. An observed 2 inches of hydrocarbon in REI-24 and a quarter of an inch in MCC-12 is a reduction from the condition prior to reported remediation efforts when several feet of hydrocarbon were reported in REI-24.

Analytical data indicate widespread low-level VOC and BNA contamination throughout Sites 1 and 3. VOC compounds are somewhat concentrated toward site centers and, with the exception of GM-21, drop to below detection in outlying wells. Targeted BNA compounds are less persistent or trend-like although the highest-level contamination was observed in centrally located REI-25, with 360 ppb naphthalene and 70 ppb 20-methyl naphthalene. BNA TICs, however, are very widespread and are reported in almost all outlying wells.

Compound-specific VOC and BNA contamination is heterogeneous. One unique contamination "fingerprint" is from MCC-03 which contains the only detected concentrations of vinyl chloride, 1,2-dichloroethene and trichloroethene and none of the other more generally distributed compounds. MCC-03 also yielded the only reported detection or PCBs, namely Arochlor 1254.

Inorganic analytical results are seemingly random. Very high aluminum and iron concentrations suggest that the results are dominated by variations in the excessive siltiness and suspended solid content between water samples. These materials, upon acidifications, would have released

considerable concentrations of inorganics into solution, overshadowing any representation of contaminant distribution.

On a scale of individual wells, site conditions appear to be very heterogeneous. Whereas the center of Site 3 yields some of the highest contaminant concentrations, MCC-04, located within the central well cluster, yields low-level concentration. The floating hydrocarbon phase observed in REI-24 and MCC-12 was not found in other adjacent wells. The effervescent reaction with HCl in some samples, reflecting general groundwater chemistry, was neither consistent sitewide nor consistent within areas of the sites. These data and observations would seem to indicate very heterogeneous subsurface conditions with respect to sediment or fill type, permeability, or prior waste disposal.

Problems encountered in this sampling event were due to site conditions and monitor well conditions. Those which need to be addressed are described below:

- Effervescence of some samples with required HCl preservative may have reduced VOC concentrations.
- Unfiltered, acidified, total metal samples may yield abnormally high concentrations that are difficult to interpret due to the exceptionally high silt and suspended solid component which existing wells produce.
- The Grundfos Rediflow-4 submersible pump was difficult to decontaminate. High uncontrollable pumping rates may draw in excessive silts and suspended solids, and may cause cascading from upper formation seepage.
- Monitoring wells have been either incorrectly constructed with regard to formation grain size, or have not been developed, allowing excessive silt and suspended solids into the wells.
- Some wells are damaged with failed or broken surface seals, bent or broken casing, and uncloseable protector caps.