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Final
Study Area Screening Evaluation Report For Calf Pasture Point Munitions Bunkers

Naval Construction Battalion Center
Davisville, Rhode Island

Northern Division
Naval Facilities Engineering Command
Contract Number N62472-90-D-1298
Contract Task Order 127

September 1994

Halliburton NUS
CORPORATION

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FINAL
STUDY AREA SCREENING
EVALUATION REPORT
FOR
CALF PASTURE POINT MUNITIONS BUNKERS

NAVAL CONSTRUCTION BATTALION CENTER
DAVISVILLE, RHODE ISLAND

COMPREHENSIVE LONG-TERM
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1.0 INTRODUCTION

Halliburton NUS Corporation (HNUS) has prepared this report presenting the results of the Study Area Screening Evaluation (SASE) investigative activities that were performed by HNUS at the Naval Construction Battalion Center (NCBC) Calf Pasture Point located in Davisville, Rhode Island. This report was prepared at the request of the United States Navy under Contract Task Order (CTO) Number 127 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62472-90-D-1298.

The project objectives for the investigation of the Calf Pasture Point Munitions Bunkers were to assess whether releases of previously stored materials may have contaminated the interior of the bunkers, and to determine if the concrete bunker floors were cracked, thus providing a potential migration pathway for contaminants which may have been released in the bunkers. In addition, the presence of any wastes reportedly buried next to Bunker 60 was investigated. Site investigation activities included a geophysical survey, a review of the condition of the bunkers and bunker floor surfaces, and test pit excavation. Soil samples were collected from the test pits and surficial soils were sampled adjacent to the bunkers. Surface wipe samples were collected from inside surfaces of the bunkers.

This report includes: a description of the site; a discussion of the site's regulatory and operational history; a characterization of the wastes potentially present at the site; descriptions of potential contaminant migration pathways at the site, including groundwater, surface water, soil, and air pathways; evaluation of analytical data relevant to each contaminant migration pathway at the site; and an investigation summary and conclusions section.

2.0 SITE DESCRIPTION AND PREVIOUS INVESTIGATIONS

This section presents a summary of the site description and history which was originally presented in the Study Area Screening Evaluation Work Plan (TRC, 1993a). The Munitions Bunkers at Calf Pasture Point are located in the northeastern corner of the Main Center of NCBC-Davisville. The Calf Pasture Point area is inactive and the bunkers are vacant. Reportedly, cans and cardboard drums containing various bleach and decontamination compounds were disposed of and buried at this site between 1960 and 1974 (TRC, 1993a).

2.1 LOCATION

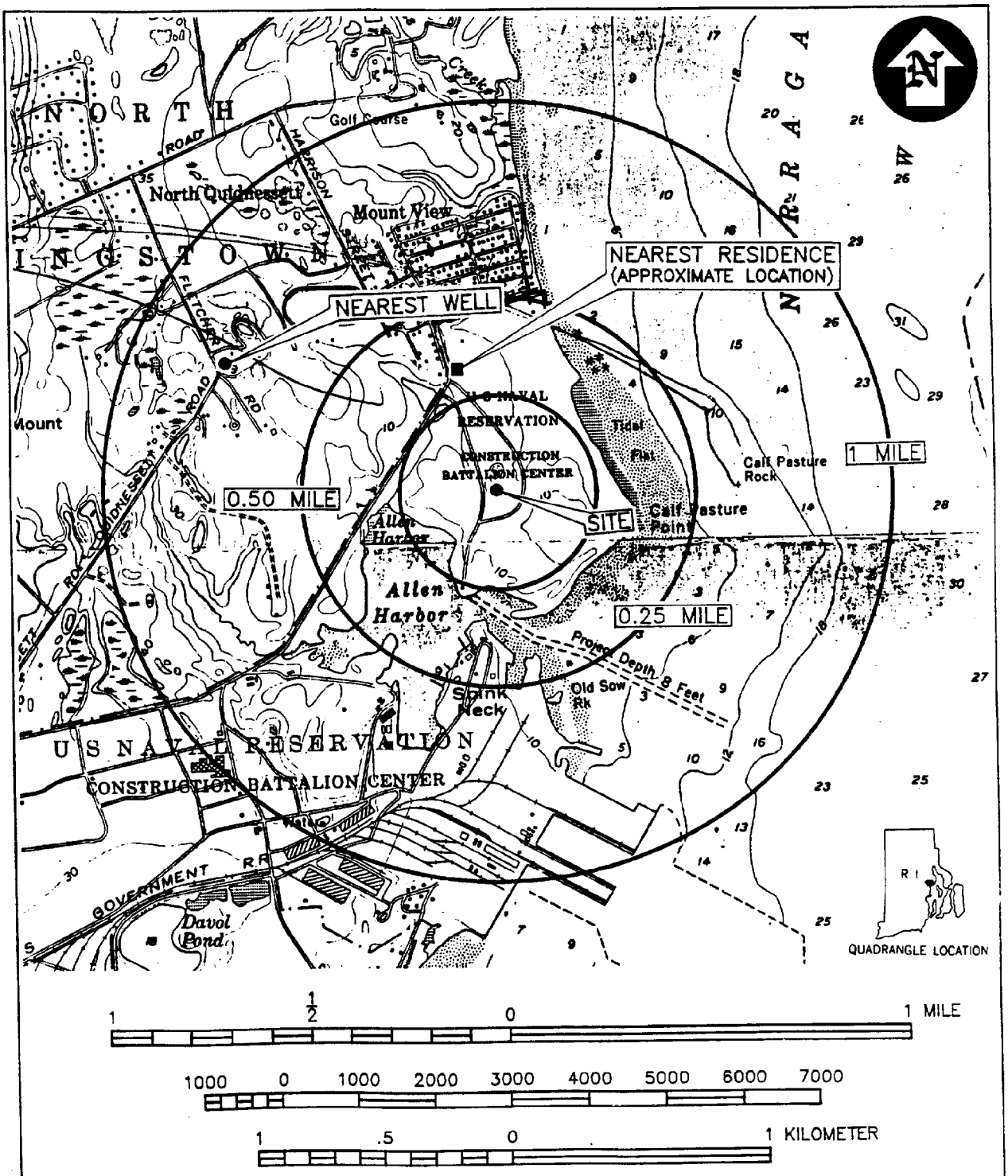
NCBC-Davisville is located in the northeastern part of the Town of North Kingstown, Rhode Island, approximately 18 miles south of Providence (Figure 2-1). NCBC-Davisville is composed of three areas including the Main Center, the West Davisville storage area, and Camp Fogarty, a training facility located approximately four miles west of the Main Center (Figure 2-2). Adjoining the NCBC-Davisville boundary on the south is the decommissioned Naval Air Station (NAS) Quonset Point that was declared excess to the Navy in April 1973. Calf Pasture Point is located on a peninsula in proximity to Narragansett Bay, in the Main Center portion of NCBC-Davisville. Residential property is located approximately 1,850 feet northwest of the Munitions Bunkers. Narragansett Bay is located due east of the bunker area, approximately 1,110 feet away at its closest point; Allen Harbor, an arm of Narragansett Bay, is located approximately 740 feet to the south of the bunker area (Figure 2-1).

2.1.1 Site Description

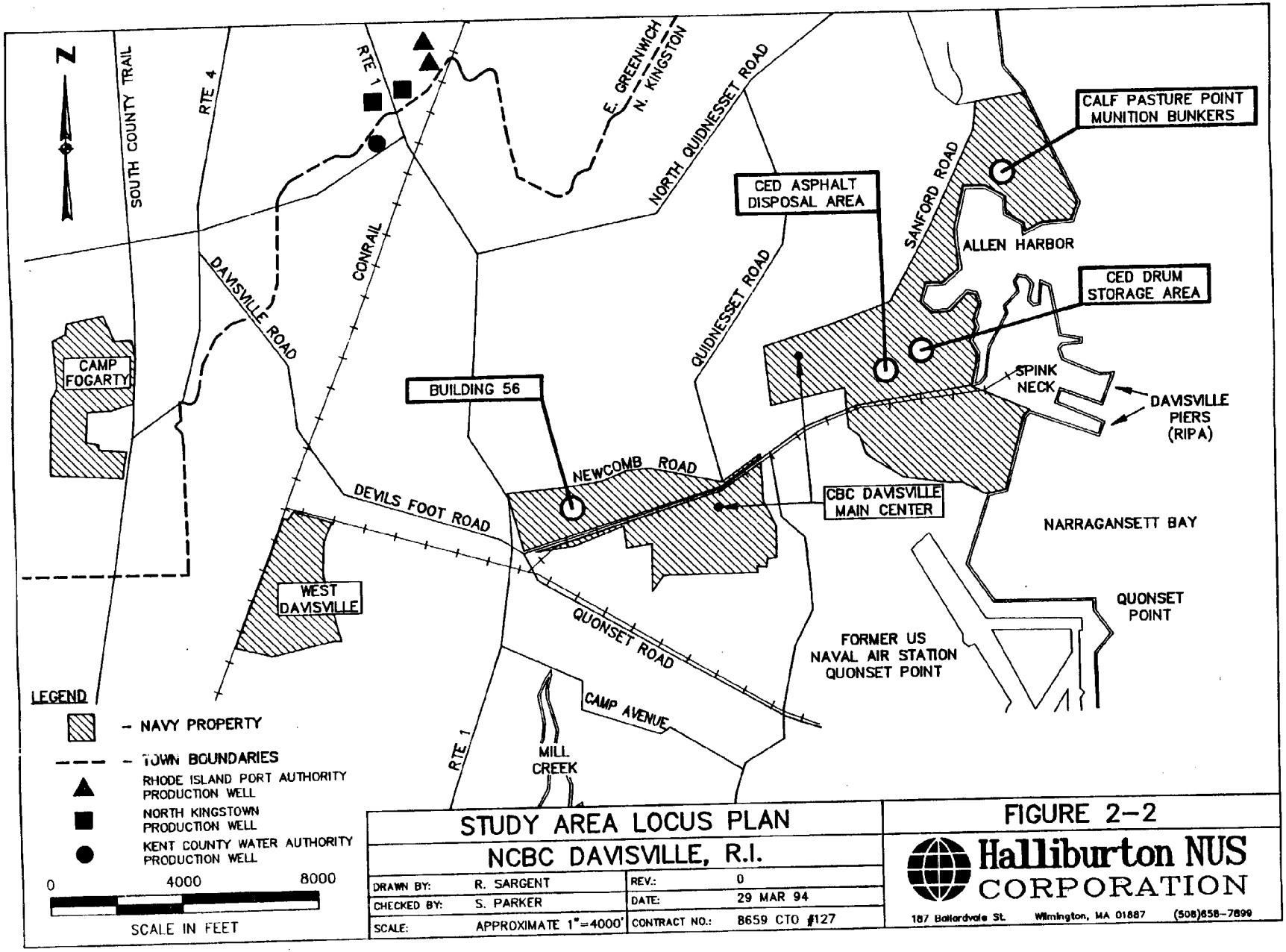
NCBC-Davisville was primarily used for training naval seamen in construction operations, and as storage and freight yards for construction materials. As a result, the site is comprised primarily of warehouse space and freight yards, most of which are currently empty. NCBC-Davisville closed on April 1, 1994. Most of the staff and materials have been moved offsite. Currently, facilities management and security staff engaged with base realignment remain on base.

Calf Pasture Point is the site of three munitions bunkers, and the site of several historical waste disposal events. The three munitions bunkers are located along Magazine Road, an unpaved, dirt roadway which leads from Sanford Road to Calf Pasture Point. The Point is a small peninsula bounded to the north and east by Narragansett Bay, and to the south by Allen Harbor. A site map of the munitions bunkers area is provided as Figure 2-3. The bunkers are located just north and west of the Calf Pasture Point Disposal Area which is currently being studied under a Remedial Investigation.

The three subject munitions bunkers, numbered 60, 339, and 59, are located on Magazine Road and are the only structures present at the site. The bunkers are located approximately 240 feet apart. "As built" drawings indicate the larger munitions bunkers (59 and 60) are 50.5 feet long, 22 feet wide, and 10.6 feet in height at the centerline. These structures are shaped like quonset huts and are constructed of 1/8-inch thick plate metal on concrete slabs. Each structure is covered by earth. An asphalt pad is present in front of Bunker 60 and concrete pavement is in front of Bunker 59. The "as built" drawings indicated Bunkers 59 and 60 were constructed in 1958; no information on the construction or size of Bunker 339 was available. During the June 1993 HNUS fieldwork, Bunker 339 was observed to be similar to the other bunkers in construction, and approximately 15 feet wide, 7 feet long and 7 feet in height. The floor of each of the three bunkers was visually evaluated for the presence of cracks and discoloration. This evaluation determined that the concrete floors were not cracked, however, several small, lightly-stained areas were noted.



LOCATION MAP				FIGURE 2–1
CALF PASTURE POINT MUNITIONS BUNKERS				Halliburton NUS CORPORATION
US NAVY – NCBC DAVISVILLE, RI				187 Ballardvale St. Wilmington, MA 01887 (508)658-7899
DRAWN BY:	R. SARGENT	REV.:	0	
CHECKED BY:	W. MARTIN	DATE:	27 OCT 93	
SCALE:	AS SHOWN	PROJECT NO.:	8659 CTO #127:	



STUDY AREA LOCUS PLAN

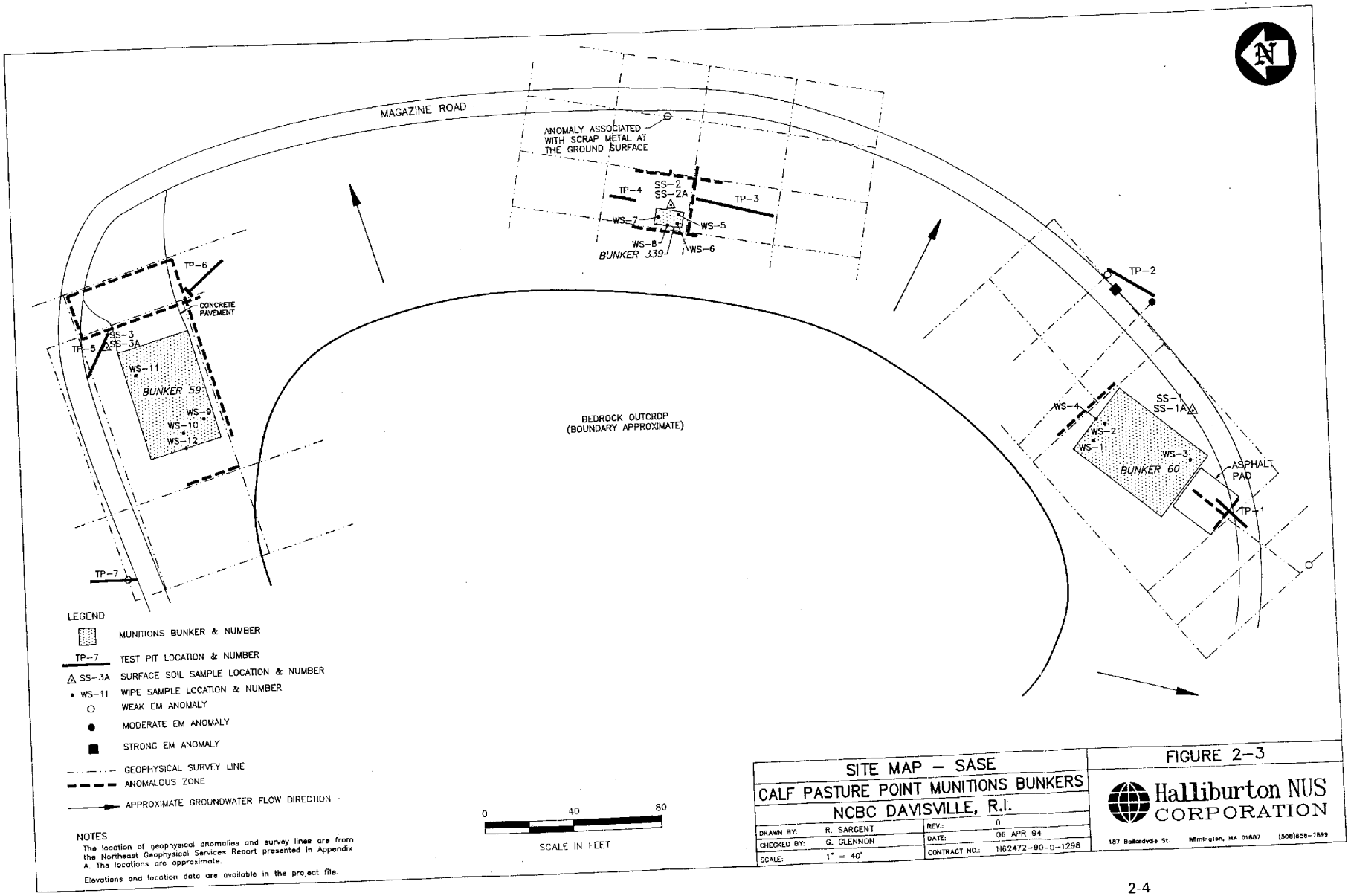
NCBC DAVISVILLE, R.I.

DRAWN BY:	R. SARGENT	REV.:	0
CHECKED BY:	S. PARKER	DATE:	29 MAR 94
SCALE:	APPROXIMATE 1"=4000'	CONTRACT NO.:	8659 CTO #127

FIGURE 2-2

Halliburton NUS CORPORATION

187 Ballardvale St. Wilmington, MA 01887 (508)658-7899


MAGAZINE ROAD
ANOMALY ASSOCIATED WITH SCRAP METAL AT THE GROUND SURFACE
TP-4
SS-2
SS-2A
TP-3
WS-7
WS-5
WS-8
WS-6
BUNKER 339
TP-6
CONCRETE PAVEMENT
SS-3
SS-3A
TP-5
WS-11
BUNKER 59
WS-9
WS-10
WS-12
TP-7
BEDROCK OUTCROP (BOUNDARY APPROXIMATE)
TP-2
WS-4
SS-1
SS-1A
WS-2
WS-1
WS-3
BUNKER 60
ASPHALT PAD
TP-1
LEGEND
MUNITIONS BUNKER & NUMBER
TP-7 TEST PIT LOCATION & NUMBER
SS-3A SURFACE SOIL SAMPLE LOCATION & NUMBER
WS-11 WIPE SAMPLE LOCATION & NUMBER
WEAK EM ANOMALY
MODERATE EM ANOMALY
STRONG EM ANOMALY
GEOPHYSICAL SURVEY LINE
ANOMALOUS ZONE
APPROXIMATE GROUNDWATER FLOW DIRECTION
0 40 80
SCALE IN FEET
NOTES
The location of geophysical anomalies and survey lines are from the Northeast Geophysical Services Report presented in Appendix A. The locations are approximate.
Elevations and location data are available in the project file.
SITE MAP - SASE
CALF PASTURE POINT MUNITIONS BUNKERS
NCBC DAVISVILLE, R.I.
DRAWN BY: R. SARGENT
CHECKED BY: G. GLENNON
SCALE: 1" = 40'
REV.: 0
DATE: 06 APR 94
CONTRACT NO.: N62472-90-D-1298
FIGURE 2-3
Halliburton NUS CORPORATION
187 Ballardvale St. Wilmington, MA 01887 (508)658-7899

The area surrounding the bunkers is vacant land overgrown with brushy vegetation and small trees. The topography is dominated by the presence of a north-south oriented oval-shaped bedrock outcrop in the central part of the site (Figure 2-3). This outcrop rises to an elevation of approximately 60 feet above mean high water, and approximately 40 feet above the surrounding terrain. Ground surface elevation in the immediate vicinity of the bunkers is approximately 20 feet above mean high water.

2.2 PREVIOUS INVESTIGATIONS

An investigation of NCBC-Davisville, Rhode Island was conducted as part of the Department of the Navy's Assessment and Control of Installation Pollutants (NACIP) program. The first phase of the NACIP program, the Initial Assessment Study (IAS), was completed by Fred C. Hart Associates, Inc. in September 1984. The munitions bunkers at Calf Pasture Point were not reviewed under the IAS.

The IAS conducted in 1984 identified sites with suspected contamination which could potentially pose a threat to human health or the environment. Fourteen potential sites were identified at NCBC-Davisville by the IAS. Thirteen of the fourteen sites were investigated by a Confirmation Study completed in 1987. Review of Confirmation Study results by the Navy and the Rhode Island Department of Environmental Management (RIDEM) provided a list of ten sites which required further evaluation (Remedial Investigation). Phase I RI investigations were completed at the ten sites in 1991. A Study Area Screening Evaluation (SASE) addressing four study areas was initiated in 1993. One of the four study areas is the Munitions Bunkers at Calf Pasture Point, which was added to the SASE by the Navy to address regulatory concerns over the bunkers' former contents (TRC, 1993a).

NCBC-Davisville was listed on the U.S. Environmental Protection Agency (EPA) National Priorities List (NPL) of abandoned or uncontrolled hazardous waste sites in November 1989. The NPL identifies those sites which pose a potential significant threat to the public health and environment. As noted above, ten sites at NCBC are currently being studied under Remedial Investigations (RI) being conducted by the Navy under the Department of Defense Installation Restoration (IR) Program. This program is similar to the U.S. EPA's Superfund Program authorized under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendment and Reauthorization Act of 1986 (SARA).

A Federal Facilities Interagency Agreement (FFA) was signed by the Navy, the State of Rhode Island, and the EPA on March 23, 1992. The FFA outlines response action requirements under the Department of Defense Installation Restoration Program at NCBC-Davisville. The FFA was developed, in part, to ensure that environmental impacts associated with past and present activities at NCBC are thoroughly investigated and remediated, as necessary. The ten sites currently being investigated under Remedial Investigations and three of the four areas being addressed by this SASE investigation are listed in the FFA. The Calf Pasture Point Munitions Bunkers are not included on this list.

2.2.1 Prior Land Use

This section summarizes the prior land use history presented in the Study Area Screening Evaluation Work Plan, (TRC, 1993a). Quonset Point-Davisville was the location of the first annual encampment of the Brigade Rhode Island Militia in 1893. During World War I, it was a site for the mobilization and training of troops, and later was the home of the Rhode Island National Guard. In the 1920s and 1930s it was a summer resort.

In 1939, Quonset Point-Davisville was acquired by the Navy, and construction began in the summer of 1940. The base received its name "Davisville" from the nearest railroad station, located at the westernmost perimeter of the installation. In July 1941 the base was operational. During construction, millions of cubic yards of sediment were dredged to create the ship basin and channel.

Wartime activities at NAS Quonset Point included training aircraft carrier pilots and crews, overhauling aircraft, supplying military equipment and planes, and providing coastal defense.

By 1942, the operations at NAS Quonset Point had outgrown the air station. The adjacent land (Davisville) was designated as the Advance Base Depot. Later that year the Naval Construction Training Center (NCTC), known as Camp Endicott, was established to train construction battalions. By November 1942, the camp was at full capacity, housing 15,350 military personnel. Over 100,000 people were trained at Camp Endicott by the end of World War II.

Davisville was inactive between World War II and the Korean Conflict. In 1951 Davisville became the headquarters for the Construction Battalion Center (CBC). The CBC loaded ships and trained military personnel for both the Korean and Vietnam Conflicts. In 1974, the NAS and Naval Air Rework Facility (NARF) at Quonset Point were decommissioned, and operations at NCBC-Davisville were reduced.

3.0 OPERATIONAL HISTORY AND WASTE CHARACTERISTICS

3.1 INITIAL ASSESSMENT STUDY

As a result of investigations conducted as part of the Initial Assessment Study (IAS), (Fred C. Hart Associates, Inc. 1984) and the Confirmation Study, (TRC, 1987) it was determined that three distinct waste disposal incidents were reported at Calf Pasture Point. These incidents involved disposal of 20 five-gallon cans of calcium hypochlorite, thirty to forty 35-gallon containers of an unidentified chloride compound and 2,500 five-gallon cans containing Decontaminating Agent Non-Corrosive (DANC) solution. DANC is a reactive, chlorinated compound. Table 3-1 presents a summary of site contaminants. The following is a summary of the historic disposal events:

- Between 1960 and 1974, approximately 20 five-gallon cans (100 gallons) of calcium hypochlorite were disposed of in a drainage ditch alongside of Bunker 60 at Calf Pasture Point. Between 1978 and 1982, metal cans containing calcium hypochlorite were removed from this site for offsite disposal. This is the only documented remedial activity known to have occurred at the site. Calcium hypochlorite $Ca(OCl)_2$ is a water-soluble solid which degrades rapidly in water. The commercial product usually contains 50% or more of $Ca(OCl)_2$. It could not be determined if all of the calcium hypochlorite disposed of in this area was removed, and the ultimate location of offsite disposal was not identified.

- In 1973, thirty to forty 35-gallon cardboard containers of an unidentified chloride compound were stored at Calf Pasture Point. This material reportedly originated from the utilities school, where it was used for water treatment purposes. These containers became very deteriorated over time and were reportedly buried at the site. Although the chloride compound was not identified, it may have been ferric chloride, a black-brown, corrosive solid which is readily soluble in water. It is expected that most chlorides would leach from the cardboard containers during the period of their burial at the site.

- At some time between 1968 and 1974, a pit measuring approximately 10 x 20 x 15 feet was filled with approximately 2,500 3-gallon cans which contained DANC solution. The cans were reportedly buried in this pit at an undetermined location at Calf Pasture Point. DANC consisted of two separate chemicals that were mixed to form the decontaminating solution: 1,3-dichloro-5,5-dimethyl-hydantoin, a crystal; and 1,1,2,2-tetrachloroethane (acetylene tetrachloride), a heavy colorless liquid. 1,3-dichloro-5,5-dimethyl-hydantoin and hydantoin products are oxidizing agents and readily break down to release chlorine when contacted by water.

Based on the potential for the discharge and migration of acetylene tetrachloride into Allen Harbor and Narragansett Bay, and the potential impact on the marine life and wetlands, the IAS recommended the Calf Pasture Point site for a Confirmation Study. Phase 1 of the Confirmation Study recommended that a magnetometry survey be conducted to identify buried metallic cans, and the excavation of any wastes which were located during this survey. Phase 2 of the Confirmation Study recommended a one-year period of quarterly groundwater sampling, and one soil sampling event (recommended testing parameter was acetylene tetrachloride, 1,1,2,2-tetrachloroethane).

TABLE 3-1
SUMMARY OF SITE CONTAMINANTS
CALF PASTURE POINT MUNITIONS BUNKERS
DAVISVILLE, RHODE ISLAND

SITE CONTAMINANT	ESTIMATED VOLUME	ACTIVITY	LOCATION
Calcium hypochlorite	100 gallons	Disposal	Bunker 60 (in or adjacent to)
Chloride (possibly ferric chloride)	1,400 gallons	Disposal	Unknown
Decontaminating Agent Non-Corrosive (DANC): 1,3-dichloro-5,5-dimethylhydantoin and 1,1,2,2-tetrachloroethane	7,500 gallons	Disposal	Unknown
High explosives	Unknown	Storage	Bunkers 59 and 60
Gun powder	Unknown	Storage	Bunker 339

References: Fred C. Hart Associates, Inc., (1984) and TRC, (1987).

3.2 CONFIRMATION STUDY

The Final Report, Verification Step Confirmation Study, (TRC, 1987) presents the following information. On March 20 and 21, 1985, a magnetometry survey was conducted at Calf Pasture Point. The survey was conducted along a surveyed grid system with a G-816 proton precession land magnetometer, and readings were recorded at 10-foot intervals. A total of seven anomalies were defined: three weak anomalies, and one strong anomaly, and three additional anomalies which were attributable to known nearby structures.

The confirmation study documents follow-up activities at the strongest anomaly, approximately 500 feet south of the Munitions Bunkers. The area was investigated using a shovel and hand auger. Several severely rusted cans, some containing an unidentified white solid substance, were unearthed "a few" inches below the surface. Two auger holes were advanced to approximately four feet deep without encountering any noticeable buried metal objects. Several other semi-buried containers, approximately three gallons in size, were found during a search of the area (200' radius). In addition, one 25-gallon container labeled NY M7616 was found (TRC,1987).

On March 27, 1985, two soil borings were drilled to depths of 18 feet and 14 feet, (approximately 13 and 9 feet below the water table, respectively), and monitoring wells were installed in each boring. The monitoring wells were located adjacent and downgradient to the located buried containers. The soil samples collected from these borings were screened with an LEL meter, with no positive readings. An OVA was used to conduct headspace screening for VOCs in soils, and indicated sustained readings between 10 ppm and 125 ppm. Two composite soil samples were collected from each boring (0-6 feet and 6-12 feet). All four soil samples were analyzed for acetylene tetrachloride. The two monitoring wells (MW7-1 and MW7-2) were sampled on April 4, 1985, eight days after installation. The field measurements of pH indicated that groundwater was slightly alkaline, probably due to the influence of sea water. The pH of sea water is approximately 8.3. The measurement of specific conductance indicated a moderate to poor water quality, also showing the influence of sea water.

The results of the soil and groundwater analyses which were performed in 1985 are summarized below. Both matrices were scanned for volatile organics. In one of the soil samples, no volatile organic compounds were detected; the other three samples each contained less than 1 mg/kg of acetylene tetrachloride and less than 1 mg/kg of total volatile organics. Benzene and one other unidentified compound were detected in measurable quantities. Acetylene tetrachloride was not detected in the groundwater samples; other unidentified volatile organics were detected at concentrations below 0.2 ppm.

After completing monitoring well installations, a conductivity survey was performed using an EM-31 instrument. The area of the large magnetometer anomaly was surveyed on a 25-foot grid pattern to define the areal extent of the disposal area. The survey did not define additional extent of the disposal area, but did confirm the high magnetometer anomaly and the uncovered drums and cans. Additionally, the area around the small magnetic anomaly 200 feet due east of the rock outcrop, towards the Narragansett Bay was also surveyed. The survey indicated a gradual rise in background conductivity which may have been indicative of a change in either the geologic or groundwater conditions. Using hand augers to examine the soils, it was determined that geologic conditions were similar in all three holes. Groundwater samples were collected from the auger holes and analyzed in the field for specific conductance, which progressively increased towards the north.

On March 18, 1986, a second sampling round was conducted in the same area. A 3-gallon can containing an unidentified white solid substance was unearthed approximately 3 inches below ground surface, and sampled. The sample was analyzed by Scanning Electron Microscopy with Energy Dispersive X-ray Spectroscopy. The results indicated that the material had a platycrystalline

morphology and was composed primarily of calcium. The sampling report stated that the material was most likely not calcium hypochlorite, as it had not exhibited a characteristic chlorine odor.

3.3 STUDY AREA SCREENING EVALUATION (SASE)

The SASE fieldwork activities were conducted by HNUS during June 1993 and February 1994 and are summarized below:

3.3.1 Geophysics Survey

On June 9 and 10, 1993, an electromagnetic survey was conducted at Calf Pasture Point Munitions Bunkers area using a Geonics EM-31 (EM-31). The survey was conducted by Northeast Geophysical Services under contract to HNUS. The objective of the survey was to aid in locating the metal cans of DANC solution reportedly buried onsite, and cans of calcium hypochlorite reportedly buried next to a bunker. The EM survey was also used to confirm the absence of any buried utilities in the selected test pit excavation areas. Three survey grids, one at each bunker, were established by HNUS personnel. Survey lines were spaced at 40 foot intervals (Figure 2-3). EM-31 measurements were taken at 5-foot intervals along each survey line. The survey lines were oriented roughly north-south and east-west at each grid. Profiles of each survey line of both inphase and quadrature measurements were examined for deflections indicative of metallic conductors. The anomalies were grouped into four categories: broad anomalous zones, and discrete strong, moderate, or weak EM anomalies, based on their relative amplitude or difference from the mode. Appendix A presents the Northeast Geophysical Services report.

The electromagnetic survey indicated the presence of anomalous zones next to each of the bunkers, and in the concrete pavement area at the entrance to Bunker 59. Upon analyzing field data, it was determined that these EM anomalies were caused either by corrugated metal in the bunker structures or by metal reinforcement bars that may be embedded in the concrete pavement. Two weak EM anomalies located near Bunker 60 and in front of Bunker 339 were determined to be caused by pieces of scrap metal at the ground surface.

No obvious surficial sources for four additional magnetic anomalies were located, and these four anomalies were selected for further investigation. Three of these anomalies were located in a group to the northeast of Bunker 60, along the east side of Magazine Road. The fourth weak anomaly was located in an area west of Bunker 59 along the north side of Magazine Road. Refer to Figure 2-3 and Table 3-2 for anomaly locations and a summary of the anomalies and follow-up investigations. Test pitting (TP-2 and TP-7) and soil sampling were also conducted at the locations of these anomalies. Four volatile compounds were detected at concentrations between 1 J μg/kg and 64 J μg/kg. These positive detections are discussed in Section 4.2.2.

Anomalies in the vicinity of the bunkers may be the result of spurious secondary electromagnetic fields generated by significant quantities of steel which forms the bunker roofs, or by overhead electrical wires located in a specific orientation to the primary electromagnetic field. Determining the source of these anomalies may require extensive, detailed surveys. No further work is planned at these locations.

It should be noted that the EM-31 unit is limited to an effective maximum exploration depth of approximately 18 feet. However, the site targets (large caches of drums and canisters, buried at shallow depths) would likely be detected at the selected line spacings.

3.3.2 Test Pit Excavations

On June 24 and 25, 1993, HNUS coordinated the excavation of seven test pits at the Calf Pasture Point Munitions Bunkers number 60, 339, and 59 (Figure 2-3). Test pits were excavated at electromagnetic anomalies found at each munitions bunker, to determine the presence of any buried wastes which reportedly were disposed of on the site. Locations for each test pit were chosen in the field, following a review of the electromagnetic survey results. Test pits were excavated to undisturbed soils, or to bedrock.

Two test pits were excavated at each bunker and one test pit was excavated at the weak anomaly location west of Bunker 59, along Magazine Road. Refer to Table 3-2 for test pit dimensions and overburden descriptions. A review of 1940s aerial photos indicates that Calf Pasture Point was formed, in part, by the placement of dredge materials. No attempt was made to identify the areas of dredge material placement. The upper layers of the test pits consisted of sandy gravel, resembling road subbase. The seven test pits were excavated to depths where the soils exhibited distinct bedding and cross-bedding features, which are indicative of undisturbed soils. Test pit # 3 was excavated to the groundwater table, encountered at 11 feet below ground surface, in order to document the depth to the water table at the site.

No buried wastes, discolored soils, or other signs of visual contamination were noted in any of the test pits. Additionally, there were no air monitoring readings detected above background levels using a photoionization detector (PID) during test pitting activities.

3.3.2.1 Test Pit Soil Sampling

Prior to backfilling, two soil samples were collected from each test pit, at selected locations and depths. The soil sample locations were selected to be representative of soils within the trench, and were spatially separated to provide areal coverage of soil samples submitted for analysis. Soil samples were not collected from test pit # 7, excavated at the Anomaly 10 location. The soil samples were analyzed for Target Compound List (TCL) organics and Target Analyte List (TAL) inorganic elements. Refer to Section 4.2.2 for a discussion of the analytical results.

3.3.3 Surficial Soil Sampling

On June 30, 1993, HNUS collected surficial soil samples in the vicinity of the munitions bunkers for analysis of total lead and TCLP lead. The soil samples were collected to assess surface soil for the potential presence of lead contamination from paint used on the bunkers. One surficial soil sample was collected outside and adjacent to each of the three bunkers. The samples were collected between the bunkers and road, in accordance with the work plan. The sample locations (SS-1, SS-2, and SS-3) are shown on Figure 2-3. On February 14, 1994, HNUS collected three composite soil samples (SS-1A, SS-2A, and SS-3A) from the same locations as the samples collected in June 1993. Each composite consisted of soil collected from five areas within a 1-foot radius of each corresponding June 1993 sample location. The TCLP analyses were performed in order to characterize the soil for disposal, in the event that high concentrations of total lead were detected. The results of the total lead analyses are presented and discussed in Sections 4.2.1, 6.2, and 7.2. The results of the TCLP lead analyses are presented and discussed in Section 4.2.1.

TABLE 3-2
CALF PASTURE POINT MUNITIONS BUNKERS
TEST PIT EXCAVATION DATA[1]

EM ANOMALY	FOLLOW-UP INVESTIGATION	TEST PIT DIMENSIONS (LENGTH X WIDTH X DEPTH)	OVERBURDEN DESCRIPTION	ANOMALY SOURCE
Anomalous Zone 1	Test Pit #1	18'8"x 3'9"x 3'4"	Black silty sand, fine to coarse sand, and a gray-white fine sand with trace of silt. Numerous boulders of various sizes and bedrock encountered at 3'4".	Possibly due to the boulders and the shallow bedrock surface encountered.
Anomalous Zone 2	Visual observation	N/A	N/A	Corrugated steel bunker.
Anomaly 3	Visual observation	N/A	N/A	Scrap metal on ground surface.
Anomaly 4, 5, & 6	Test Pit #2	17'10"x 3'9"x 4'	Silty sand, fine to coarse sand with gravel and cobbles up to 4". At 3'6" a 3" layer of shells was encountered.	Undetermined. Excavated to undisturbed soil.
Anomalous Zone 7	Test Pit #3	18'x 5'x 11'	Brown silty sand, with gravel up to 3-4". Dark brown/black peat-like material above water table. Water table encountered at 11'. Excavated a piece of guy wire with turnbuckle.	Possibly due to the 3 foot long piece of guy wire with turnbuckle. Excavated to undisturbed soil.
Anomaly 8	Visual observation	N/A	N/A	Scrap metal on ground surface.
N/A[1]	Test Pit #4	17'8"x 5'x 3'9"	No description logged.	Excavated to undisturbed soil.
Anomalous Zone 9	Test Pit #5	"T" shaped: Top of "T" 15'6"x 4'x 4' Perpendicular axis 14'x 3'2"x 4'6"	Brown silty sand, fine to medium sand, and a blue-gray silt. Encountered bedrock along the top of the "T" at 4 feet.	Corrugated steel bunker and the rebar suspected in the concrete. Excavated to undisturbed soil.
N/A[1]	Test Pit # 6	24'1"x 4'7"x 5'	Brown/tan silty sand, fine to medium sand, with trace of silt with fine gravel. Dark brown silty sand, fine to coarse sand.	Excavated to undisturbed soil.
Anomaly 10	Test Pit # 7	11'2"x 4'x 3'9"	Silty sand, silts and gravel layer near bottom of excavation.	Undetermined. Excavated to undisturbed soil.

(1) Refer to Figure 2-3 for location of test pits and anomalies.

3.3.4 Wipe Sampling

On June 30, 1993, HNUS collected four wipe samples from each of the three bunkers: one from the back inside wall and three from floor areas in each bunker. The purpose of the wipe sampling was to determine the impact on bunker inside surfaces of materials stored in the bunkers. Refer to Figure 2-3 for wipe sample locations. The wipe samples were analyzed for TCL semi-volatile and pesticide/PCB organic compounds and TAL inorganic analytes. The analytical results for these samples are presented and discussed in Section 6.2.

4.0 GROUNDWATER PATHWAY

4.1 GROUNDWATER PATHWAY DESCRIPTION

This section provides information concerning the characteristics of the groundwater pathway at the site.

4.1.1 Regional Bedrock Geology

NCBC-Davisville is located within the southern portion of the Narragansett Basin which is underlain primarily by the Rhode Island formation. The bedrock is folded and metamorphosed. Varying assemblages of quartz-mica-schist are mapped locally. Outcroppings are scattered in the vicinity of NCBC.

4.1.2 Regional Surficial Geology

Unconsolidated sediments in the NCBC-Davisville area are glacial in origin, eroded and transported during the most recent glacial advance filling the existing valleys (Shafer, 1961). Overburden deposits are comprised of glacial till and outwash, consisting of sand, silt, clay, and gravel.

The till is characteristically poorly sorted, dense, and variable in texture. Outwash deposits from glacial meltwaters are composed of sorted sands, silts, and gravels deposited in streams (glaciofluvial deposits) or lakes (glaciolacustrine deposits). These units are characteristically less dense and more permeable than till.

Post-glacial deposits, including shore, swamp, and marsh deposits, have also been identified in the NCBC-Davisville area. The shore deposits are derived from shoreline marine processes and are composed of sands and gravels. The swamp deposits occur in freshwater swamps and salt water marshes and generally consist of organic peat and inorganic silt and sand (Shafer, 1961). The NCBC-Davisville area has been extensively altered by construction activities and emplacement of artificial fill materials.

4.1.3 Site Geology

Surficial materials at Calf Pasture Point include shore deposits consisting of fine grained glaciolacustrine soils, sand, gravel, and artificial fill. Test pits excavated within Calf Pasture Point confirm published surficial geologic maps. Bedrock was encountered in the bottom of Test Pits #1 and #5 at approximately 3.3 feet and 4.0 feet, respectively.

Test pit data indicates that the unconsolidated materials at Calf Pasture Point are comprised of sand with varying amounts of silt and gravel, to depths of up to approximately 11 feet. A layer of shells was encountered in Test Pit #2 at 3.5 feet. Cobbles up to 4 inches were also observed in Test Pit #2. The test pits encountered both uniformly graded (fine-grained) and widely graded (fine- to medium- or fine- to coarse-grained) sands, and angular to rounded gravel. The soils encountered were layered with respect to both color and grain size.

4.1.4 Hydrogeology

Previous investigations (TRC, 1987) have indicated that groundwater movement is from the west highlands (zones of recharge) to the east low-lying areas (zones of discharge) (i.e., Allen Harbor and Narragansett Bay).

There are two potential sources of groundwater underlying the Coastal River basin: a lower, bedrock aquifer, and an upper unconsolidated aquifer. As previously reported, the bedrock beneath the NCBC-Davisville area consists of metamorphosed rock. This type of bedrock unit typically has a negligible amount of primary porosity and very limited secondary porosity (i.e., joints, fractures, bedding planes). Therefore, wells finished in the bedrock are not expected to yield large quantities of water (TRC, 1987).

Based on available geological and hydrogeological data, groundwater within Calf Pasture Point appears to flow radially from the outcrop area in the west central portion of the site, towards Allen Harbor and Narragansett Bay (TRC, 1987). The primary aquifer beneath the NCBC-Davisville area consists of glaciofluvial deposits and locally is the principle source of potable water. Wells with specific capacities between 5 and 300 gallons per minute per foot of drawdown have been reported (TRC, 1987). The saturated thickness of the unconsolidated aquifer may be minimal in the area at the time of test pit excavation. Any soluble wastes disposed of at the site can possibly migrate through both the unconsolidated and the bedrock aquifers.

The soils at this site are estimated to have a moderate to high hydraulic conductivity, based upon the characteristics of the soils encountered during test pitting.

Groundwater occurs at the site within approximately 11 feet of the ground surface (observed in Test Pit #3) and is expected to flow radially toward Allen Harbor and Narragansett Bay. This groundwater flow direction is supported by groundwater level measurements conducted at Calf Pasture Dump by TRC (1993b). Groundwater flow is also expected to be influenced by tidal fluctuations.

4.1.5 Water Supply Information

The bunkers at Calf Pasture Point are located in an area with a Rhode Island Department of Environmental Management (DEM) Class "GB" groundwater classification. "GB" classified groundwater is primarily located in highly urbanized areas or in the vicinity of disposal sites for solid waste, hazardous waste or sewage sludge, and may not be appropriate for human consumption without treatment, due to known or presumed deterioration.

No active groundwater supply wells exist at NCBC-Davisville on Navy property (TRC, 1993a). All potable water supplies within the NCBC-Davisville area are supplied by groundwater sources. The nearest public drinking water supply wells are located approximately 2.0 miles north of the NCBC-Davisville area and are operated by the Rhode Island Port Authority and Economic Corporation (RIPA EC) and by the Water Works Commission of North Kingstown.

Five additional public groundwater supply wells are located near the intersection of U.S. Route 1 (Boston Post Road) and Route 402. These wells are located approximately 3 miles west-northwest of the site in the Hunt River reservoir. Two of the wells are owned and managed by the Town of North Kingstown, two of the wells are owned and managed by the Rhode Island Port Authority, and one well is owned and managed by the Kent County Water Authority.

The closest known private well to Calf Pasture Point is located approximately 1.1 miles west-northwest of the site, at the intersection of Quidnessett Road and Fletcher Road. Refer to Figure 2-1 for the location of the well. Additional private wells are located to the west on Newcomb Road and Potter Road and further north on Fletcher Road.

Documented water supply wells are located in apparent upgradient locations from Calf Pasture Point. Therefore, it is unlikely that groundwater in the vicinity of the supply wells is impacted by site conditions.

4.2 GROUNDWATER PATHWAY DATA EVALUATION

This section provides an evaluation of the analytical data pertaining to contaminant migration from soils to groundwater, referred to as the groundwater pathway. The data evaluation tables in this and subsequent pathway data evaluation sections present only those analytes that were detected in at least one sample. The tables compare the maximum detected concentration of each analyte to the maximum background concentration (inorganic analytes only) and a risk-based Soil Screening Level (SSL). Frequency of detection is then only evaluated for those analytes with maximum detected concentrations which exceed the maximum background concentration (inorganic analytes only) and the SSL.

The source of maximum background concentrations in the data evaluation tables is the NCBC Draft Remedial Investigation Report presented by TRC Environmental Corporation (1993b). The background samples were collected by TRC from 7 unimpacted areas located as close to NCBC sites as possible. Identification of unimpacted areas was made on the basis of aerial photographs an evaluation of organic analytical data.

The groundwater pathway SSL is a chemical concentration in soil which represents a level of contamination above which there is a potential for migration of the specific compound to groundwater. A contaminant concentration exceeding the SSL may represent sufficient concern to warrant further site-specific study. Contaminant concentrations in soil which exceed the screening level would not necessarily designate a site as contaminated, nor trigger a response action. However, they may suggest that a further evaluation of potential risks posed by the site may be appropriate. Further evaluation of SSL exceedances include consideration of the frequency of detection and evaluation of the magnitude of the specific SSL exceedance.

The source of the SSLs presented in the data evaluation tables is the EPA Draft Soil Screening Level Guidance (September 1993). SSL values proposed by EPA are presented, when available. SSLs for analytes for which EPA has not proposed an SSL were calculated by applying a partitioning equation provided in the Draft SSL Guidance to the following groundwater standards, in order of precedence: non-zero Maximum Contaminant Level Goal (MCLG); Maximum Contaminant Level (MCL); and an aqueous concentration corresponding to a 10^{-6} risk for carcinogens or a hazard quotient of 1 for noncarcinogens. A dilution and attenuation factor (DAF) of 10, which the Draft Guidance suggests is generally appropriate, was then applied to the calculated SSL value. In certain cases where there was insufficient data to calculate an SSL for an analyte, data for a chemically similar analyte was used. The spreadsheet and source documents used to calculate the SSLs are presented in Appendix E. This spreadsheet indicates the source of each SSL used in the data evaluation tables.

The frequency of detection presented in the data evaluation tables was determined by dividing the total number of positive detections by the total number of sample locations. A positive detection in either or both samples in a duplicate pair (i.e., samples collected concurrently from the same location) were counted as one positive detection in one sample. June 1993 sample locations were considered to be distinct from February 1994 sample locations.

4.2.1 Surface Soil

Tables 4-1 and 4-2 present an evaluation of the analytical data for the surface soil samples collected from locations between Magazine Road and the three bunkers.

The maximum concentration of total lead detected in these samples was below the maximum background concentration. The maximum concentration of TCLP lead detected in these surface soil samples was below the TCLP regulatory level for lead.

4.2.2 Subsurface Soil

Tables 4-3 and 4-4 present an evaluation of the analytical data for the subsurface soil samples collected from 12 locations in 6 test pits.

Four volatile organic compounds were detected in soil samples collected from the test pits. Of these, methylene chloride was the only one which exceeded its respective groundwater SSL. Methylene chloride was detected in ten of the twelve soil samples, at concentrations ranging from 13 μg/kg to 53 J μg/kg. The SSL for methylene chloride is 7 μg/kg. There is no record of disposal of methylene chloride onsite.

Eleven inorganic analytes were detected at concentrations which exceeded the maximum background concentrations. Of these eleven analytes, four (calcium, iron, magnesium, and potassium) were not evaluated further because they are essential human nutrients. No groundwater SSL was available for aluminum. Aluminum was detected in 12 of 12 sample locations. Aluminum is a major constituent of mineral soils. The maximum detected concentrations of the remaining six analytes (barium, chromium, cobalt, manganese, mercury, and nickel) were all below the corresponding groundwater SSLs.

TABLE 4-1
GROUNDWATER PATHWAY DATA EVALUATION
TOTAL LEAD IN SURFACE SOIL SAMPLES FROM 6 LOCATIONS
CALF PASTURE POINT MUNITIONS BUNKERS
DAVISVILLE, RHODE ISLAND

ANALYTE	MAXIMUM DETECTED CONCENTRATION (mg/kg)	MAXIMUM BACKGROUND CONCENTRATION (mg/kg)	MAXIMUM DETECTED CONCENTRATION > MAXIMUM BACKGROUND?	SSL (mg/kg)	MAXIMUM DETECTED CONCENTRATION > SSL?	FREQUENCY OF DETECTION
Lead	38.7	53.8	No	NE	NE	NE

NE Not Evaluated.

TABLE 4-2
GROUNDWATER PATHWAY DATA EVALUATION
TCLP LEAD IN SURFACE SOIL SAMPLES FROM 6 LOCATIONS
CALF PASTURE POINT MUNITIONS BUNKERS
DAVISVILLE, RHODE ISLAND

ANALYTE	MAXIMUM DETECTED CONCENTRATION (mg/l)	REGULATORY LEVEL[1] (mg/l)	MAXIMUM DETECTED CONCENTRATION > REGULATORY LEVEL?	FREQUENCY OF DETECTION
TCLP Lead	0.047	5.0	No	NE

NE Not Evaluated.

(1) U.S. EPA Toxicity Characteristic Leaching Procedure (TCLP) Regulatory Level. Concentrations exceeding this value are subject to RCRA hazardous waste requirements (US EPA, 1990).

TABLE 4-3
GROUNDWATER PATHWAY DATA EVALUATION
ORGANIC COMPOUNDS IN SUBSURFACE SOIL SAMPLES
FROM 12 LOCATIONS IN 6 TEST PITS
CALF PASTURE POINT MUNITIONS BUNKERS
DAVISVILLE, RHODE ISLAND

COMPOUND	MAXIMUM DETECTED CONCENTRATION (μg/kg)	SSL (μg/kg)	MAXIMUM DETECTED CONCENTRATION > SSL?	FREQUENCY OF DETECTION
Acetone	64 J	1,020	No	NE
Methylene chloride	53 J	7.0	Yes	10/12
Xylene	1 J	57,000	No	NE
Toluene	2 J	3,600	No	NE

J Quantitation is approximate.
NE Not Evaluated.

TABLE 4-4
GROUNDWATER PATHWAY DATA EVALUATION
INORGANIC ANALYTES IN SUBSURFACE SOIL SAMPLES
FROM 12 LOCATIONS IN 6 TEST PITS
CALF PASTURE POINT MUNITIONS BUNKERS
DAVISVILLE, RHODE ISLAND

ANALYTE	MAXIMUM DETECTED CONCENTRATION (mg/kg)	MAXIMUM BACKGROUND CONCENTRATION (mg/kg)	MAXIMUM DETECTED CONCENTRATION > MAXIMUM BACKGROUND?	SSL (mg/kg)	MAXIMUM DETECTED CONCENTRATION > SSL?	FREQUENCY OF DETECTION
Aluminum	10,900	8,560	Yes	NA	NE	12/12
Arsenic	5.2	8.1	No	NE	NE	NE
Barium	33.1	15.5	Yes	543	No	NE
Beryllium	0.55	0.66	No	NE	NE	NE
Calcium	4,700	628	Yes	NE(1)	NE	NE
Chromium	14.5	9.6	Yes	2,210	No	NE
Cobalt	11.3	4.6	Yes	154	No	NE
Copper	13.0	15	No	NE	NE	NE
Iron	17,800	12,000	Yes	NE(1)	NE	NE
Lead	12.9 J	53.8	No	NE	NE	NE
Magnesium	3,890	1,220	Yes	NE(1)	NE	NE
Manganese	190	150	Yes	261	No	NE
Mercury	0.16	0.03	Yes	3.0	No	NE
Nickel	9.1	5	Yes	82.0	No	NE
Potassium	1,360	728	Yes	NE(1)	NE	NE
Vanadium	18.9	24.6	No	NE	NE	NE
Zinc	31.5	172	No	NE	NE	NE

J Quantitation is approximate.
NA Not Available.
NE Not Evaluated.

(1) Analyte is an essential human nutrient.

5.0 SURFACE WATER PATHWAY

5.1 SURFACE WATER PATHWAY DESCRIPTION

NCBC-Davisville is located within the Potowomut-Wickford drainage basin, which comprises approximately 60 square miles in the central-south portion of Rhode Island. Streams divide the basin into several sub-basins. Calf Pasture Point lies within the Coastal River basin which drains from the highlands to the west and discharges into Narragansett Bay. The site lies within the 100-year flood plain (Ecology and Environment, Inc., 1993).

The site slopes gradually towards Narragansett Bay. The soils are described as well-drained, and the vegetative cover consists of tall grasses, reeds, and small trees. Over 22.5 acres of wetlands have been mapped on Calf Pasture Point, including 3.5 acres bordering Narragansett Bay and 2.5 acres bordering Allen Harbor (Ecology and Environment, Inc., 1993). Fisheries are located in Narragansett Bay. Shellfishing was closed in Allen Harbor in approximately 1986 due to sediment contamination near the Allen Harbor landfill.

Annual precipitation in the area has ranged from 24.8 to 66.2 inches, with an average of 42.3 inches. The frequency of measurable precipitation events (0.01 inch or greater) averages once every three days and is evenly distributed throughout the year. The average snowfall is almost 40 inches and has varied from 11.3 to 75.6 inches (TRC, 1993a).

No year-round water bodies or water run-off channels were identified on the site during the SASE investigation. Surface runoff channels are poorly developed at the site because precipitation rapidly infiltrates into the relatively high-permeability soils and exits the site primarily through the groundwater pathway.

5.2 SURFACE WATER PATHWAY DATA EVALUATION

No surface water bodies were noted onsite during SASE field work. In accordance with the work plan, no surface water or sediment samples were collected during this investigation. Surface water exits the site primarily through the groundwater path, therefore, minimal risk is posed by the surface water pathway.

6.0 SOIL EXPOSURE PATHWAY

6.1 SOIL EXPOSURE PATHWAY DESCRIPTION

The evaluation of the soil exposure pathway data in the following section assumes a residential reuse scenario for the site.

6.2 SOIL EXPOSURE PATHWAY DATA EVALUATION

This section provides an evaluation of the analytical data pertaining to the soil exposure pathway. This pathway addresses a scenario which assumes long-term daily exposure via ingestion of soil (U.S. EPA, 1993). The data evaluation tables presented in this section were developed using the approach discussed in Section 4.2.
The soil exposure pathway SSL is a chemical concentration in soil that represents a level of contamination above which there may be sufficient concern to warrant further site-specific study. Contaminant concentrations in soil which exceed the screening level would not necessarily designate a site as contaminated, nor trigger a response action. However, they may suggest that a further evaluation of potential risks posed by the site may be appropriate. Further evaluation of SSL exceedances includes consideration of the frequency of detection and evaluation of the magnitude of the specific SSL exceedance.

The source of the SSLs presented in the data evaluation tables is the EPA Draft Soil Screening Level Guidance (September 1993). SSL values proposed by EPA are presented, when available. SSLs for analytes for which EPA has not proposed an SSL were calculated by applying an equation provided in the Draft SSL Guidance to the Oral Slope Factor for carcinogens, or Oral Reference Dose for noncarcinogens. In certain cases where there was insufficient data to calculate an SSL for an analyte, data for a chemically similar analyte was used. The spreadsheet and source documents used to calculate the SSLs are presented in Appendix E. This spreadsheet indicates the source of each SSL used in the data evaluation tables.

6.2.1 Surface Soil

Table 6-1 presents an evaluation of the analytical data for the surface soil samples collected from six locations between the three bunkers (#59, 60, 339) and Magazine Road in June 1993 and February 1994. Refer to Figure 2-3 for the specific sample locations.

The maximum concentration of total lead detected in the surface soil samples was below the maximum background concentration; therefore, no further evaluation of surface soils as a contaminant pathway is necessary.

6.2.2 Wipe Samples

Tables 6-2 and 6-3 present an evaluation of the analytical results from wipe sampling conducted in the bunkers in June 1993. The bunker doors are currently welded shut, however, this evaluation considers unrestricted access to the bunker interiors.

TABLE 6-1
SOIL EXPOSURE PATHWAY DATA EVALUATION
LEAD IN SURFACE SOIL SAMPLES FROM 6 LOCATIONS
CALF PASTURE POINT MUNITIONS BUNKERS
DAVISVILLE, RHODE ISLAND

ANALYTE	MAXIMUM DETECTED CONCENTRATION (mg/kg)	MAXIMUM BACKGROUND CONCENTRATION (mg/kg)	MAXIMUM DETECTED CONCENTRATION > MAXIMUM BACKGROUND?	SSL (mg/kg)	MAXIMUM CONCENTRATION > SSL?	FREQUENCY OF DETECTION
Lead	38.7	53.8	No	NE	NE	NE

NE Not Evaluated.

TABLE 6-2
SOIL EXPOSURE PATHWAY DATA EVALUATION
ORGANIC COMPOUNDS IN WIPE SAMPLES
FROM 12 LOCATIONS IN 3 BUNKERS
CALF PASTURE POINT MUNITIONS BUNKERS
DAVISVILLE, RHODE ISLAND

COMPOUND	MAXIMUM DETECTED CONCENTRATION ($\mu g/100\ cm^2$)	NEW JERSEY CLEANUP STANDARD[1] ($\mu g/100\ cm^2$)	MAXIMUM DETECTED CONCENTRATION > NJCS?	FREQUENCY OF DETECTION
Naphthalene	4 J	0.145	Yes	5/12
2-Methylnaphthalene	1 J	0.726	Yes	1/12
n-Nitrosodiphenylamine	5 J	786	No	NE
Phenanthrene	0.8 J	NA	NE	1/12
Di-n-butylphthalate	1 J	3.63	No	NE
Fluoranthene	0.6 J	1.45	No	NE
4,4'-DDT	0.13 J	0.018	Yes	1/12
Methoxychlor	17 J	0.182	Yes	3/12
Endrin aldehyde	0.1 J	NA	NE	1/12
alpha-Chlordane	0.12 J	0.002	Yes	2/12
gamma-Chlordane	0.11 J	0.002	Yes	2/12

J Quantitation is approximate.
NA Not Available.
NE Not Evaluated.

(1) New Jersey cleanup standard for accessible surfaces of building interiors.

TABLE 6-3
SOIL EXPOSURE PATHWAY DATA EVALUATION
INORGANIC ANALYTES IN WIPE SAMPLES
FROM 12 LOCATIONS IN 3 BUNKERS
CALF PASTURE POINT MUNITIONS BUNKERS
DAVISVILLE, RHODE ISLAND

ANALYTE	MAXIMUM DETECTED CONCENTRATION ($\mu g/100\ cm^2$)	NEW JERSEY CLEANUP STANDARD[3] ($\mu g/100\ cm^2$)	MAXIMUM DETECTED CONCENTRATION > NJCS?	FREQUENCY OF DETECTION
Aluminum	10,500	NA	NE	4/12
Arsenic	6.3	2.2	Yes	3/12
Barium	71.8 J	2.54	Yes	1/12
Beryllium	0.66	0.182	Yes	1/12
Cadmium	5.3	280	No	4/12
Calcium	15,600	NE[1]	NE	NE
Chromium	62.6	36.3	Yes	3/12
Cobalt	10.5	0.290	Yes	5/12
Copper	346	1.45	Yes	4/12
Iron	227,000	NE[1]	NE	NE
Lead	380	21.5[2]	Yes	1/12
Magnesium	2,290	NE[1]	NE	NE
Manganese	851 J	0.182	Yes	7/12
Mercury	0.63	240	No	5/12
Nickel	117	0.726	Yes	7/12
Potassium	3,430	NE[1]	NE	NE
Silver	2.4	0.182	Yes	1/12
Vanadium	13.7	0.254	Yes	2/12
Zinc	3,060	10.9	Yes	2/12

J Quantitation is approximate.
NA Not Available.
NE Not Evaluated.

(1) Analyte is an essential human nutrient.

(2) Rhode Island Department of Health standard for lead in dust on interior floors.

(3) New Jersey cleanup standard for accessible surfaces of building interiors, unless otherwise specified.

Since national standards for contamination of building interiors have not been established, the maximum concentration of each analyte detected in the 12 wipe samples is compared to a Building Interior Cleanup Standard proposed by the New Jersey Department of Environmental Protection (1992). New Jersey's proposed clean-up standards adopt existing regulatory standards, such as the 1990 U.S. Department of Housing and Urban Development (HUD) clearance criteria for lead abatement projects, and use models to calculate contaminant-specific clean-up goals.

The cleanup standards for carcinogenic effects are based on a scenario which assumes daily exposure of an adult, via ingestion, to an 8.9 m^2 accessible contaminated surface over a 70-year period. The cleanup standards for noncarcinogenic effects are based on a scenario which assumes exposure of a worker, via ingestion, to an 8.9 m^2 accessible contaminated surface for 5 days per week, over a 25-year period. Numerical cleanup standard values proposed by New Jersey are presented, when available. Cleanup standard values for analytes for which New Jersey has not proposed a numerical value were calculated using equations provided in the proposed cleanup standard regulations. The spreadsheet used to calculate the cleanup standard values is presented in Appendix E.

The New Jersey Clean-up Standards have no regulatory impact on sites located in Rhode Island. They are referenced here only to provide comparative contaminant concentrations for the evaluation of surficial contamination (primarily dust) inside buildings, where no national or State of Rhode Island standards exist. The State of Rhode Island has established a "lead-free" standard for building interior surfaces; this standard is used in the evaluation of lead wipe sample results.

Eleven organic compounds were detected in the wipe samples. Of these eleven compounds, six (naphthalene; 2-methylnaphthalene; 4,4'-DDT; methoxychlor; alpha-chlordane; and gamma-chlordane) were detected at concentrations above the applicable New Jersey cleanup standard. Of these, naphthalene had the highest frequency of detection (5/12); 2-methylnaphthalene; phenanthrene; 4,4'-DDT; and endrin aldehyde had the lowest frequency of detection (1/12). New Jersey cleanup standards were unavailable for phenanthrene and endrin aldehyde, each of which was detected at a frequency of 1/12.

Nineteen inorganic analytes were detected in the wipe samples. Of these 19 analytes, 12 (arsenic, barium, beryllium, chromium, cobalt, copper, lead, manganese, nickel, silver, vanadium, and zinc) were detected at concentrations above the applicable New Jersey cleanup standard. Of these, manganese and nickel had the highest frequency of detection (7/12); barium, beryllium, lead, and silver had the lowest frequency of detection (1/12). A New Jersey cleanup standard was unavailable for aluminum, which was detected at 4 of 12 locations. New Jersey cleanup standards were not evaluated for the essential human nutrients calcium, iron, magnesium, and potassium. The Rhode Island Department of Health (1992) standard for lead in dust on interior floors was used in the evaluation of the lead results. This standard is designed to be protective of children in residential settings.

6.3 ECOLOGICAL RECEPTORS

During September and October 1989, the Rhode Island Department of Environmental Management Natural Heritage Program (RIDEM NHP) conducted a rare and endangered species survey of the NCBC facility. The focus of the survey was to identify areas on the base that may have the potential to serve as habitat for rare and endangered species. According to the RIDEM NHP, no rare species are known to reside on NCBC property. A species of interest that has maintained a nest site at the base for several years is the osprey (Pandion haliaetus). No specific recommendations regarding rare species are applicable to the Allen Harbor area. However, Allen Harbor is an important estuarine system requiring protection.

7.0 AIR PATHWAY

7.1 AIR PATHWAY DESCRIPTION

The evaluation of the air exposure pathway data in the following section assumes a residential reuse scenario for the site.

7.2 AIR PATHWAY DATA EVALUATION

This section provides an evaluation of the analytical data pertaining to the air pathway. This pathway addresses a scenario which assumes long-term daily inhalation of chemicals present in soil. The data evaluation tables presented in this section were developed using the approach discussed in Section 4.2.

The air pathway SSL is a chemical concentration in soil that represents a level of contamination above which there may be sufficient concern to warrant further site-specific study. Contaminant concentrations in soil which exceed the screening level would not necessarily designate a site as contaminated, nor trigger a response action. However, they may suggest that a further evaluation of potential risks posed by the site may be appropriate. Further evaluation of SSL exceedances includes consideration of the frequency of detection and evaluation of the magnitude of the specific SSL exceedance.

The source of the SSLs presented in the data evaluation tables is the EPA Draft Soil Screening Level Guidance (September 1993). SSL values proposed by EPA are presented, when available. SSLs for analytes for which EPA has not proposed an SSL were calculated by applying an equation provided in the Draft SSL Guidance to the Inhalation Unit Risk Factor for carcinogens or Inhalation Reference Concentration for noncarcinogens. In certain cases where there was insufficient data to calculate an SSL for an analyte, data for a chemically similar analyte was used. The spreadsheet and source documents used to calculate the SSLs are presented in Appendix E. This spreadsheet indicates the source of each SSL used in the data evaluation tables.

7.2.1 Surface Soil

Table 7-1 presents an evaluation of the analytical data for the surface soil samples collected from six locations between the bunkers and Magazine Road in June 1993 and February 1994. Refer to Figure 2-3 for the sample locations. The samples were analyzed for total lead and TCLP lead. The TCLP lead results are not considered to be relevant to the evaluation of the air pathway at the site. The maximum concentration of total lead detected in the surface soil samples was below the maximum background concentration. Therefore, the risk posed by lead as a potential airborne dust contaminant is within background levels and no further evaluation of the air pathway is necessary.

TABLE 7-1
AIR PATHWAY DATA EVALUATION
LEAD IN SURFACE SOIL SAMPLES FROM 6 LOCATIONS
CALF PASTURE POINT MUNITIONS BUNKERS
DAVISVILLE, RHODE ISLAND

ANALYTE	MAXIMUM DETECTED CONCENTRATION (mg/kg)	MAXIMUM BACKGROUND CONCENTRATION (mg/kg)	MAXIMUM DETECTED CONCENTRATION > MAXIMUM BACKGROUND?.	SSL (mg/kg)	MAXIMUM DETECTED CONCENTRATION > SSL?	FREQUENCY OF DETECTION
Lead	38.7	53.8	No	NE	NE	NE

NE Not Evaluated.

8.0 SUMMARY AND CONCLUSIONS

The objectives of this Study Area Screening Evaluation were: to assess whether releases of previously-stored materials may have contaminated the interiors of three munitions bunkers on Calf Pasture Point; to assess whether previously-stored materials could have been released from the bunkers; and to determine the presence of wastes reportedly buried next to one of the bunkers.

Field activities included: a geophysical survey; a review of the condition of the bunkers and bunker floor surfaces; test pit excavation; collection of subsurface soil samples from the test pits; collection of surface soil samples adjacent to the bunkers; and collection of wipe samples from the interior surfaces of the bunkers.

Four exposure pathways at the site (groundwater, soil, surface water, and air) were characterized and analytical data pertaining to each pathway was evaluated through comparisons with applicable standards (maximum background concentrations, Soil Screening Levels (SSLs), and Rhode Island and New Jersey cleanup standards).

The geophysics survey and subsequent test pit excavations did not indicate the presence of any buried containers. Evaluation of the bunker floors determined that the floors were not cracked; however, several small, lightly-stained areas were noted. Wipe samples were collected from these areas. No impacts of reported buried wastes were noted during the SASE investigation.

An evaluation of the analytical data pertaining to the groundwater pathway determined the following: only methylene chloride was detected in subsurface soil samples at a maximum concentration which exceeded its groundwater pathway SSL; and the maximum concentration of TCLP lead detected in surface soil samples collected from locations between the three bunkers and Magazine Road was below the TCLP regulatory level for lead. Risks posed by other site contaminants were within acceptable limits as established by SSLs.

No year-round water bodies or water run-off channels were identified on the site during the SASE investigation. In accordance with the work plan, no surface water or sediment samples were collected during this investigation; therefore, analytical data pertaining to the surface water pathway was not available for evaluation. However, considering the lack of surface water bodies at the site, the risk posed by this route is considered low.

An evaluation of the data pertaining to the bunker interiors determined the following: six organic compounds (naphthalene, 2-methylnaphthalene, 4,4'-DDT, methoxychlor, alpha-chlordane, and gamma-chlordane) and twelve inorganic analytes (arsenic, barium, beryllium, chromium, cobalt, copper, lead, manganese, nickel, silver, vanadium, and zinc) were detected in wipe samples from the interior of the bunkers at maximum concentrations which exceeded the Rhode Island lead standard or proposed New Jersey cleanup standard.

An evaluation of the soil exposure pathway for lead indicates that the maximum concentration of total lead detected in surface soil samples collected from locations between the three bunkers and Magazine Road was below the maximum background concentration, therefore, no risk above background levels is present in soils sampled during the SASE investigation.

An evaluation of the data pertaining to the air pathway determined that the maximum concentration of total lead detected in surface soil samples collected from between the bunkers and Magazine Road was below the maximum background concentration therefore, no risk above background levels are posed by lead in soils.

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REFERENCES

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SURFACE GEOPHYSICAL SURVEYS
STUDY AREA SCREENING EVALUATIONS
NAVAL CONSTRUCTION BATTALION CENTER
DAVISVILLE, RHODE ISLAND
NAVY CLEAN CTO 127
JUNE 30, 1993

for

SUBCONTRACT AGREEMENT NO. GCPP-93-097-1298
HALIBURTON NUS CORPORATION

Northeast Geophysical Services
Division of F. M. Beck, Inc.
198 Main Street
Yarmouth, Maine
June 30, 1992

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SURFACE GEOPHYSICAL SURVEYS
STUDY AREA SCREENING EVALUATIONS
NAVAL CONSTRUCTION BATTALION CENTER
DAVISVILLE, RHODE ISLAND
NAVY CLEAN CTO 127

INTRODUCTION

At the request of Haliburton NUS Corporation (HNUS) reconnaissance electromagnetic (EM), magnetic and ground penetrating radar (GPR) geophysical surveys were completed at the Naval Construction Battalion Center (NCBC), Davisville, Rhode Island. The objectives of these surveys were to identify geophysical anomalies that may indicate the presence of subsurface cultural features, including buried vessels, piping, utility conduits, and construction materials.

Northeast Geophysical Services (NGS) provided all equipment, personnel, mobilization, materials, data reduction, interpretation and reporting for the surveys. HNUS established all survey grids and provided all survey control.

The field surveys were completed on June 9, 10 and 11, 1993. This report describes the equipment and methods used and the results of the survey. Results are presented as maps of magnetic, electromagnetic and ground penetrating radar anomalies. Some statistical data, magnetic baseline data, and magnetic and electromagnetic profiles of the lines surveyed are also presented in the appendices.

LOCATION AND SITE CONDITIONS

Three areas were investigated as follows:

<u>Study Area 01 - CED Drum Storage Area</u>: Electromagnetic and Magnetic Surveys
<u>Study Area 04 - CED Asphalt Disposal Area</u>: Ground Penetrating Radar Survey
<u>Calf Pasture Point Munitions Bunkers</u>: Electromagnetic Survey

Locations and site descriptions for each of these areas are as presented in Section 1 of the request for proposals (HNUS RFP #1298-93-097). See Appendix A.

GEOPHYSICAL METHODS

Electromagnetic Methods and Instrumentation

Electromagnetic measurements are made by inducing a current into the ground from a transmitter coil, and recording the resulting secondary electromagnetic field at a receiver coil a fixed distance away. The method is based on electromagnetic induction, and physical contact with the ground is not required. The strength of the secondary field depends upon the conductivity of materials in the ground.

For the electromagnetic surveys a Geonics EM-31 was used to make measurements of the quadrature and inphase components of the electromagnetic field. The EM-31 is a one-person device containing both transmitter and receiver coils on a 3.7-meter frame. The instrument was used in the vertical dipole mode which has an effective maximum exploration depth of approximately 18 feet.

The inphase component of the electromagnetic field is sensitive to the presence of metal objects. When used in this mode, the EM-31 acts as a metal-detector. Units of measurement are parts per thousand (ppt) of the total field. Abrupt deflections (positive and negative) in the inphase measurement are indicative of metallic conductors.

The quadrature mode of the EM-31 instrument is adjusted to read directly in units of conductivity called milli-Siemens per meter (mS/m). Terrain conductivity may be affected by a number of factors including moisture content, mineralogy, and soil thickness. Buried metallic objects can also contribute to the readings. Lineal conductors such as pipelines or fence lines will often cause an M-shaped anomaly pattern in the quadrature readings with negative readings directly over the conductor and positive readings on either side. In the absence of metallic objects, large increases in conductivity are likely due to increased ion concentration in the soil and/or groundwater.

The strength or amplitude of an EM anomaly is mainly a function of the size of the metallic object and the distance of that object from the EM-31 instrument. Strong EM anomalies generally represent larger, near-surface conductors whereas

weaker anomalies are likely smaller conductive objects or conductors that are more distant (either laterally or vertically) from the instrument.

EM-31 measurements were taken at 5-foot intervals along each survey line at the CED Drum Storage Area Grid and Grids A, B, and C at the Calf Pasture Point Munitions Bunker Area. Survey lines were oriented roughly north-south and east-west at each grid. Profiles of each survey line of both inphase and quadrature measurements were examined for deflections indicative of metallic conductors.

At the grid nodes, where the east-west and north-south survey lines intersect, pairs of EM measurements taken at different instrument orientations were available for comparison. Under natural conditions instrument orientation will not significantly affect the EM measurements. The presence of localized metal can create an anisotropic effect with differences in measurements between instrument orientations. EM values at the nodes of each survey grid were examined for anisotropy which might indicate nearby metal.

Magnetic Methods and Instrumentation

Magnetic measurements were made with an E.G. & G. Geometrics G-856 proton precession magnetometer/gradiometer. This instrument measures the total magnetic field intensity at two sensors, separated by a fixed vertical distance. From this data the magnetic field gradient between the two sensors is calculated. The gradient is expressed in nanoteslas per unit distance (nanoteslas per foot in this survey).

By using vertical gradient measurements rather than a single total field measurement, the need to collect base station data for correction of survey data for diurnal variations and magnetic storms is eliminated. (Base station data was collected, however, to meet contract specifications, and as a check on instrument functioning during the survey.)

In the absence of any ferrous objects or magnetic minerals (magnetite, pyrrhotite), the total field intensity will be that of the earth's magnetic field, and the gradient will be near .02 nanoteslas per meter in middle latitudes. Gradient anomalies produced by the presence of ferrous objects will be proportional to the amount of magnetic material present, and inversely proportional to the third or fourth power of distance from the sensor.

Readings were taken at 10-foot intervals along each survey line at the CED Drum Storage Area. Summary statistics were calculated for the data, and a histogram of gradient values was constructed. The statistical mode most closely approximates the natural background conditions in the absence of ferrous metal. Distance from the mode was used to measure anomaly size.

Ground Penetrating Radar Methods and Instrumentation

Ground penetrating radar utilizes high frequency radio waves to probe the subsurface. Radio waves are transmitted into the ground from an antenna which is pulled across the surface. In the subsurface, radio waves are reflected at interfaces of materials with contrasting dielectric properties. The returning signal is intercepted by a receiver and converted to a graphic image. The horizontal axis of the graphic image is distance along the traverse. The vertical axis is the two-way travel time of the radar pulses, in nanoseconds (ns).

The instrument used for this survey was an SIR System-3 with 500 and 300 MHz antennas, manufactured by Geophysical Survey Systems, Inc. Tests with both antennas at Study Area 04 showed the 300 MHz to give the best results, and was used for this survey.

The antenna was dragged along the ground surface and across the trench at approximately 2 mph.

Lines traversing the visible trench were extended a considerable distance to the south in order to determine a characteristic reflection pattern for the undisturbed subsurface. The profiles were then examined for areas that had a different reflection pattern from this "background" pattern.

The GPR profiles were examined in the field as they were produced. In the office, GPR profiles were examined in more detail, and anomalous areas noted on the profiles were transferred to a map.

SURVEY RESULTS

Study Area 01 - CED Drum Storage Area

Electromagnetic Survey

At the CED Drum Storage Area, EM measurements were taken at 5-foot intervals on a 50 by 50-foot survey grid. A total of 1,332 measurements were taken of the inphase and quadrature components along about 6,500 lineal feet. A summary of the statistics and a histogram of the EM data is in Appendix B.

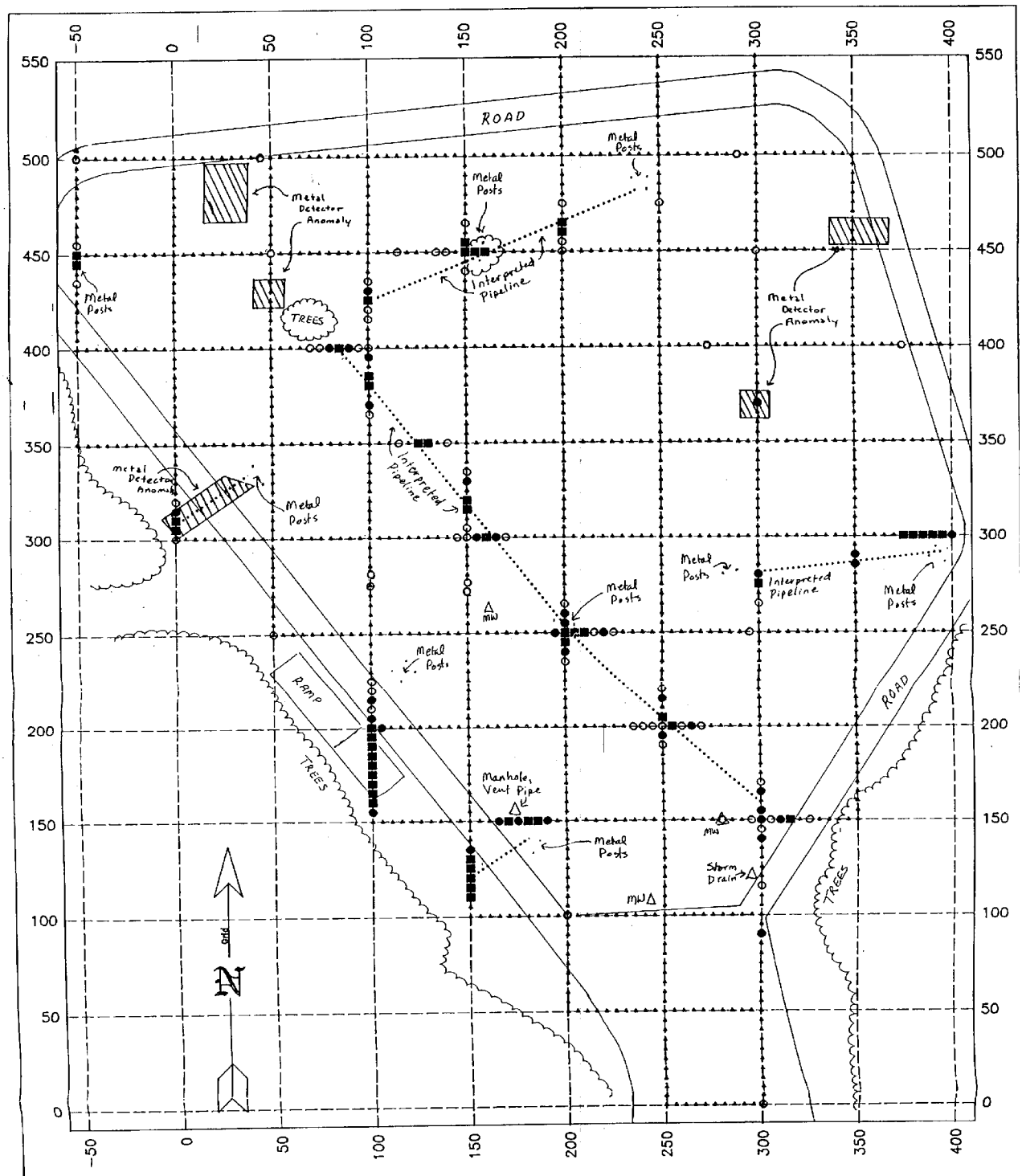
A profile of each survey line was plotted and examined for deflections (anomalies) in the inphase and also quadrature measurements. A plot map showing the location and relative amplitude of the EM anomalies is shown in Figure 1. The EM anomalies were grouped into categories of strong, moderate or weak, based on their relative amplitude or difference from the mode. The results, presented in Figure 1, show that most of the strong EM anomalies are associated with surface metal or known buried pipelines.

EM measurements taken at the grid nodes (intersections of the east-west and north-south) survey lines were examined for anisotropy. In general, the difference between pairs of inphase measurements was less than 0.25 ppt. Measurements that differed by more than 0.6 ppt were considered anisotropic, and indicative of possible nearby metal. The comparisons of grid node data are shown in Appendix F. These results show that the nodes which have anisotropic values (greater than 0.6 ppt) are at or within 10 feet of EM anomalies identified on Figure 1.

EM anomalies at the CED Drum Storage Area were field checked by Northeast Geophysical Services accompanied by Chuck Martin of HNUS. A Fisher M-Scope TW6 metal detector/pipe locator was used to locate and confirm the EM anomalies. Those anomalies that could not be explained by surface metal or known pipelines were marked in the field for possible further investigation.

Magnetic Gradient Survey

Results of the magnetic gradient survey are presented on the Magnetic Gradient Contour Map (Figure 2). Summary statistics and a histogram of magnetic data are presented in Appendix C. A total of 670 magnetic gradient readings were taken over the grid (approximately 6,500 lineal feet).



LEGEND

- Data Point
- Weak EM Anomaly
- Moderate Em Anomaly
- Strong EM Anomaly

Instrument: Geonics EM-31 vertical dipoles

FIGURE 1

Electromagnetic Anomaly Map	
Study Area 1 – CED Drum Storage Area	
For: Halliburton NUS Environmental Corporation	
Davisville, Rhode Island	Scale : 1"=50'
Survey Date: June 9, 1993	Revisions

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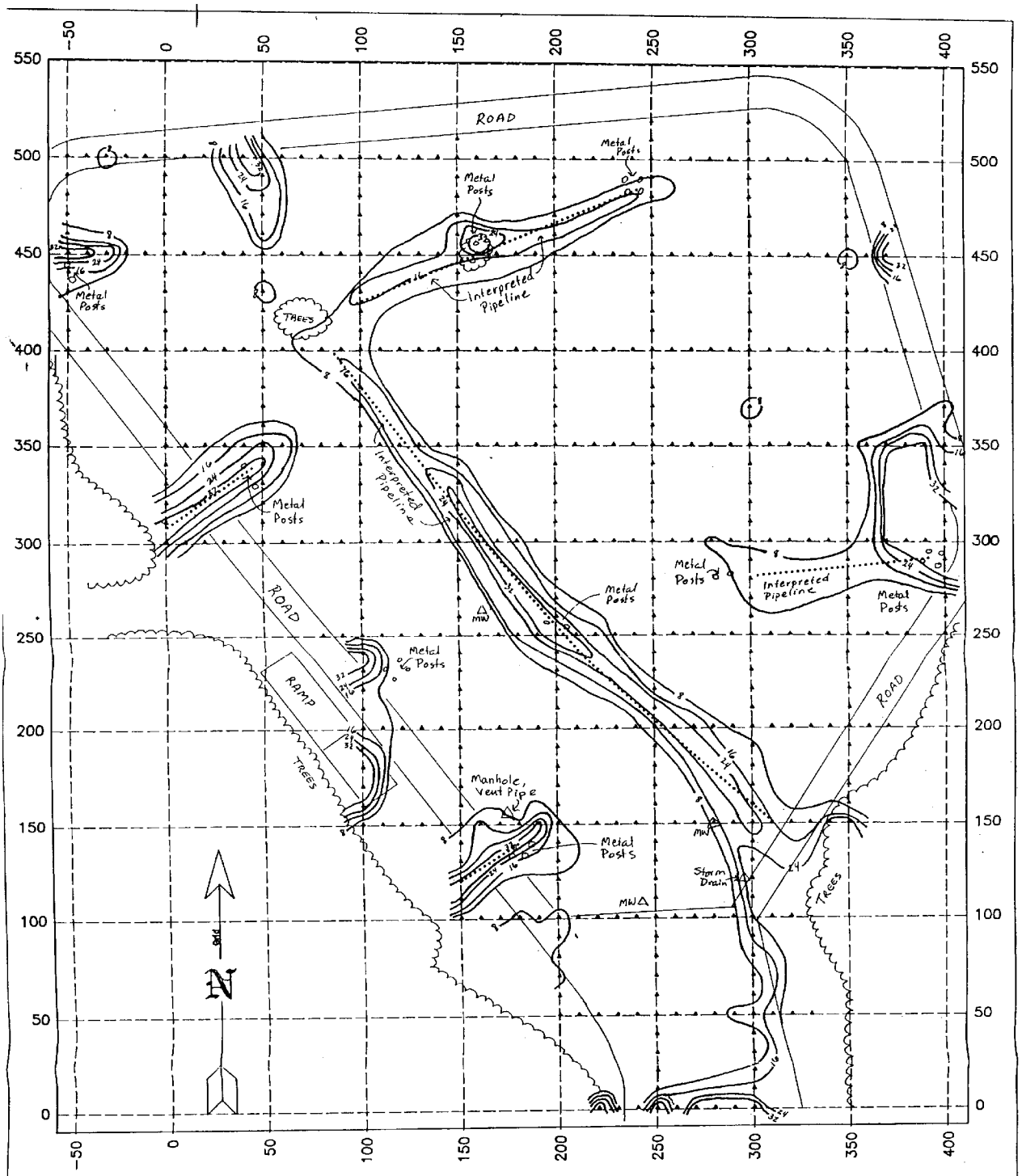

EXPLANATION

▲ data point

Grid distances in feet.

Contour Interval = 8.

Units = nanoteslas/foot.

Instrument: EG&G Geometrics G-856 Gradiometer
Sensors held 6.3 and 9 feet above ground surface.

The contoured values are the absolute values of the vertical magnetic gradient at each station. Since the statistical mode of all gradient readings is zero, increasing contour values reflect distance from the mode. The mode represents approximately the background magnetic gradient in the absence of ferrous metal.

Due to the wide spacing of grid lines (as required by the work plan) the continuity of contour lines between some data points is uncertain.

FIGURE 2

Magnetic Gradient Contour Map	
Study Area 1 – CED Drum Storage Area	
For: Halliburton NUS Environmental Corporation	
Davisville, Rhode Island	Scale : 1"=50'
Survey Date: June 9–10, 1993	Revisions

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Yarmouth, Maine

A base station, located at station 150E, 400N, was monitored at least once each half-hour throughout the survey period. The total field and gradient readings for the base station are presented in Appendix D. The gradient data show good repeatability of gradient readings; the total field data shows diurnal variations of the earth's magnetic field of approximately 15 nanoteslas, and the absence of magnetic storms.

Gradient values of +/- 8 nanoteslas per foot or more were considered anomalous in this study. This value was selected based on a number of factors, including our experience with drum detection in the northeast; examination of the summary statistics, histograms and profiles of magnetic data presented in Appendix C; literature on drum detection; and assumptions we made regarding burial depth. Anomalous areas are indicated by the 8 nanoteslas per foot contour line on the Magnetic Gradient Contour Map, Figure 2.

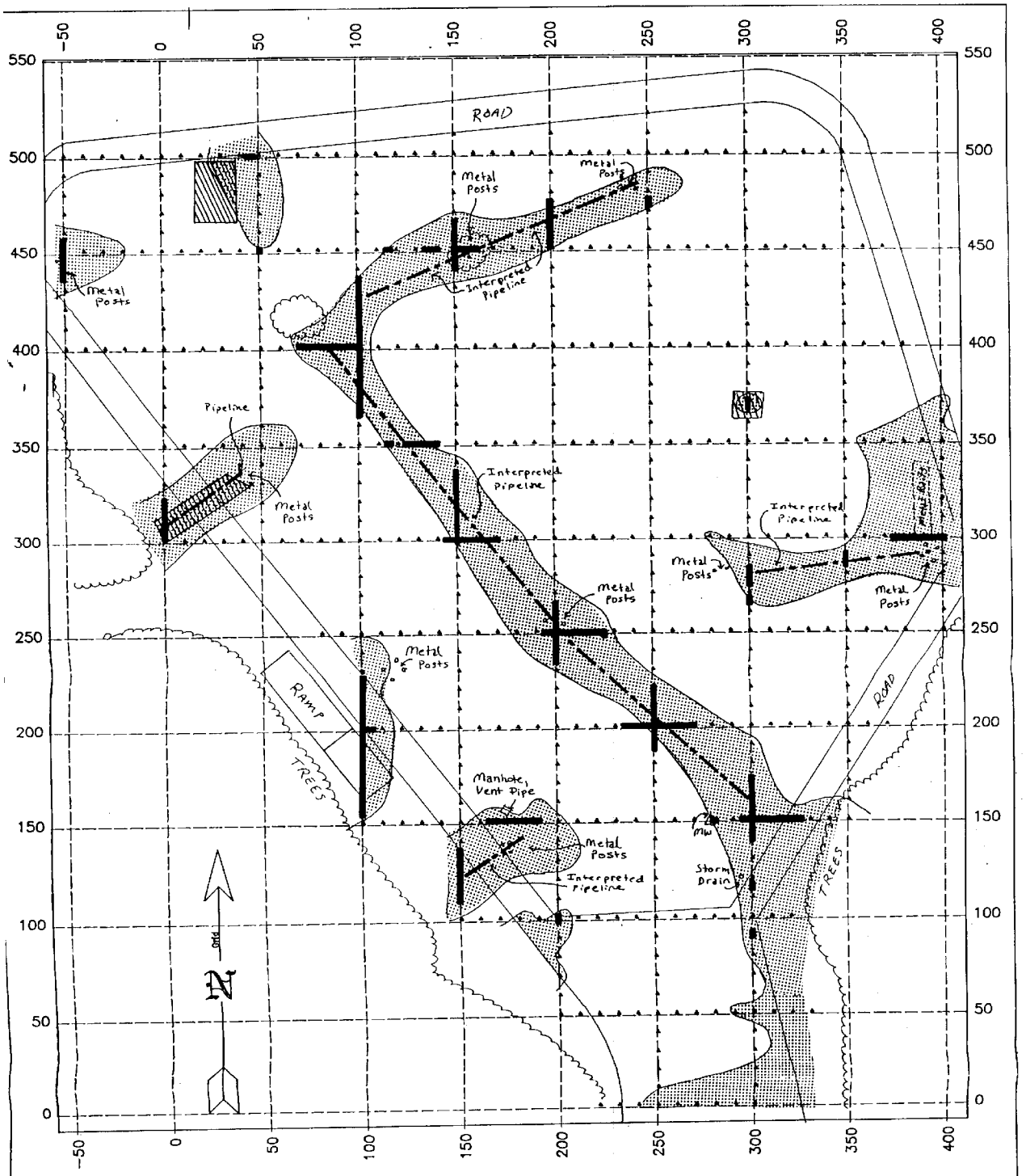
At the CED Drum Storage Area relatively shallow burial depths, probably 5 feet or less, are assumed for any possible buried drums or other ferrous objects. It is likely that buried drums would produce anomalies significantly larger than 8 nanoteslas per foot.

Magnetic anomalies at the CED Drum Storage Area were field checked by Northeast Geophysical Services accompanied by Chuck Martin of HNUS. A Fisher M-Scope TW6 metal detector/pipe locator was used to locate and confirm the magnetic anomalies. Those anomalies that could not be explained by surface metal or known pipelines were marked in the field for possible further investigation. These locations are approximately as follows:

1. the intersection of Lines 50E and 500N
2. 50E, 430N
3. 350-370E, 450N
4. 300E, 370N.

Coincident Electromagnetic and Magnetic Anomalies

Figure 3 shows only those electromagnetic and magnetic anomalies that are coincident, or nearly so. Coincident metal detector anomalies are also shown. Most of these coincident anomalies are associated with the buried pipes, catch basins and other features shown on the map. Two of these anomalies could not be explained by any of these features. They are located at the intersection of Lines 50E and 500N, and 300E, 370N. These locations were among the locations marked in the field for possible further investigation.



LEGEND

- data point
- Magnetic Anomaly
- EM Anomaly Coincident with or Proximal to Magnetic Anomaly
- Metal Detector Anomaly

Instruments:
Geonics EM-31, vertical dipoles
EG&G Geometrics G-856
Fisher M-Scope, Model TW-4

FIGURE 3

Coincident EM & Magnetic Anomaly Map	
Study Area 1 – CED Drum Storage Area	
For: Halliburton NUS Environmental Corporation	
Davisville, Rhode Island	Scale : 1"=50'
Survey Date: June 9–10, 1993	Revisions
Northeast Geophysical Services A division of F.M. Beck, Inc. Yarmouth, Maine	

Calf Pasture Point Munitions Bunkers Area

Electromagnetic Survey

Three survey grids were established by HNUS personnel at the Calf Pasture Point Munitions Bunkers area. Grid A (Figure 4) is located around Bunker 60. Grid B (Figure 5) is located around Bunker 339. Grid C (Figure 6) is located around Bunker 59. Measurements of inphase and quadrature were taken at 5-foot intervals along each survey line at each grid. Collectively, a total of 599 measurements were taken over 2,825 lineal feet at the three grids. A summary of the statistics and a histogram of the EM data for the Calf Pasture Point Munitions Bunkers area is in Appendix E.

A profile of each survey line was plotted and examined for deflections (anomalies) in the inphase and also quadrature measurements (Appendix E). Plot maps of each grid showing the location and relative amplitude of the EM anomalies is shown in Figures 4, 5, and 6. The EM anomalies were grouped into three categories of strong, moderate, or weak based on their relative amplitude or difference from the mode. Broad areas of anomalous EM response are also shown.

EM measurements taken at the grid nodes (intersections of the east-west and north-south) survey lines were examined for anisotropy. In general the difference between pairs of inphase measurements was less than 0.25 ppt. Measurements that differed by more than 0.6 ppt were considered anisotropic, indicative of possible nearby metal. The results of the EM comparisons are shown in appendix F. These results show that the nodes which have anisotropic values (greater than 0.6 ppt) are at or within 10 feet of EM anomalies identified on Figures 4, 5, and 6.

EM results for the three grids at the Calf Pasture Point Munitions Bunker Area were reviewed and discussed by Northeast Geophysical Services and Chuck Martin of HNUS. Most of the strong EM anomalous zones are located next to and are almost certainly caused by the Bunkers themselves which are partly made of corrugated metal. Other EM anomalous zones are located in the paved areas at the entrances to the Bunkers. These anomalies are suspected to be caused by metal reinforcement bars that are likely embedded in the concrete pavement. In Grid A (Figure 4) there is an anomalous area located to the northeast of Bunker 60 along the east side of the access road. There was no visible cause for this anomaly and it may represent a buried cable or pipe. This area and perhaps three other isolated, weak EM

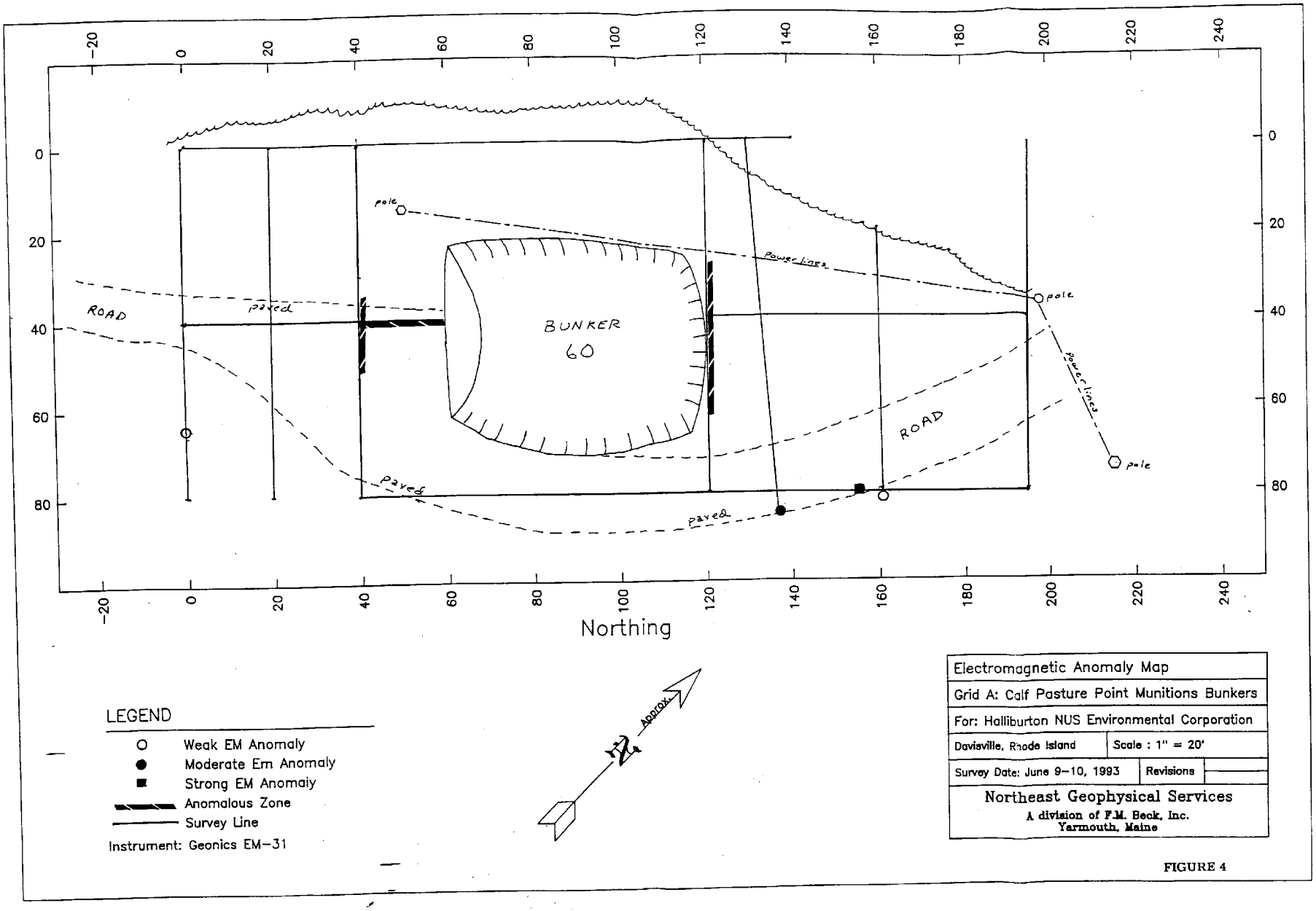

-20
0
20
40
60
80
100
120
140
160
180
200
220
240
Northing
BUNKER
60
ROAD
paved
pole
Power lines
LEGEND
Weak EM Anomaly
Moderate Em Anomaly
Strong EM Anomaly
Anomalous Zone
Survey Line
Instrument: Geonics EM-31
Approx.
Electromagnetic Anomaly Map
Grid A: Calf Pasture Point Munitions Bunkers
For: Halliburton NUS Environmental Corporation
Davisville, Rhode Island
Scale : 1" = 20'
Survey Date: June 9-10, 1993
Revisions
Northeast Geophysical Services
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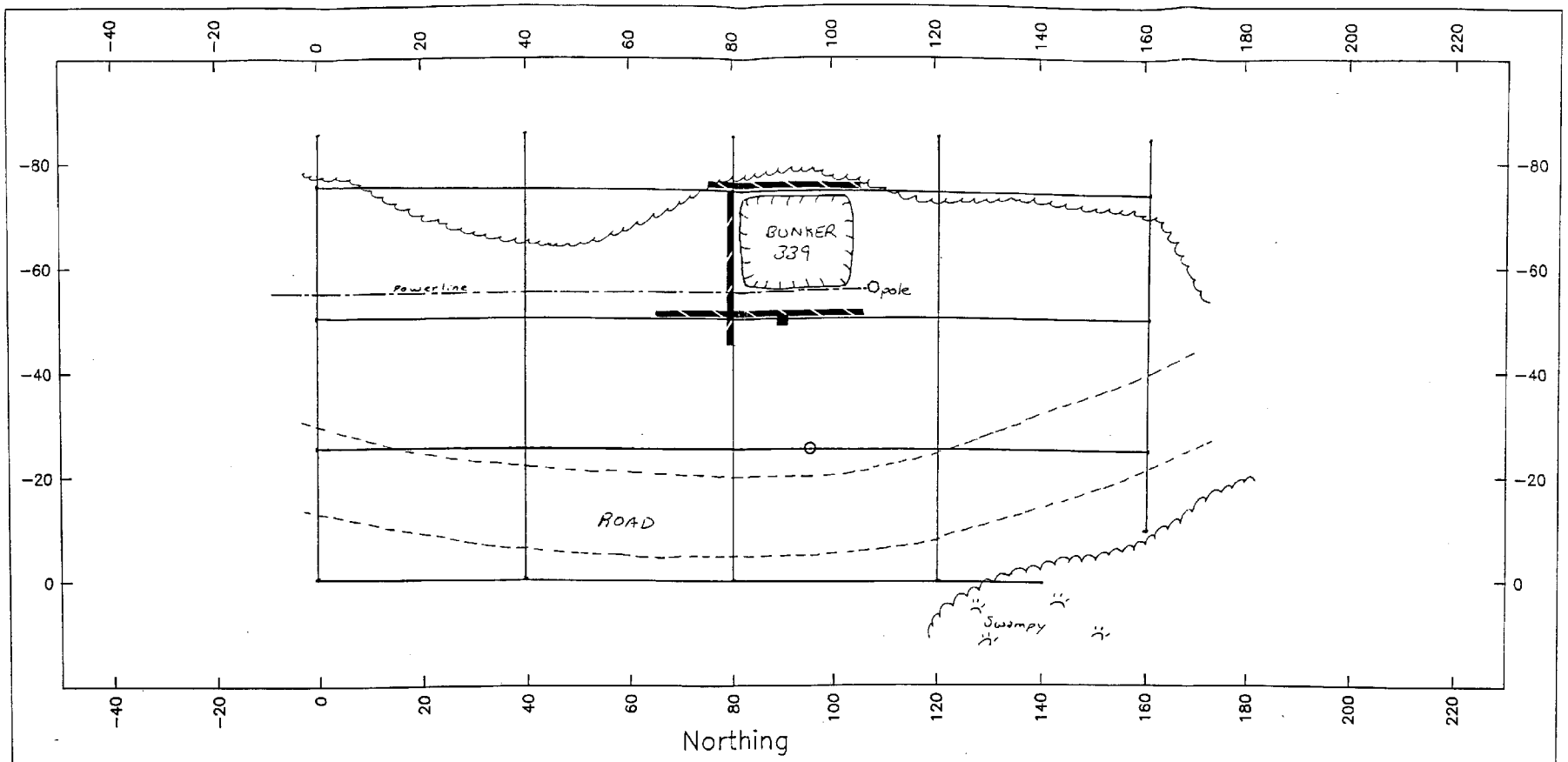
FIGURE 4



LEGEND

- Weak EM Anomaly
- Moderate Em Anomaly
- Strong EM Anomaly
- Anomalous Zone
- Survey Line

Instrument: Geonics EM-31

Approx.

Electromagnetic Anomaly Map	
Grid B: Calf Pasture Point Munitions Bunkers	
For: Halliburton NUS Environmental Corporation	
Davisville, Rhode Island	Scale : 1" = 20'
Survey Date: June 9-10, 1993	Revisions
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FIGURE 5

anomalies, as shown on Figures 4, 5 and 6, may warrant further investigation.

Electromagnetic and Magnetic Survey Limitations

The electromagnetic and magnetic instruments used are useful tools for detecting buried conductive objects such as metal drums and pipelines. As with any geophysical instruments, however, there are limitations to their effectiveness.

At the CED Drum Storage Site and the Calf Pasture Point Munitions Bunkers Site there are two limitations imposed by survey conditions which should be mentioned. First, the EM-31 has a maximum effective search radius of 18 feet. Where single drums are sought the effective search radius of the magnetometer is on the order of 10 to 12 feet. Line spacing of these reconnaissance surveys were generally 40 to 50 feet. This means that 15 to 35 percent of the area within each grid is not covered by this survey. However, it is statistically likely that any large cache of drums would be detected by either instrument at these line spacings.

A second limitation to the surveys is in areas of anomalous response caused by features such as buried pipes and catch basins. Any buried conductor or ferrous metal located near to (10 to 15 feet) a surface conductor or ferrous metal object would likely be masked by the surficial conductor.

Study Area 04 - CED Asphalt Disposal Area

The objectives of the Ground Penetrating Radar survey at Study Area 04 were to locate anomalous areas on GPR records that may indicate the former boundaries of a larger trench at this location, and to look for anomalous reflection patterns that may indicate possible asphalt seepage from the trench into the surrounding overburden. To accomplish this a number of lines were surveyed across the trench and two lines were also surveyed parallel to the trench along the south and north sides.

Lines were located where indicated by survey stakes established by HNUS personnel. These were placed south and north of the trench, at measured distances from the its east end. The stakes for each line crossing the trench were at variable distances, ranging from 5 to 12 feet, south and north of the trench. For purposes of presentation, the stakes on the south side of the trench are presented on the map as if they are in a

straight line, and the stakes are assumed to be 25 feet apart. The width of the visible trench is approximately 8 feet. It is approximately 3 feet deep at the deepest part, near the east end. The ground surface south and north of the trench was very flat.

Radar Signal Penetration

A time range of 90 nanoseconds was used for this survey. This yields an effective range of 81 ns after page margins are subtracted. Good penetration was achieved throughout that range.

In the absence of any known depths to pipes or other objects a depth scale on radar profiles can be assumed from estimated radar velocities for earth materials. Assuming the soils, sediments and/or fill at the site possess the usual properties of earth materials, a two-way travel time of 4.5 to 6 nanoseconds (ns/ft) per foot (an electromagnetic velocity of .44 to .33 feet per nanosecond) can be assumed. This translates to an effective depth of investigation (allowing for page margins) of 13.5 to 18 feet.

Trench Boundary Results

A typical radar profile that crossed the trench is presented in Figure 7. To the south and north of the survey stake locations that roughly delimit the visible trench, the radar reflection pattern typical of this area can be seen. It is a chaotic pattern with wavy and small hyperbolic reflections and diffractions. The pattern most closely corresponds to the chaotic reflection configuration of Beres and Haeni (1991), which is typical of cross-bedded sand and gravel.

Between the stakes, in the area of the trench, wavy but more continuous reflectors are present, suggesting a different reflecting medium. Topographic changes of a few feet were encountered in crossing the trench. The topographic changes contribute to the waviness of these reflectors. If the profile were corrected for topographic changes the reflectors in the trench area would probably appear more strongly horizontal and continuous. This different reflection pattern was considered anomalous, compared to the surrounding chaotic non-trench pattern.

Figures 8 and 9 present radar profiles near the east end of the trench. On these profiles the anomalous pattern of more continuous horizontal reflectors clearly extends to the south of the survey stakes that roughly mark the southern boundary of the

trench. North of the trench the chaotic pattern is present. The presence of the anomalous pattern to the south of the trench is a possible indication that material similar to the material in the trench is buried or has seeped into the ground there. Since no reflections that suggest prior excavation are evident to the south, seepage is considered more likely than burial. Absence of reflections, sometimes found in hydrocarbon contamination sites, is not part of the reflection pattern here.

The Ground Penetrating Radar Survey Map (Figure 10) shows the areas of each line where the anomalous pattern of reflections was encountered.

CONCLUSIONS

Under the direction of HNUS, Northeast Geophysical Services conducted geophysical surveys at three sites at the Naval Construction Battalion Center in Davisville, Rhode Island.

At Study Area 1, the CED Drum Storage Area, an electromagnetic (EM-31) and magnetic gradient survey was conducted on a 50 by 50-foot grid. Anomalous magnetic and EM responses were mapped and correlated. Anomalous areas that were not caused by surficial metal or by known buried pipelines were field checked with a metal detector and marked in the field for possible further investigation.

At the Calf Pasture Point Munitions Bunkers Area, an EM-31 survey was conducted on three grids, labeled A B and C, which surround Bunkers 60, 339, and 59, respectively. Anomalous EM responses were mapped on each grid. Upon review it was determined that most of the EM anomalies were caused by metal in the bunkers or suspected metal rebar in the concrete adjacent to the Bunker entrances. Three or four weaker EM anomalies, as indicated on the EM Anomaly Maps, may warrant further investigation.

At Study Area 4, the CED Asphalt Disposal Area a GPR survey identified two patterns of ground penetrating radar reflections. A chaotic pattern, characteristic of cross-bedded sand and gravel, was predominant away from the trench. More continuous, horizontal or wavy reflectors were present in the immediate vicinity of the trench. At the east end of the trench the second pattern of reflectors was found extending to the south of the trench. This area was recommended for further investigation.

APPENIDX A

SITE LOCATION MAPS, DESCRIPTION OF SITE CONDITIONS AND LOCAL GEOLOGY DESCRIPTIONS FROM RFP #1298-93-097

Line 189 W, Ground Penetrating Radar Profile
Study Area 04 - CED Asphalt Disposal Area

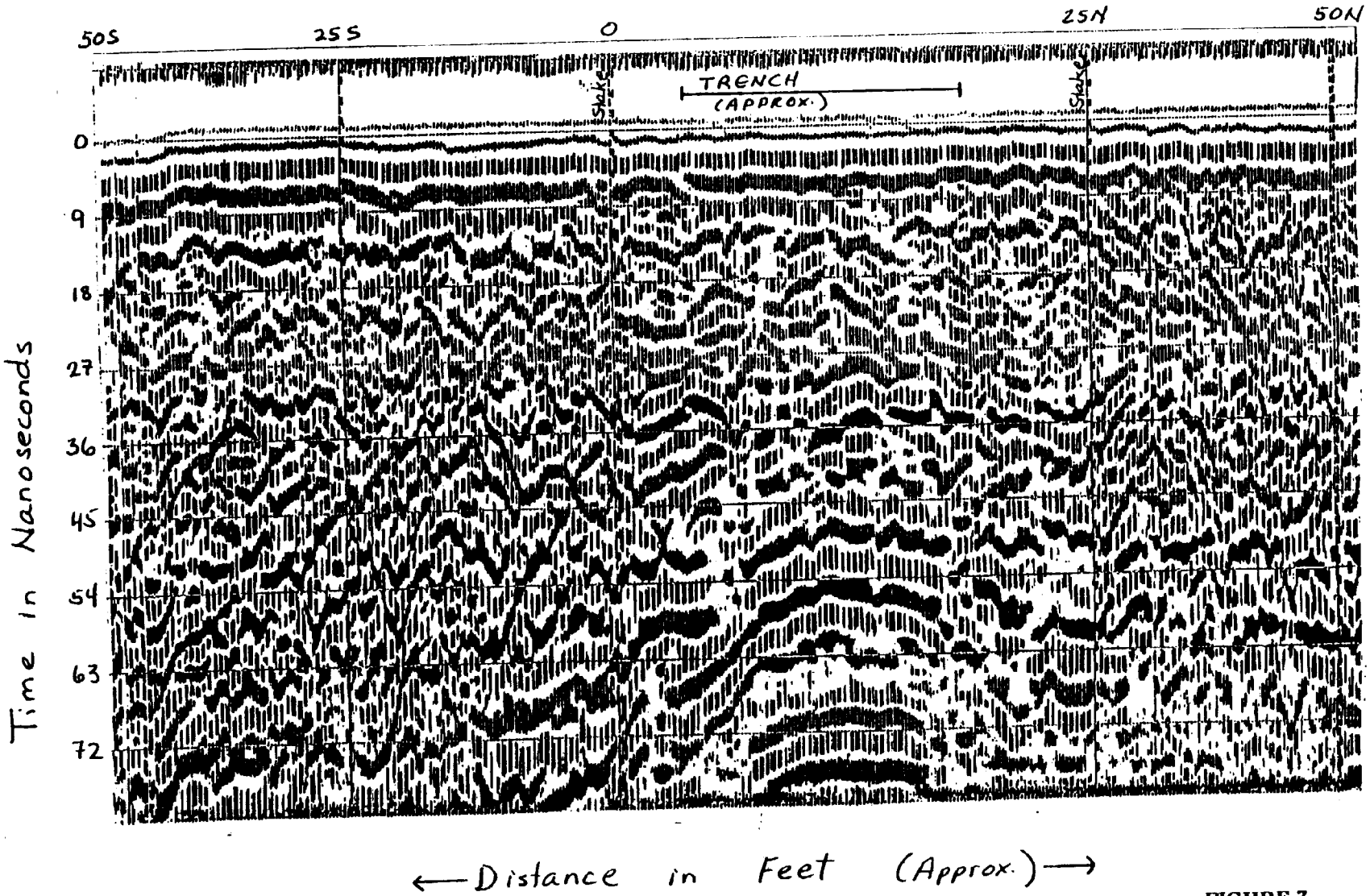
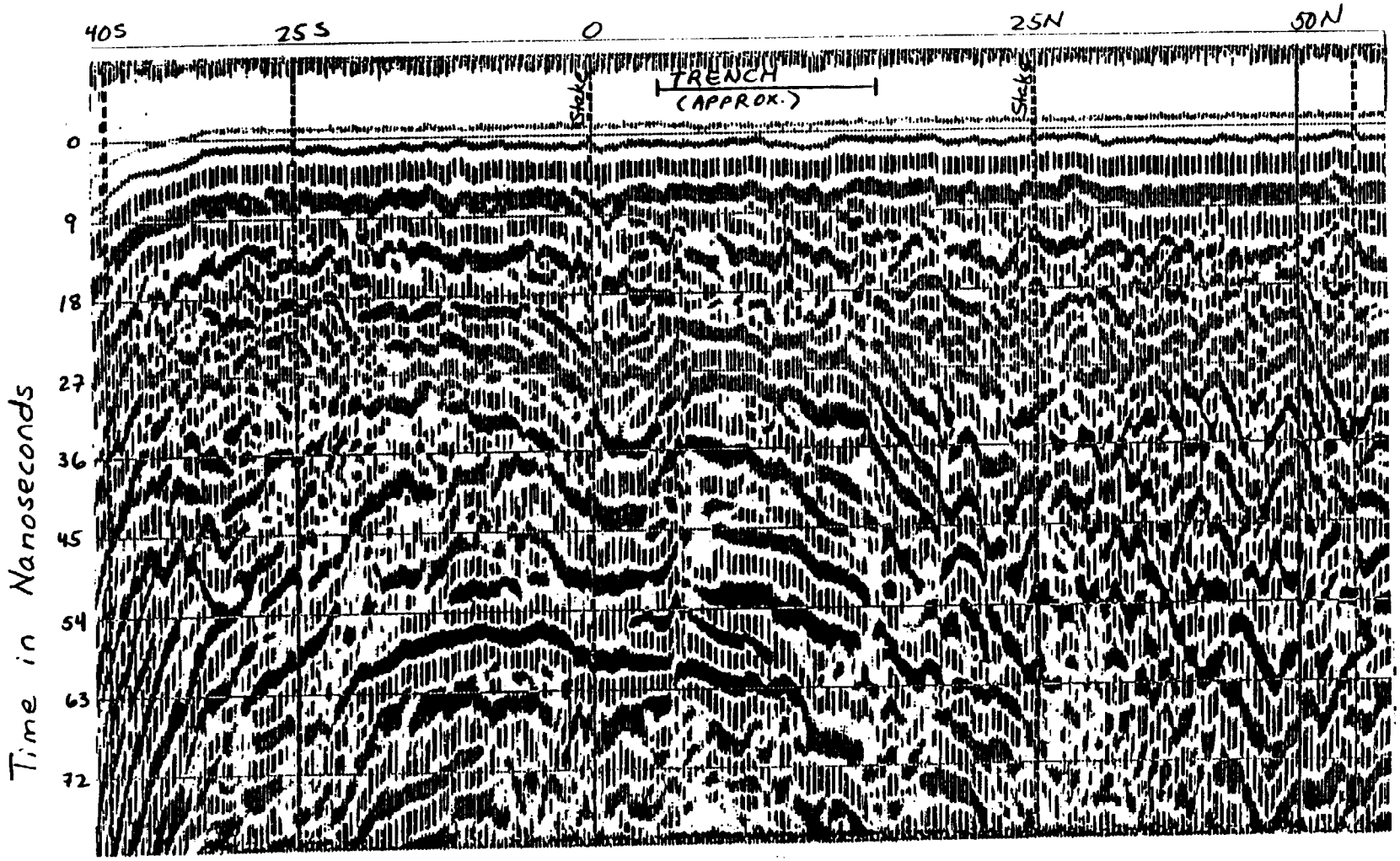


FIGURE 7

Line 90W, Ground Penetrating Radar Profile
Study Area 04- CED Asphalt Disposal Area



← Distance in Feet (Approx.) →

FIGURE 8

Line 79 W, Ground Penetrating Radar Profile
Study Area 04 - CED Asphalt Disposal Area

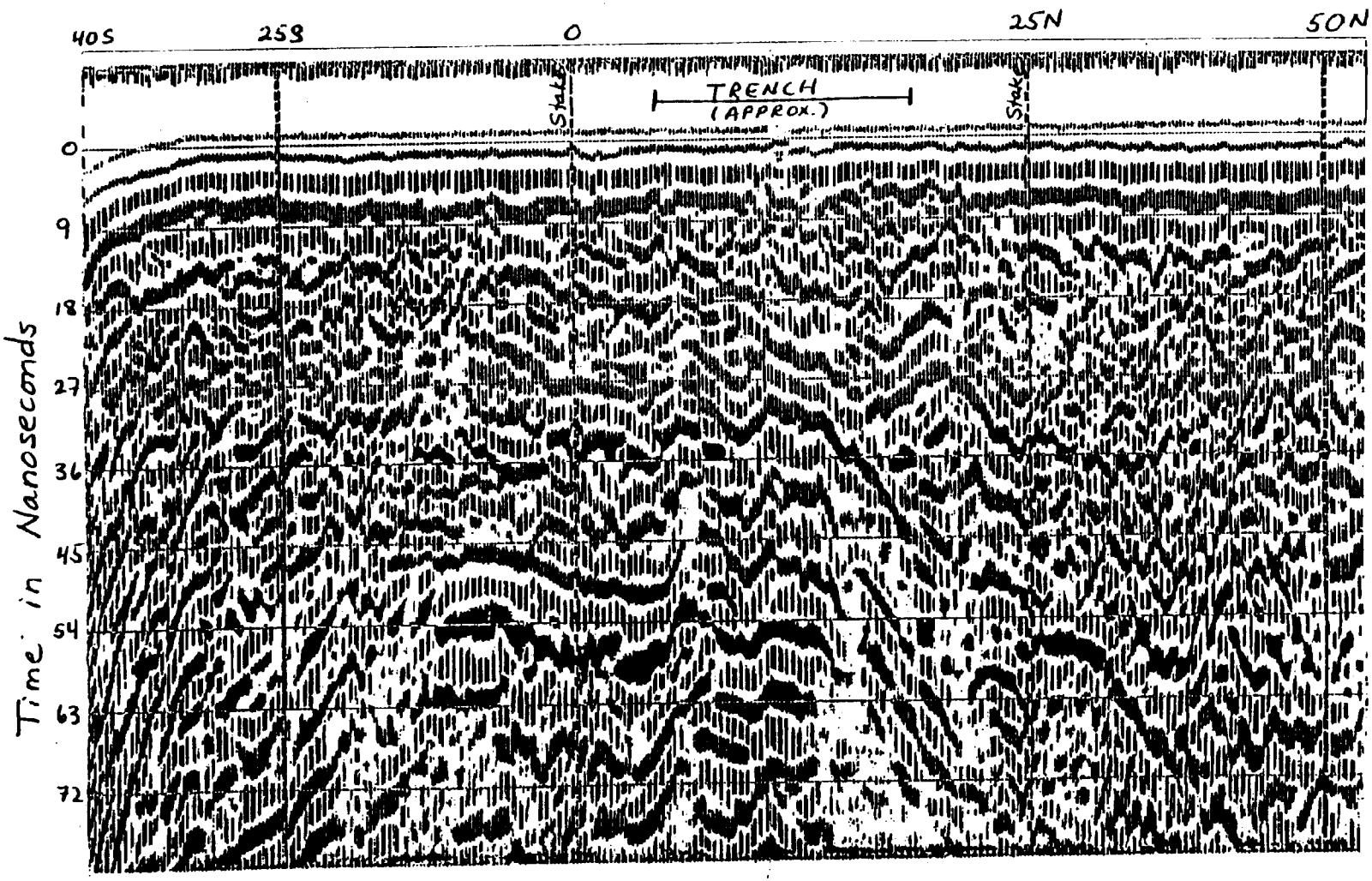


FIGURE 9

SURFACE GEOPHYSICAL SURVEY
STUDY AREA SCREENING EVALUATIONS
NAVAL CONSTRUCTION BATTALION CENTER
DAVISVILLE, RHODE ISLAND
NAVY CLEAN CTO 127

1.0 INTRODUCTION

HALLIBURTON NUS Corporation (HNUS) is assisting the Northern Division (NORTH DIV) of the Naval Facilities Engineering Command (NAVFAC) in coordinating environmental site evaluations at the Naval Construction Battalion Center (NCBC) in Davisville, Rhode Island. This work will be performed under Contract task Order (CTO) 127 and will require the Subcontractor to perform certain geophysical surveys, and present data in a summary report.

1.1 Objective

A surface geophysical survey will be conducted at NCBC to determine the presence and location of various active or abandoned subsurface cultural features. These features include, but are not limited to, buried vessels, piping, active utility conduits, and construction materials.

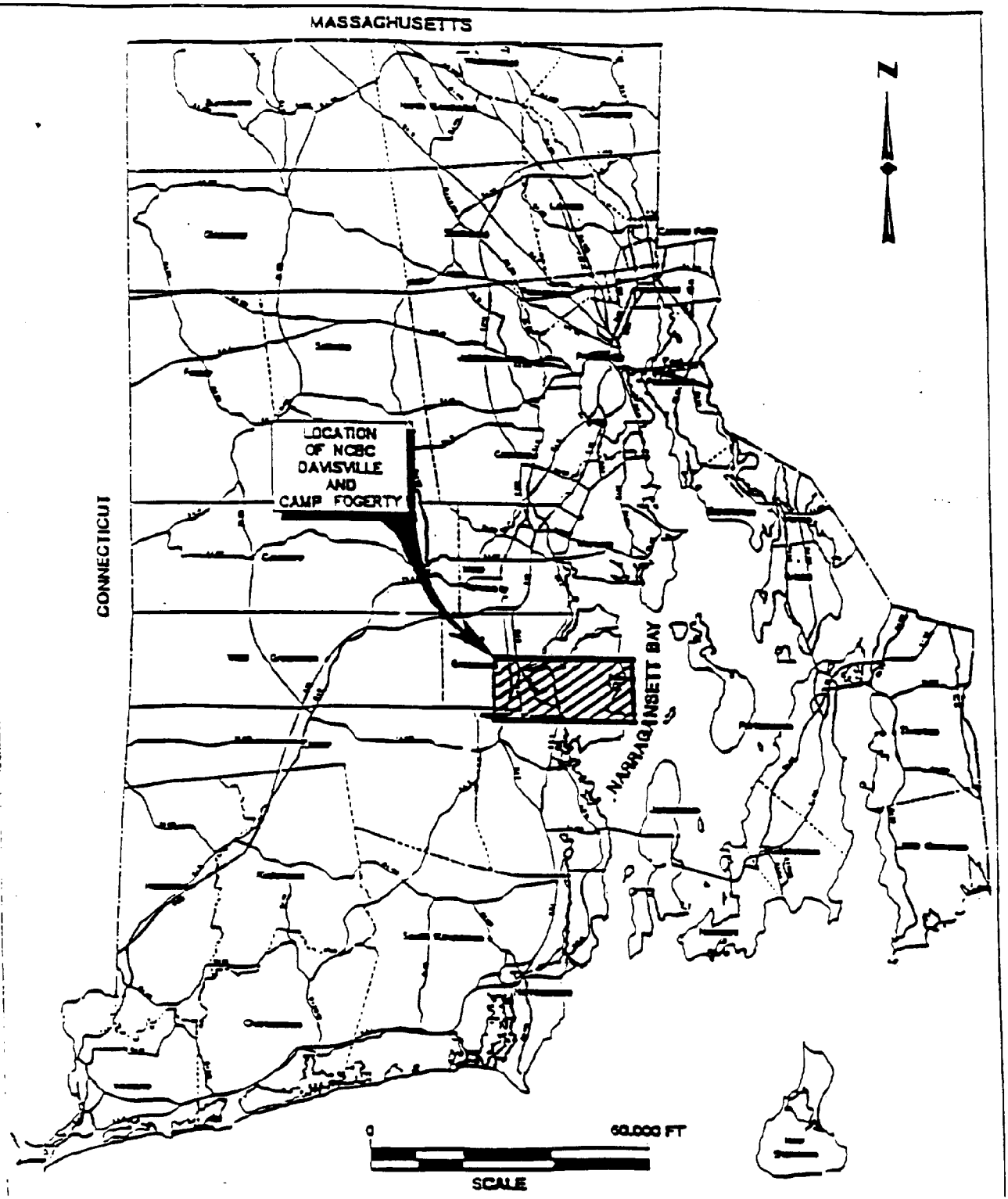
Geophysical techniques which will be utilized include ground penetrating radar, magnetic surveying, and electromagnetic surveying.

1.2 Location of Work

Geophysical surveys will be accomplished at three sites at NCBC: the CED (Construction Equipment Department) Drum Disposal Area; the CED Asphalt Disposal Area; and the Munitions Bunkers at Calf Pasture Point (Figures 1-1 and 1-2).

1.3 Site Description

The CED Drum Storage Area consists of an open, level, sparsely vegetated, 3.7 acre area, located approximately 150 feet north of Building 224. It is bounded by Battalion Boulevard to the south and a semi-circular road on the other sides. No buildings are present onsite. A concrete leach field distribution box (set at ground surface) and an associated vent pipe, a loading ramp, several sets of steel/concrete bollards (protective posts) which surround surface drains, and four test wells are located onsite. The distribution box and vent pipe are related to an inactive leach field present on the site.



NCBC and CAMP FOGERTY LOCATION PLAN

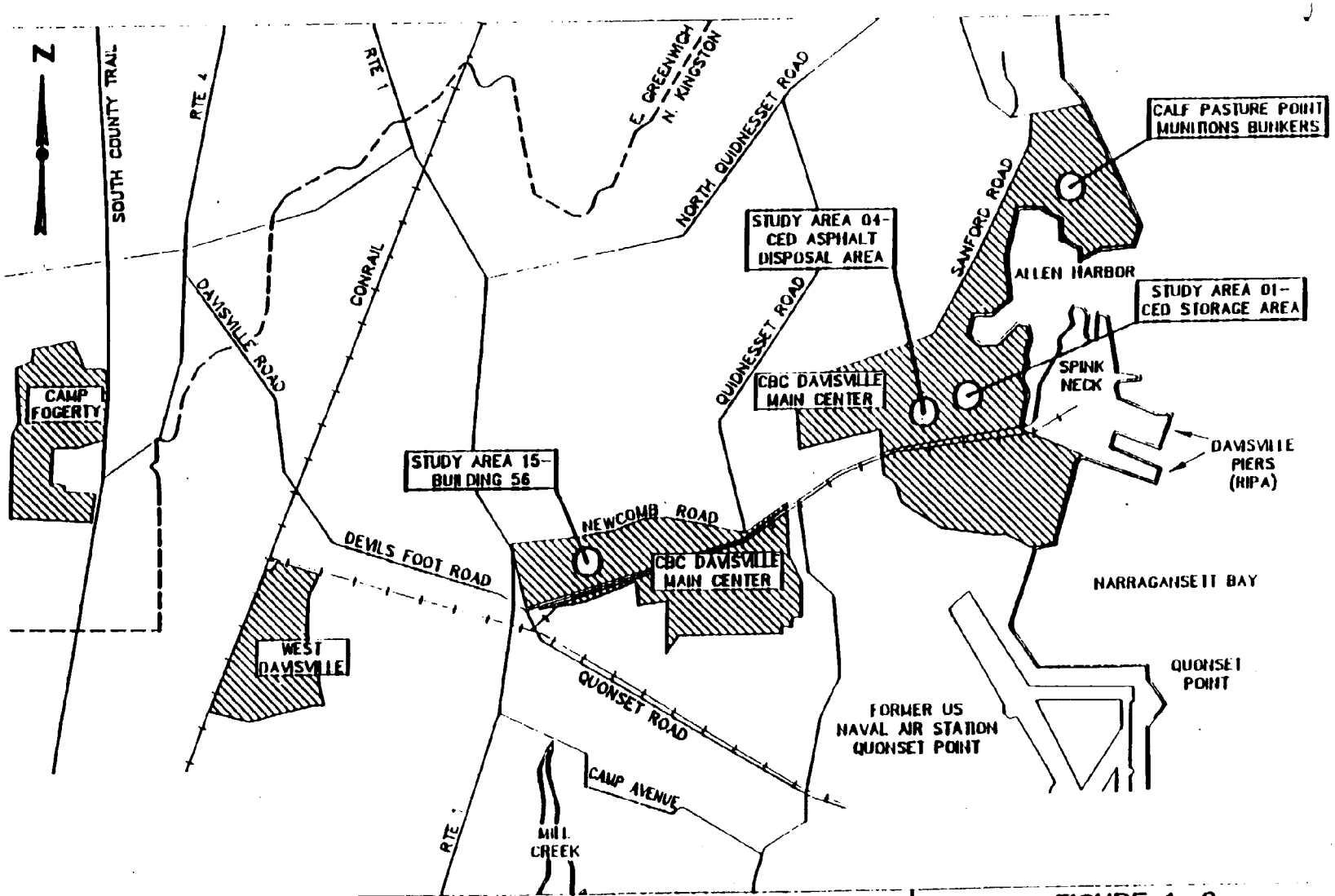
FIGURE 1-1

US NAVY – NCBC DAVISVILLE, RI

DRAWN BY: R. SARGENT | REV.: 0

CHECKED BY: J. MARTIN

HALLIBURTON NUS
Environmental Corporation



GEND

- NAVY PROPERTY
- TOWN BOUNDARIES

STUDY AREA LOCUS PLAN
NCBC DAVISVILLE, R.I.

DRAWN BY:	R SARGENT	REV.:	0
CHECKED BY:	W MARTIN	DATE:	27 APR 93
SCALE:	APPROXIMATE 1"=3700'	PROJECT NO:	7758 C10 #114

FIGURE 1-2

HALLIBURTON NUS
Environmental Corporation

The CED Asphalt Disposal Area consists of an open trench which is approximately 700 feet long, 8 feet wide, and five feet deep. The long axis of the trench is oriented WSW-ESE, parallel to Battalion Boulevard. The eastern tenth of the trench is filled with a black, solid, asphaltic material. There are several small trees and boulders (diameter greater than 2 feet) in the trench. The topography in the vicinity of the trench is flat.

The Munitions Bunkers at Calf Pasture Point are located along Magazine Road, a dirt road which leads from Sanford Road onto Calf Pasture Point. The three bunkers are located approximately 240 feet apart. The bunkers are the only structures on Calf Pasture Point. The bunkers are constructed of plate metal on concrete foundations. The area surrounding the bunkers consists primarily of vacant land overgrown with brush and small trees. The topography immediately behind the munitions bunkers is dominated by a north-south oriented bedrock outcrop which rises to an elevation of approximately 40 feet above the surrounding terrain.

1.4 Local Geology

This description is provided to familiarize the Subcontractor with the general subsurface conditions anticipated at the work site. The description provided is not comprehensive and may not be complete. Subsurface conditions encountered may differ from those stated in this section. The Subcontractor, and not the HNUS Representative, is responsible for assessing the subsurface conditions at the site when scoping, estimating and implementing the services described in this specification.

Bedrock in the NCBC area consists of a complex syncline of Pennsylvanian Age metasedimentary rocks. Overburden in the NCBC area consists of glacial outwash deposits (sand and gravel). The depth to bedrock is generally greater than 50 feet. The depth to the water table is generally 20 feet or less. Boring logs for monitoring wells previously installed by other contractors near the CED Drum Storage Area, are included in Attachment A. This information is provided as general information and may not be representative of geologic conditions at the proposed survey locations.

1.5 Scope of Work

The Contractor shall provide all equipment, personnel and materials to accomplish the objectives stated above, including, mobilization, demobilization, conducting the ground penetrating radar, magnetic, and electromagnetic surveys, data reduction, data interpretation, and data reporting.

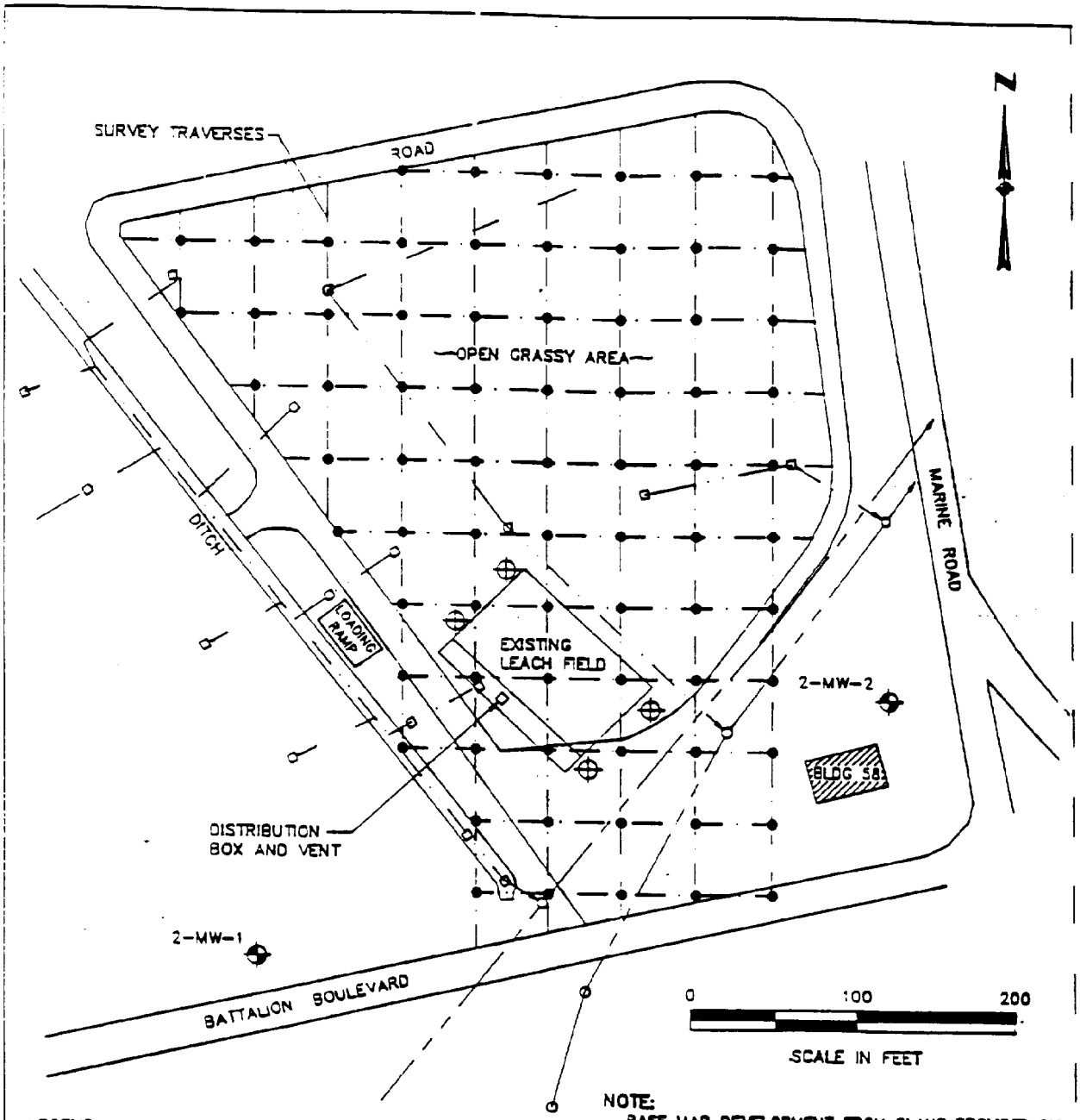
1.6 Potential Hazardous Exposures

Information regarding potential hazardous exposures, personal protective equipment and surveillance is provided in the attached Site-Specific Health and Safety Plan.

2.0 TECHNICAL REQUIREMENTS

APPENDIX B

STUDY AREA 01 - CED DRUM STORAGE AREA
HISTOGRAM OF ELECTROMAGNETIC DATA
ELECTROMAGNETIC PROFILES



LEGEND

- CATCH BASIN
- EXISTING MONITORING WELL
- EXISTING TEST WELL
- SURVEY SAMPLE

NOTE:
BASE MAP DEVELOPMENT FROM PLANS PROVIDED BY THE NCBC ENGINEERING DEPARTMENT ENTITLED "SUB-SURFACE A.B.D." DATED 6/88, SHEETS NO. 2169 AND 2259, ORIGINAL SCALE 1"=20', AND "MASTER SHORE STATION DEVELOPMENT PLAN" DATED 8/85, y & d DRAWING NO. 638272, SHEET 14 OF 27, AND FIGURE 5 OF TRC PHASE II WORK PLAN (2/92)

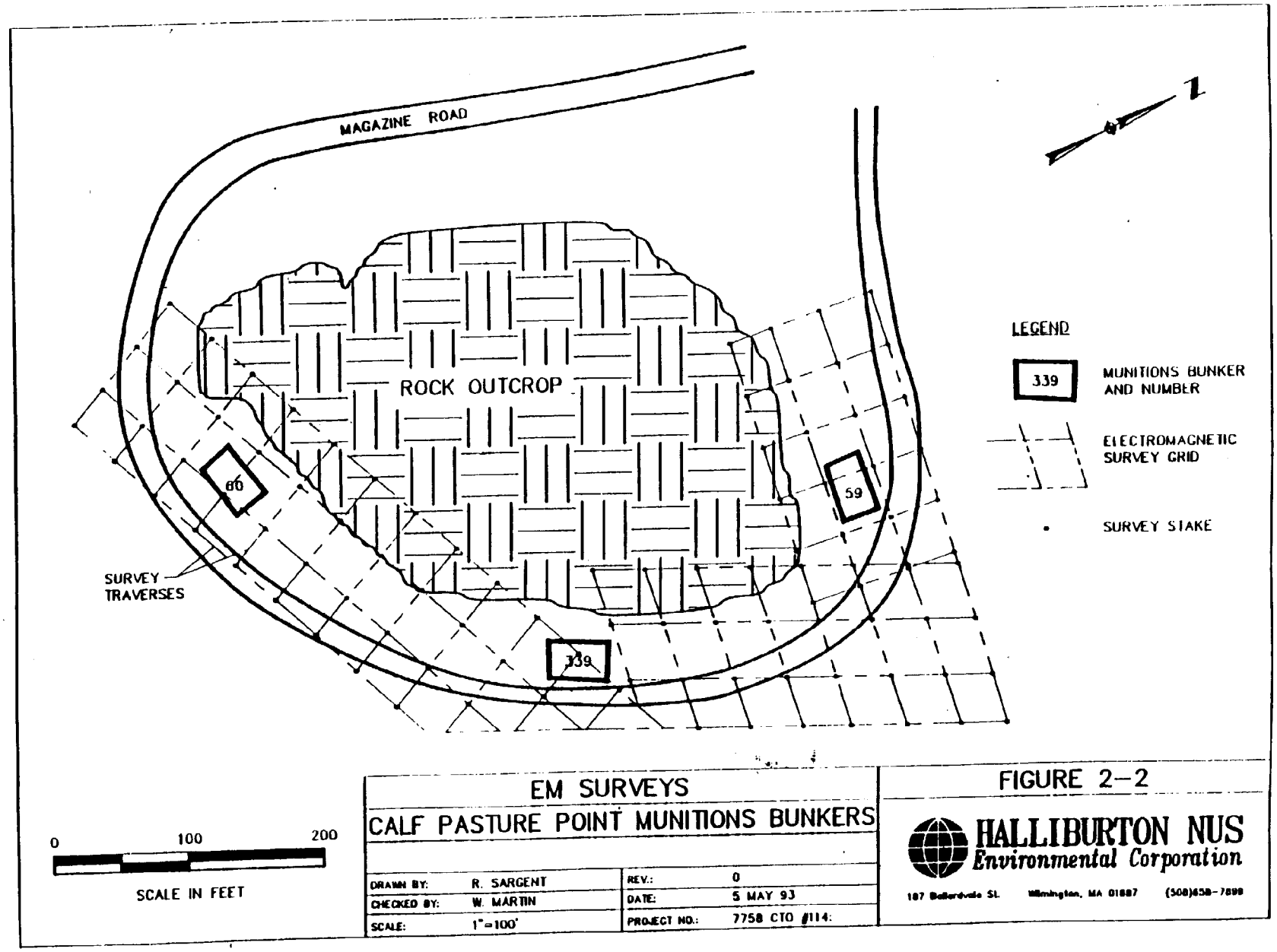
EM 31 & MAGNETOMETER SURVEYS

STUDY AREA 1 – CED DRUM STORAGE AREA

FIGURE 2-1

DRAWN BY:	R. SARGENT	REV.:	0
CHECKED BY:	N. MARTIN	DATE:	5 MAY 93
SCALE:	1"=100'	PROJECT NO.:	7758 CTO #114:

HALLIBURTON NUS
Environmental Corporation
157 Cabot Street St. Wakefield, MA 01887 (508)[illegible]-7000



EM SURVEYS

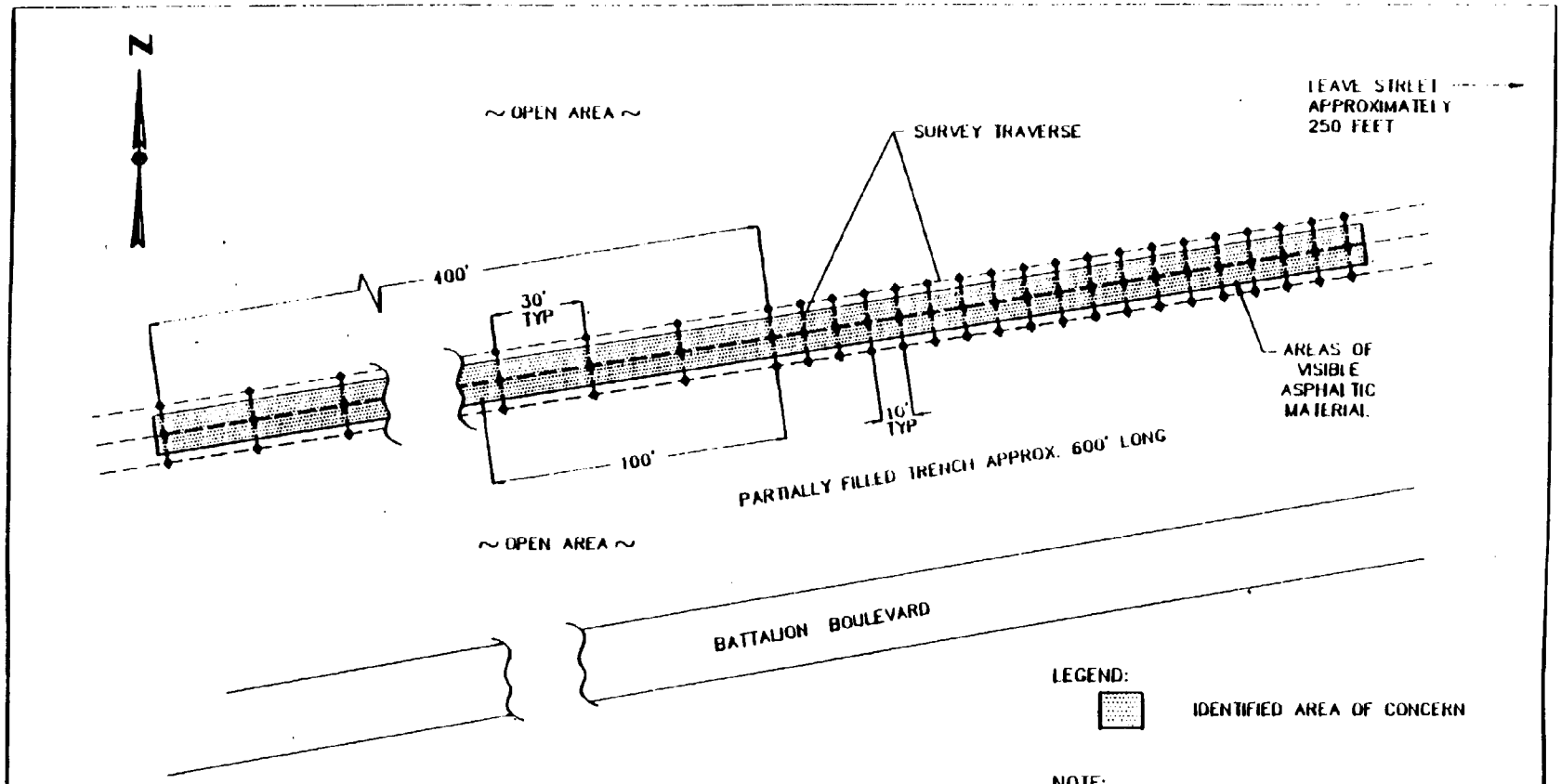
CALF PASTURE POINT MUNITIONS BUNKERS

DRAWN BY:	R. SARGENT	REV.:	0
CHECKED BY:	W. MARTIN	DATE:	5 MAY 93
SCALE:	1"=100'	PROJECT NO.:	7758 CTO #114:

FIGURE 2-2

HALLIBURTON NUS Environmental Corporation

187 Ballardvale St. Wilmington, MA 01887 (508)658-7899



LEGEND:

IDENTIFIED AREA OF CONCERN

NOTE:
BASE MAP DEVELOPED FROM PLANS PROVIDED BY THE NCBC ENGINEERING DEPARTMENT ENTITLED "MASTER SHORE STATION DEVELOPMENT PLAN" DATED 6/85, Y & D DRAWING NO. 638272, SHEET 14 OF 27, AND FIGURE 2-8 OF INITIAL ASSESSMENT STUDE, 9/84.

0 50 100

SCALE IN FEET

GPR SURVEY

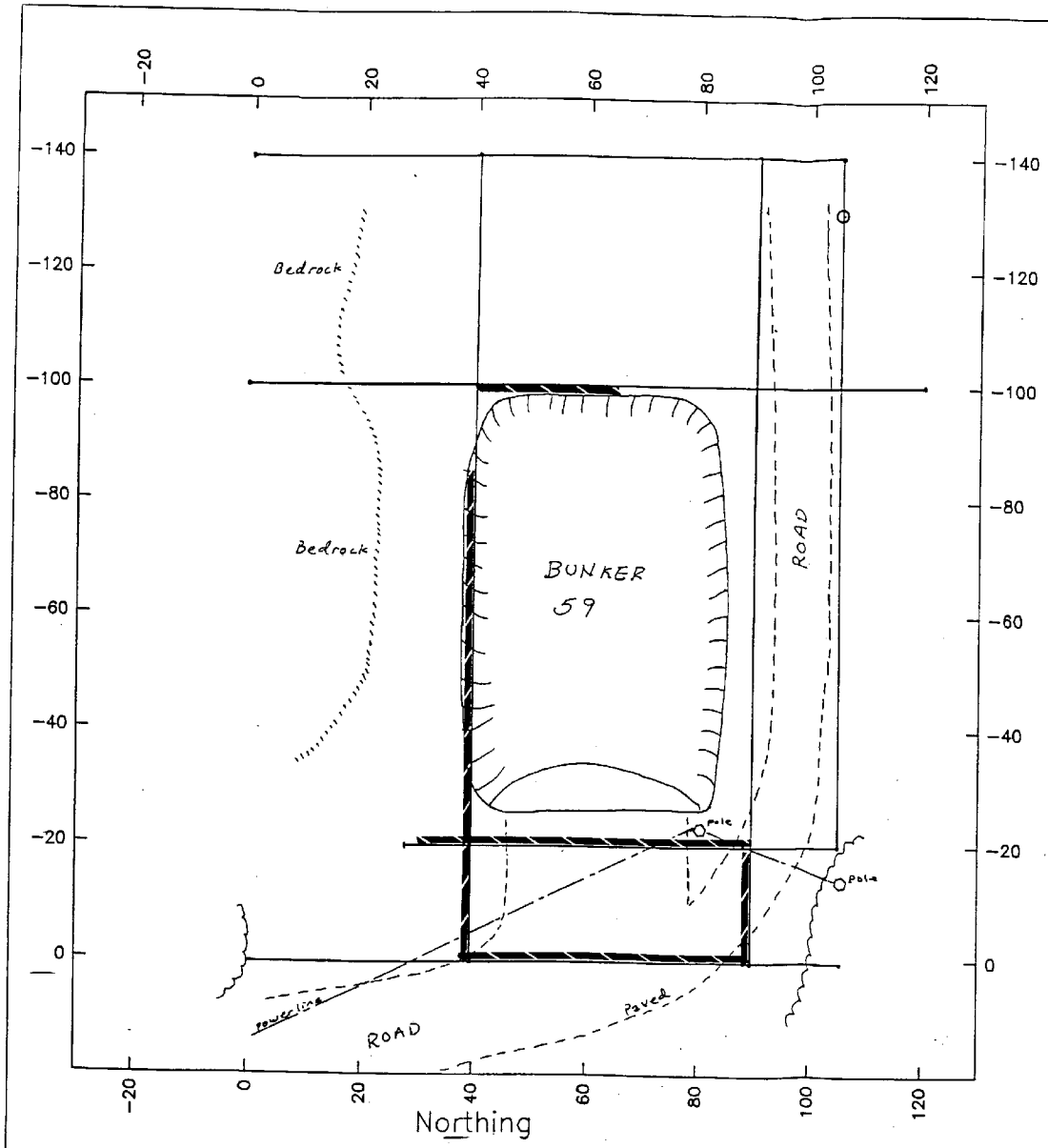
STUDY AREA 04 – CED ASPHALT DISPOSAL AREA

DRAWN BY:	R. SARGENT	REV.:	0
CHECKED BY:	W. MARTIN	DATE:	5 MAY 93
SCALE:	1"=50'	PROJECT NO.:	7758 CTO #114:

FIGURE 2-3

HALLIBURTON NUS Environmental Corporation

187 Ballardvale St. Wilmington, MA 01887 (508)658-7888



LEGEND

- Weak EM Anomaly
- Moderate Em Anomaly
- Strong EM Anomaly
- Anomalous Zone
- Survey Line

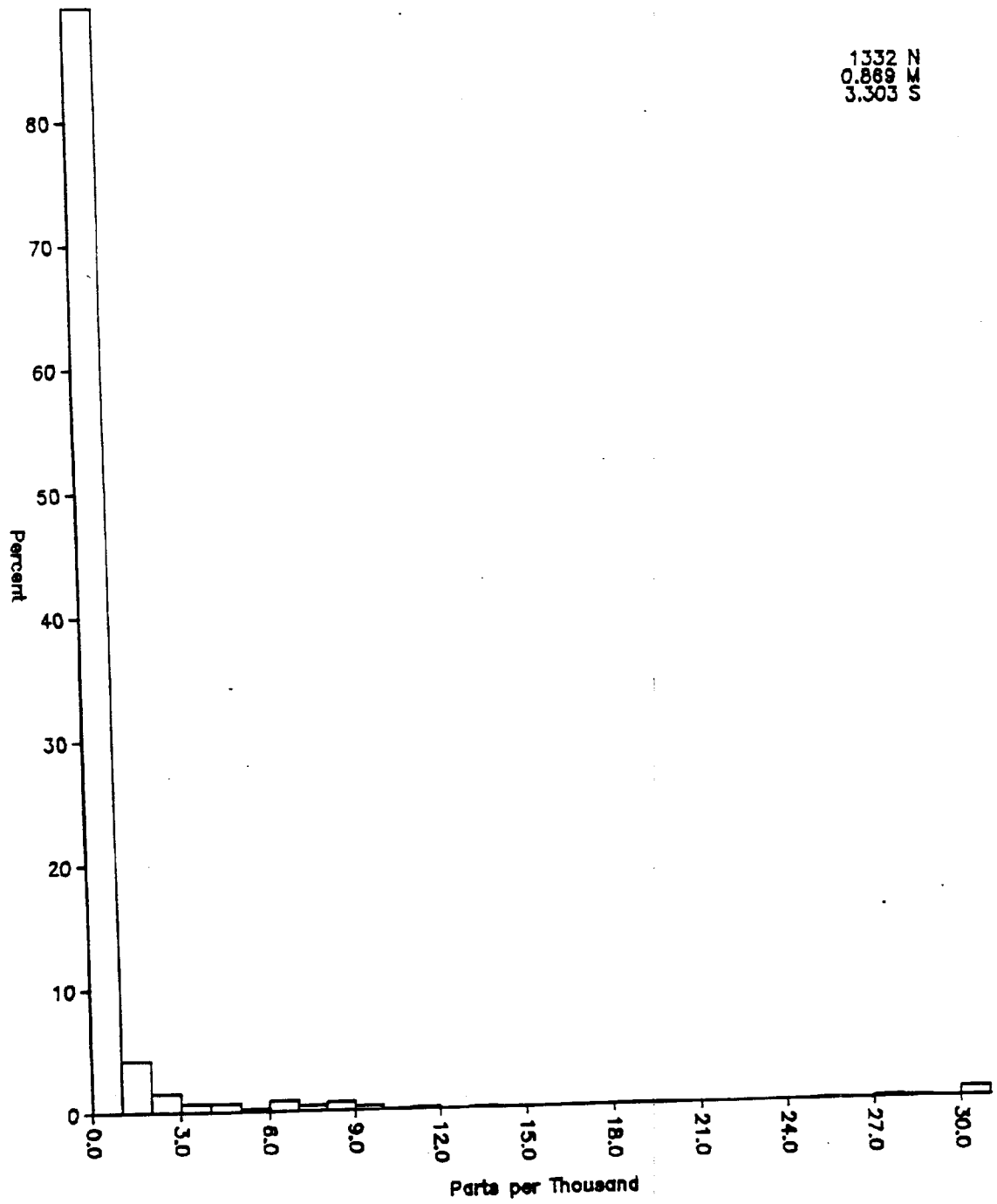
Instrument: Geonics EM-31

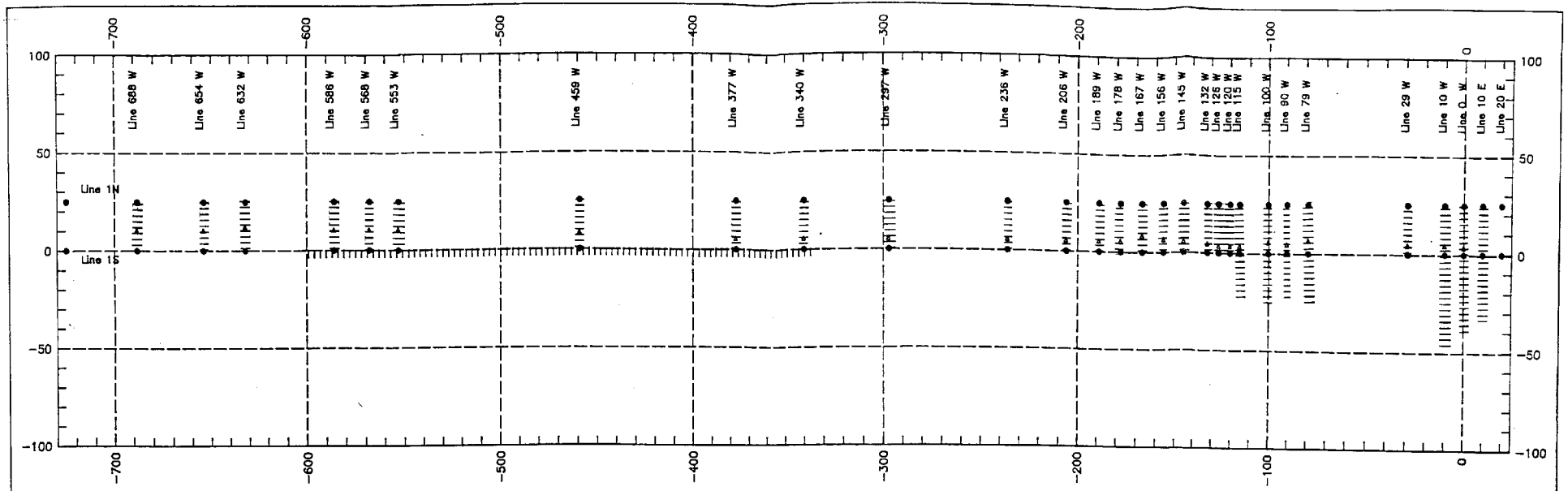
Electromagnetic Anomaly Map	
Grid C: Calf Pasture Point Munitions Bunkers	
For: Halliburton NUS Environmental Corporation	
Davisville, Rhode Island	Scale : 1" = 20'
Survey Date: June 9-10, 1993	Revisions
Northeast Geophysical Services A division of F.M. Beck, Inc. Yarmouth, Maine	

FIGURE 6

Area 1

Electromagnetic (Inphase) Data





LEGEND

- ● stake location
- ▲ south edge of visible trench
- area of anomalous radar reflections – see text

Instrument: GSSI SIR–3 with 300 MHz antenna

Grid coordinates in feet.

Note: West–east dimensions were measured. Trench width is approximately 8 feet. Drawing is schematic.

0 50 100 150

Scale in feet (approximate)

N Grid

Ground Penetrating Radar Survey	
Study Area 4 – CED Asphalt Disposal Area	
For: Halliburton NUS Environmental Corporation	
Davisville, Rhode Island	Scale : 1"–50'
Survey Date: June 10, 1993	Revisions

Northeast Geophysical Services
A division of F.M. Beck, Inc.
Yarmouth, Maine

FIGURE 10

Study Area 01 - CED Drum Storage Area 6/93
Histogram of Electromagnetic (Inphase) Data

(Values analyzed are absolute value of the inphase minus the statistical mode, -0.7; units are parts per thousand of the total field.)

Linear classes

Class #	class min	class max	mean	count	percent	cum % <
1	0.00	1.00	0.209	1187	89.11	89.11
2	1.00	2.00	1.457	56	4.20	93.32
3	2.00	3.00	2.325	20	1.50	94.82
4	3.00	4.00	3.473	9	0.68	95.50
5	4.00	5.00	4.557	9	0.68	96.17
6	5.00	6.00	5.333	3	0.23	96.40
7	6.00	7.00	6.430	11	0.83	97.22
8	7.00	8.00	7.392	6	0.45	97.67
9	8.00	9.00	8.431	9	0.68	98.35
10	9.00	10.00	9.663	4	0.30	98.65
11	10.00	11.00	10.041	1	0.08	98.72
12	11.00	12.00	11.675	2	0.15	98.87
14	13.00	14.00	13.280	1	0.08	98.95
26	25.00	26.00	25.141	1	0.08	99.02
28	27.00	28.00	27.279	2	0.15	99.17
29	28.00	29.00	28.080	1	0.08	99.25
31	30.00	31.00	30.918	10	0.75	100.00
				=======	========	
				1332	100.00	

TECHBASE information:
1332 points included in classes. 0 points outside the axis range.

Study Area 01- CED Drum Storage Area 6/93
Instrument: Geonics EM-31

Summary Statistics of Electromagnetic Data

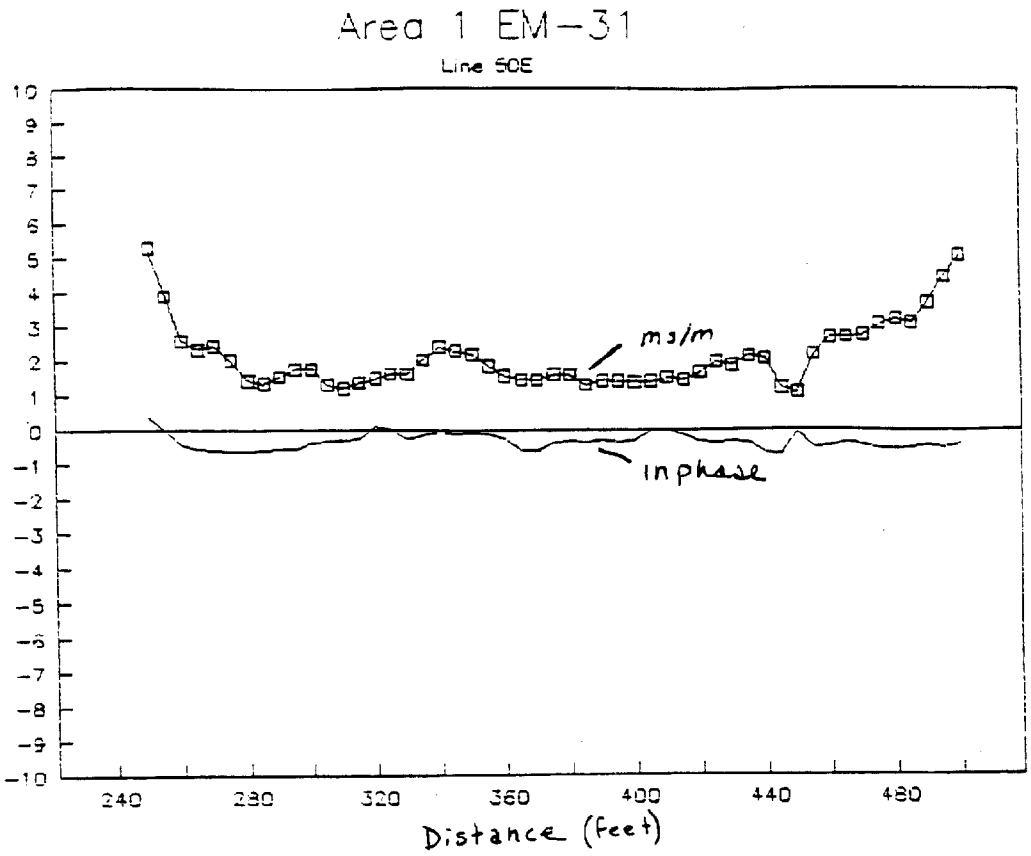
	Quadrature (milliSiemens per meter)	Inphase (parts per thousand)
Number	1732	1332
Mean	1.451	-1.037
Std Dev	3.843	3.399
Variance	14.8	11.6
Maximum	35.4	10.7
Minimum	-30.8	-31.7
Range	66.1	42.3
Median	1.60	-0.60
Mode	1.5	-0.7

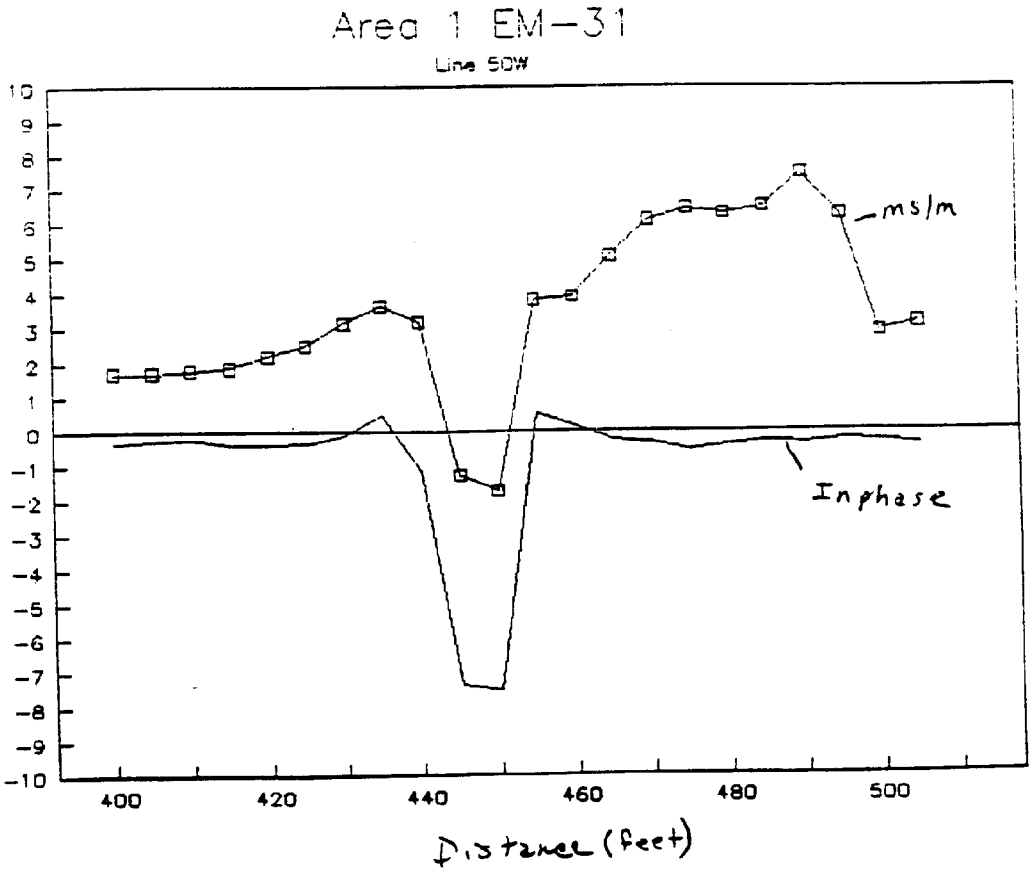
Study Area 01 - IED Drum Storage Area
Histogram of Electromagnetic (Quadrature) Data

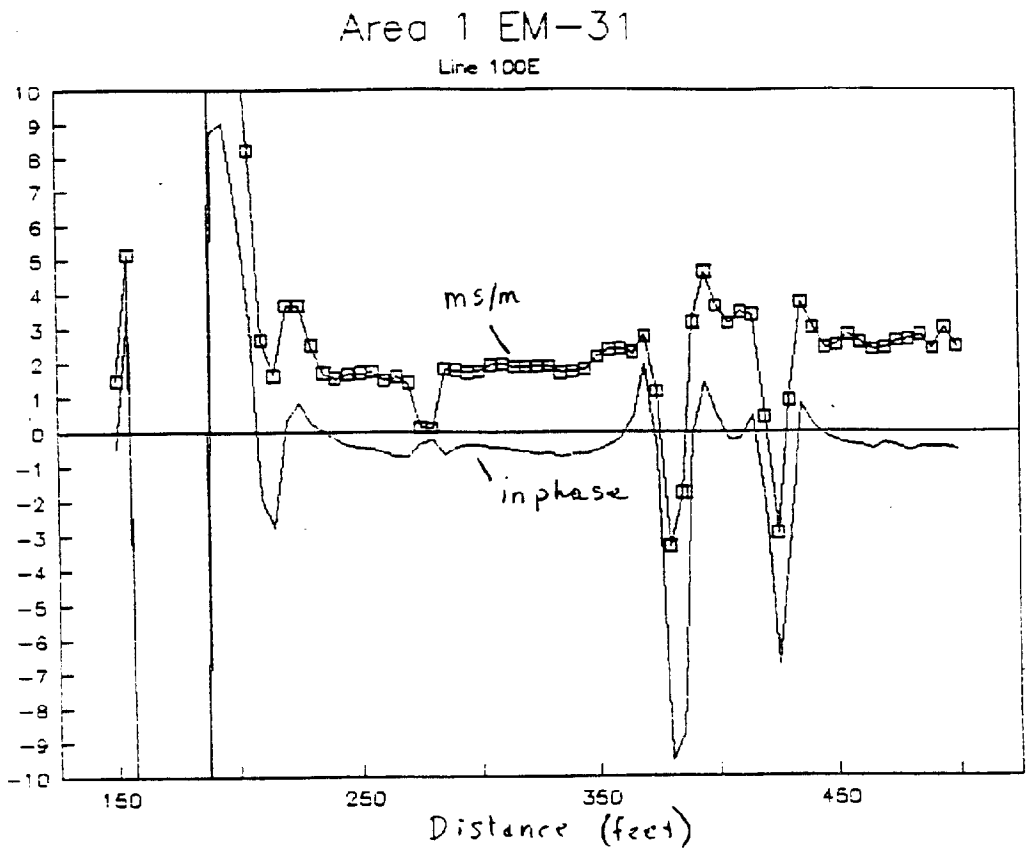
Linear classes

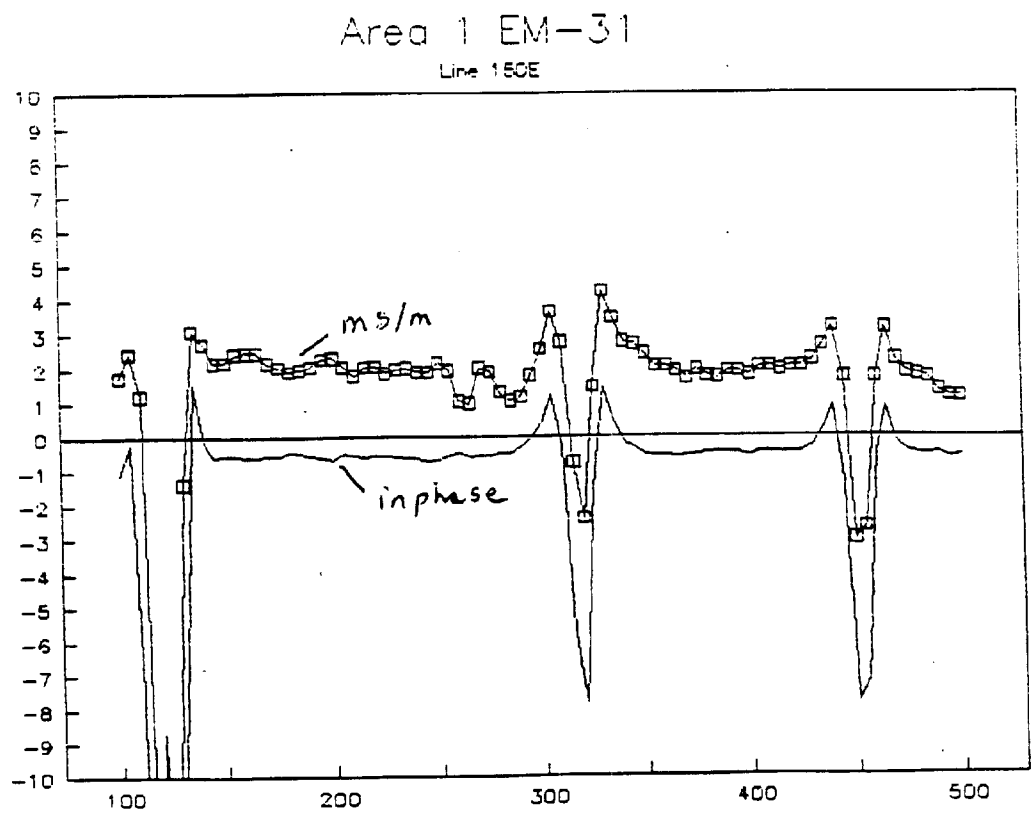
Class #	class min	class max	mean	count	percent	cum % <
1	-31.00	-30.00	-30.749	13	0.98	0.98
10	-22.00	-21.00	-21.720	2	0.15	1.13
16	-16.00	-15.00	-15.120	1	0.08	1.20
20	-12.00	-11.00	-11.680	1	0.08	1.28
22	-10.00	-9.00	-9.460	1	0.08	1.35
26	-6.00	-5.00	-5.820	1	0.08	1.43
27	-5.00	-4.00	-4.473	3	0.23	1.65
28	-4.00	-3.00	-3.309	7	0.53	2.18
29	-3.00	-2.00	-2.602	9	0.68	2.85
30	-2.00	-1.00	-1.515	11	0.83	3.68
31	-1.00	0.00	-0.488	17	1.28	4.95
32	0.00	1.00	0.769	100	7.51	12.46
33	1.00	2.00	1.479	739	55.48	67.94
34	2.00	3.00	2.388	291	21.85	89.79
35	3.00	4.00	3.448	86	6.46	96.25
36	4.00	5.00	4.446	30	2.25	98.50
37	5.00	6.00	5.247	6	0.45	98.95
38	6.00	7.00	6.328	5	0.38	99.32
39	7.00	8.00	7.480	1	0.08	99.40
40	8.00	9.00	8.220	1	0.08	99.47
41	9.00	10.00	9.840	1	0.08	99.55
44	12.00	13.00	12.680	1	0.08	99.62
45	13.00	14.00	13.140	1	0.08	99.70
48	16.00	17.00	16.350	2	0.15	99.85
59	27.00	28.00	27.780	1	0.08	99.92
67	35.00	36.00	35.380	1	0.08	100.00
				=======	========	
				1332	100.00	

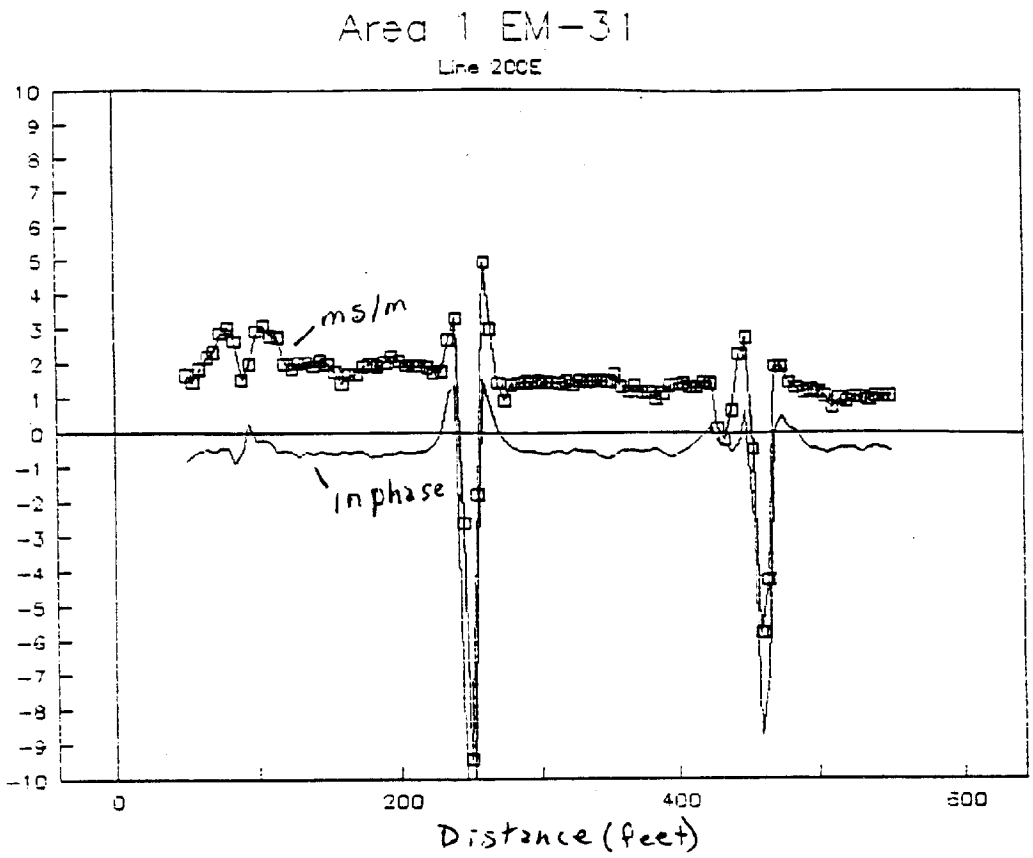
TECHBASE information:
1332 points included in classes. 0 points outside the axis range.

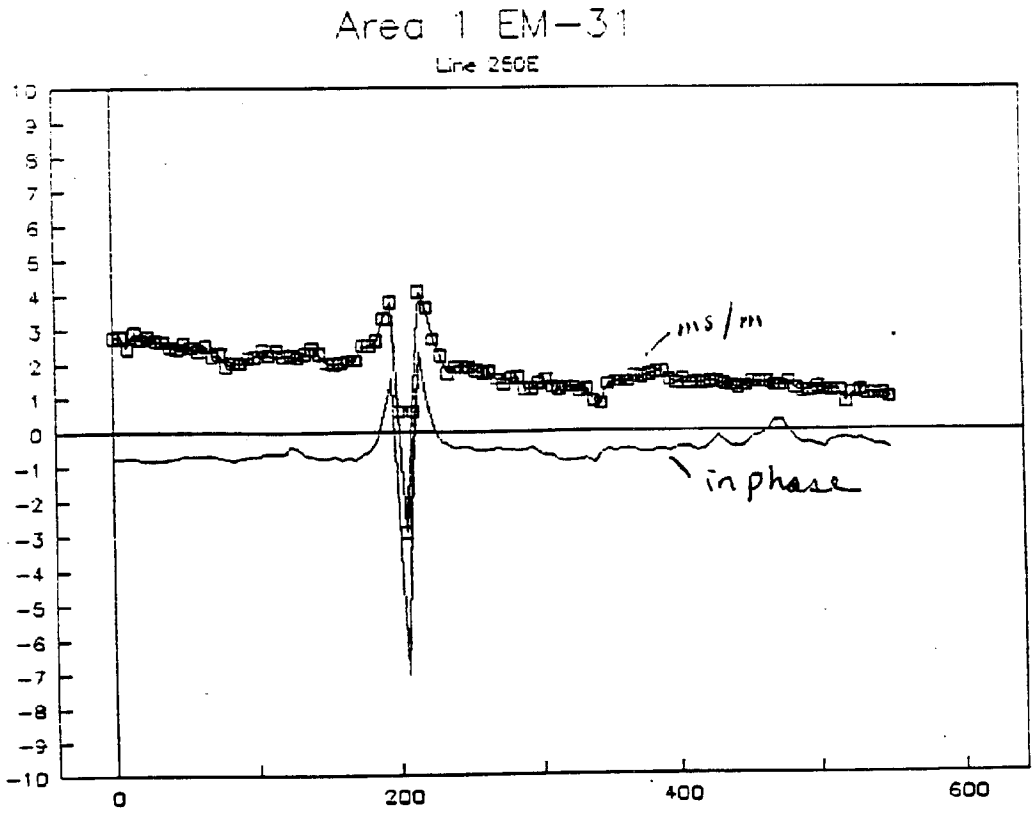

Area 1 EM-31
Line 50E
ms/m
inphase
Distance (feet)

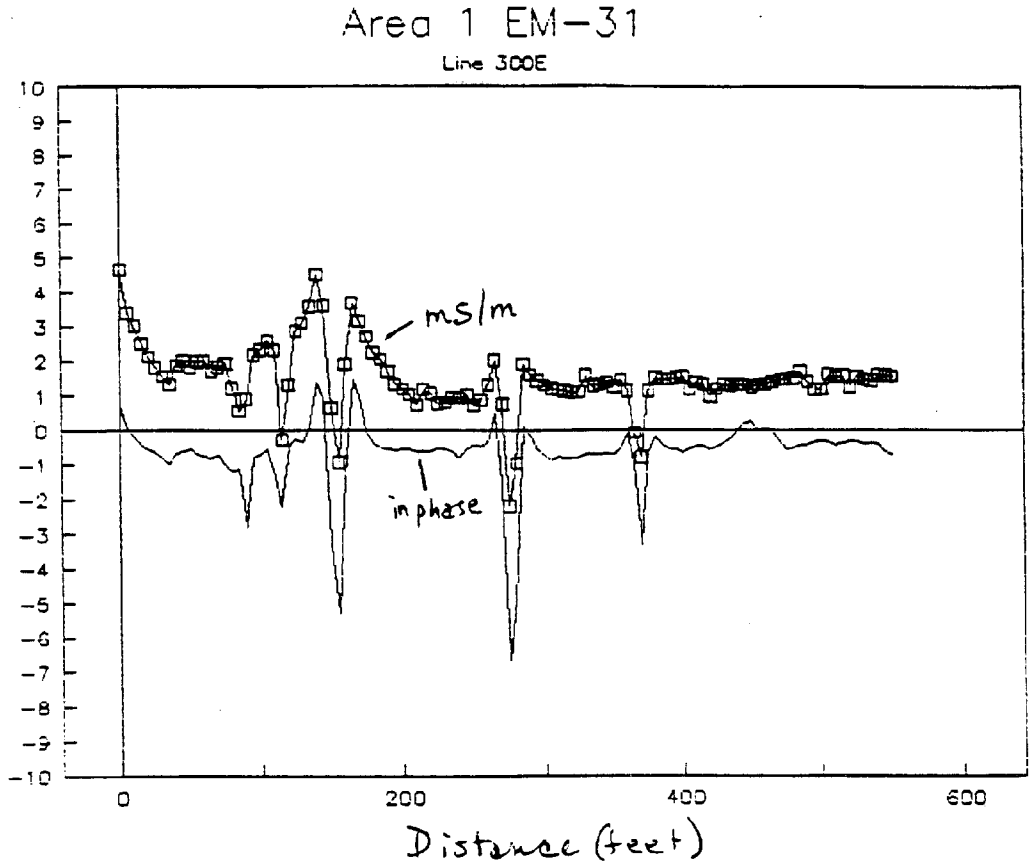

Area 1 EM-31
Line 50W
ms/m
Inphase
Distance (feet)

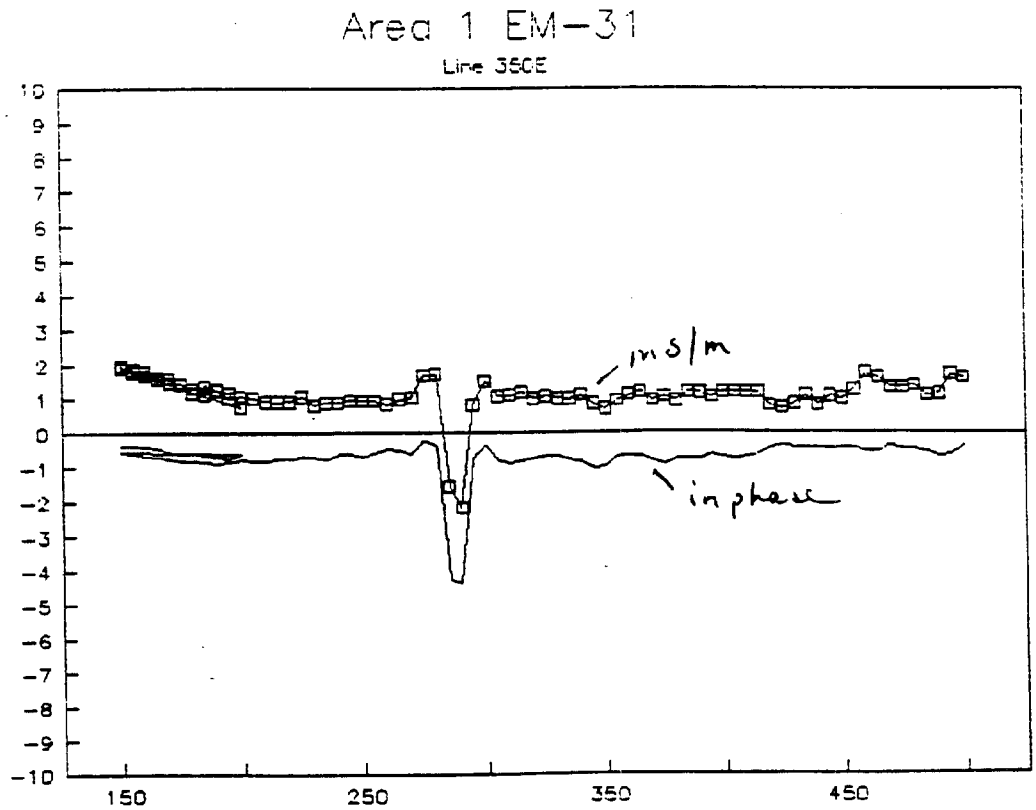

Area 1 EM-31
Line 100E
ms/m
inphase
Distance (feet)

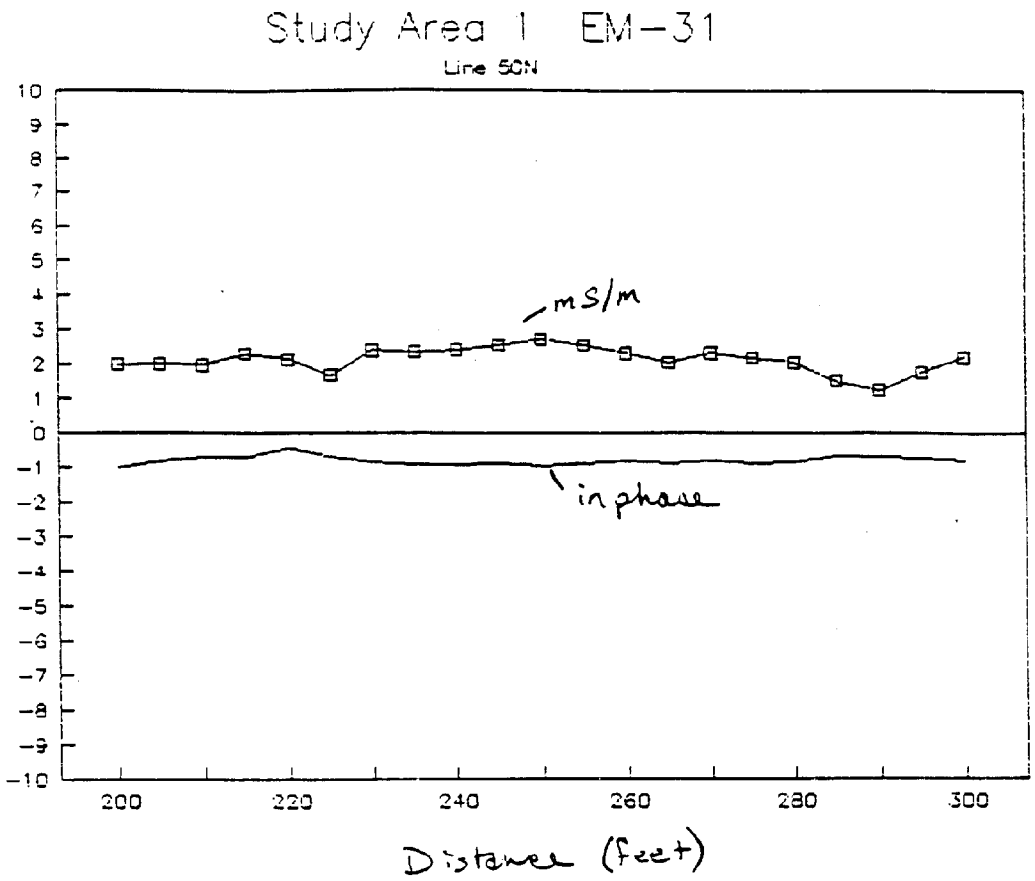

Area 1 EM-31
Line 150E
ms/m
inphase

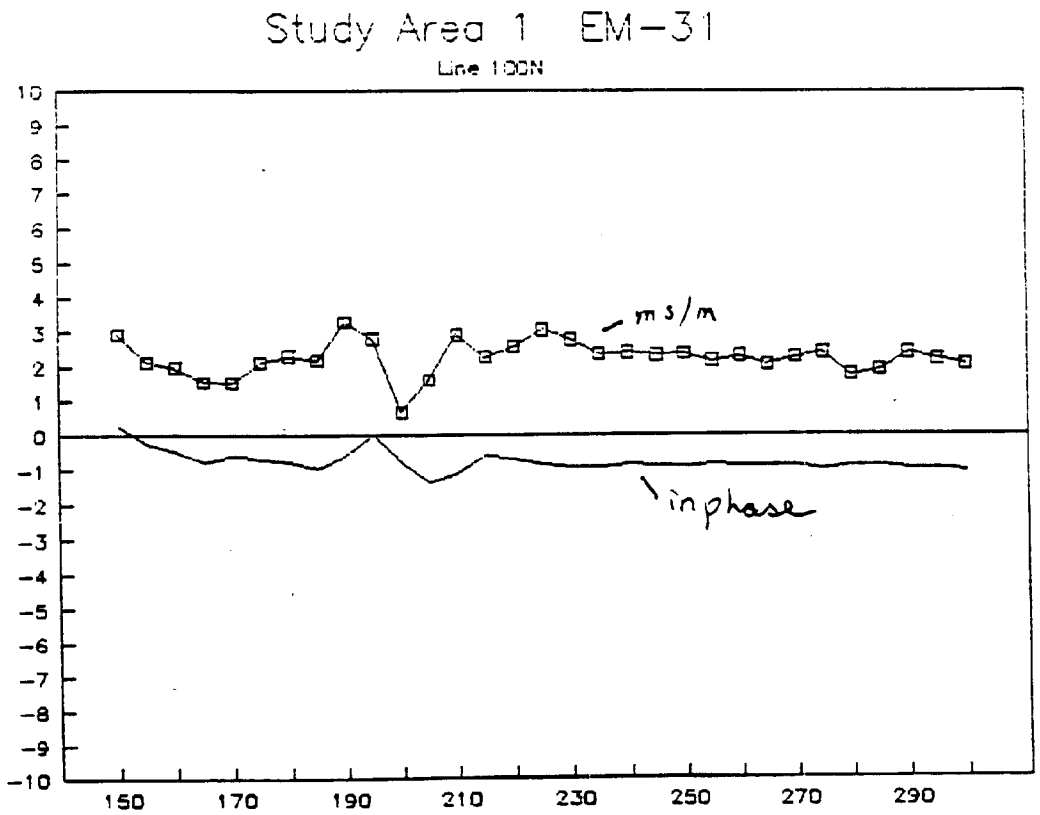

Area 1 EM-31
Line 200E
ms/m
inphase
Distance (feet)

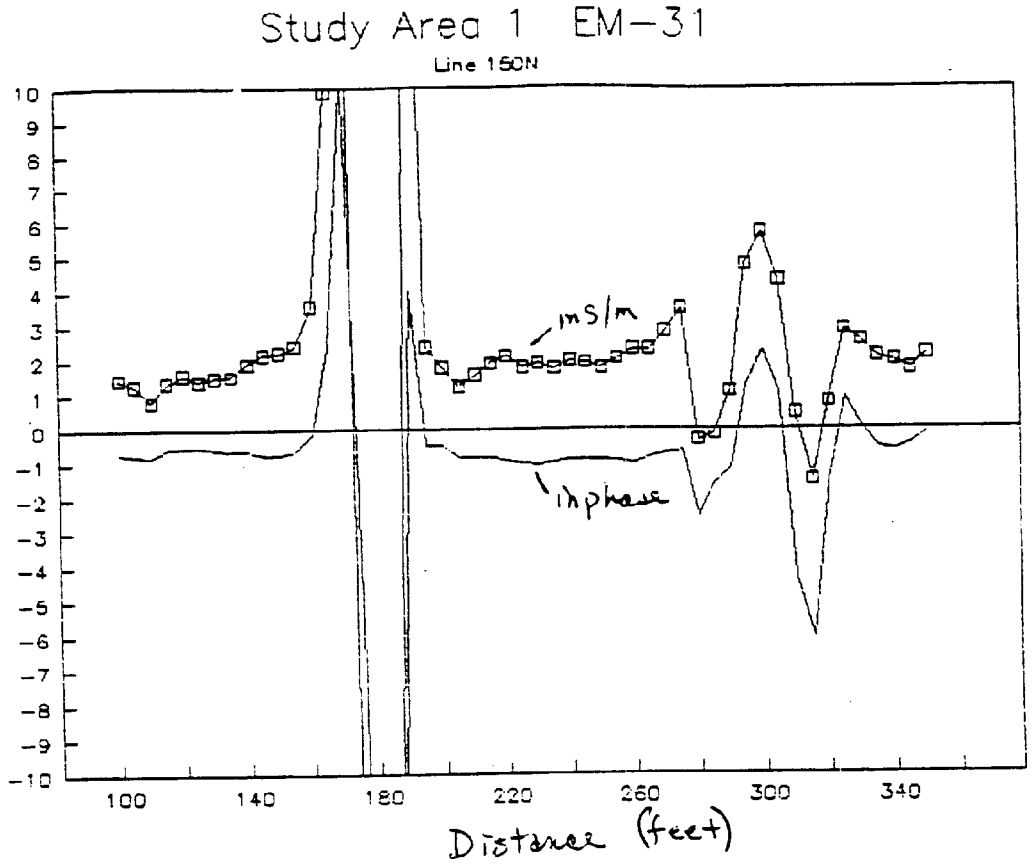

Area 1 EM-31
Line 250E
ms/m
inphase

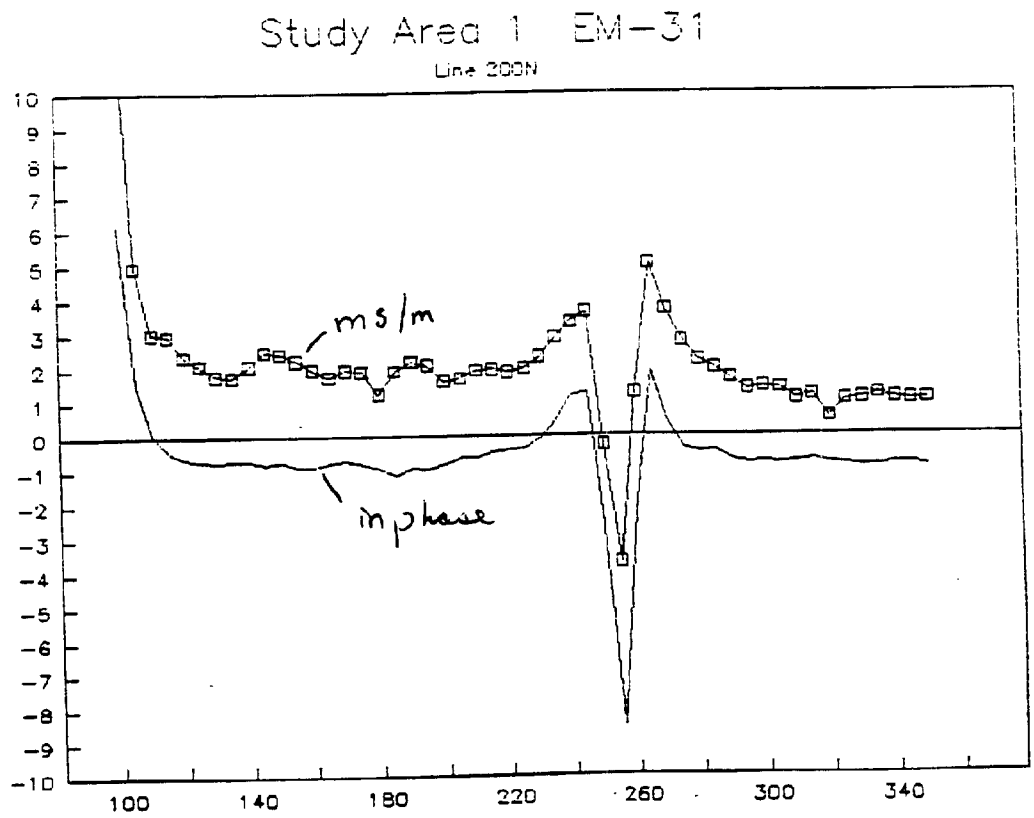

Area 1 EM-31
Line 300E
mS/m
in phase
Distance (feet)

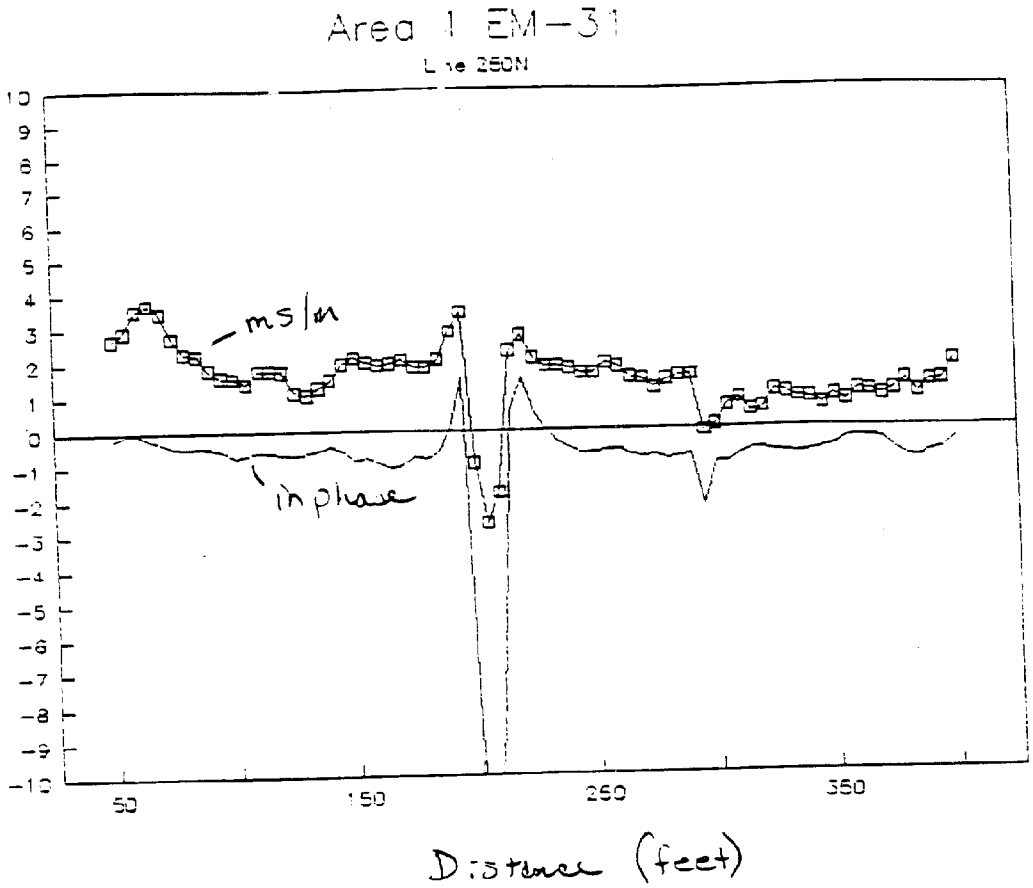

Area 1 EM-31
Line 350E
mS/m
in phase

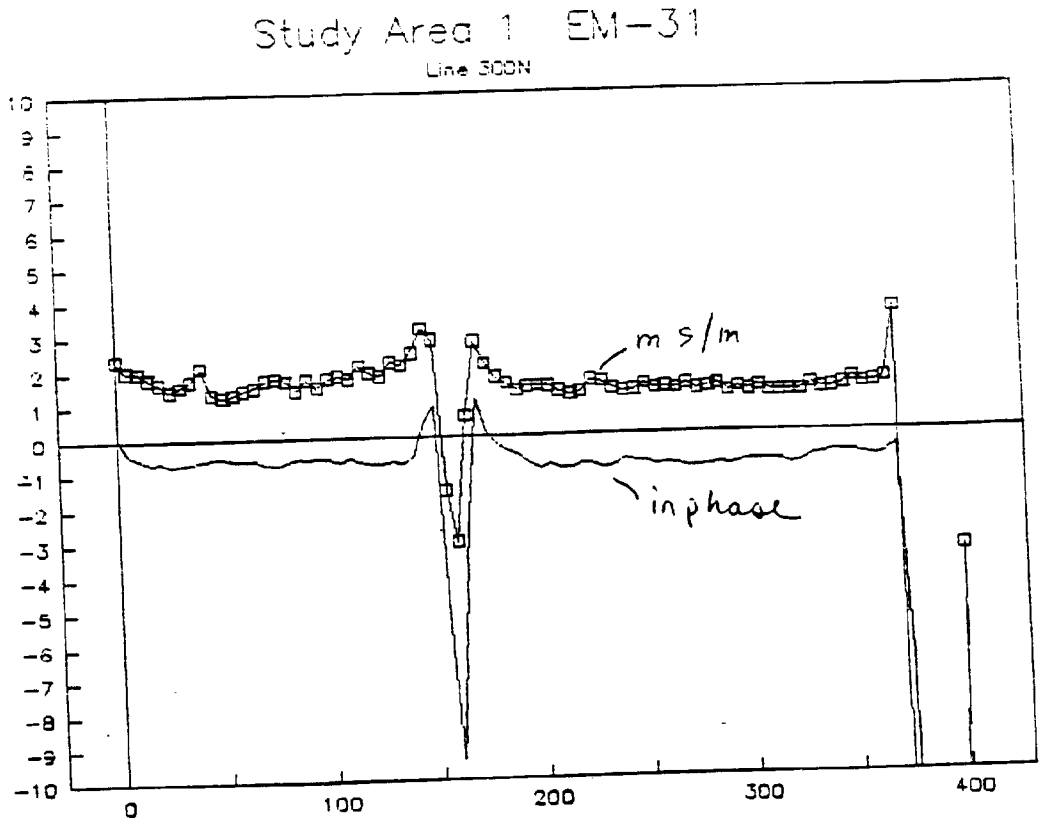

Study Area 1 EM-31
Line 50N
mS/m
inphase
Distance (feet)

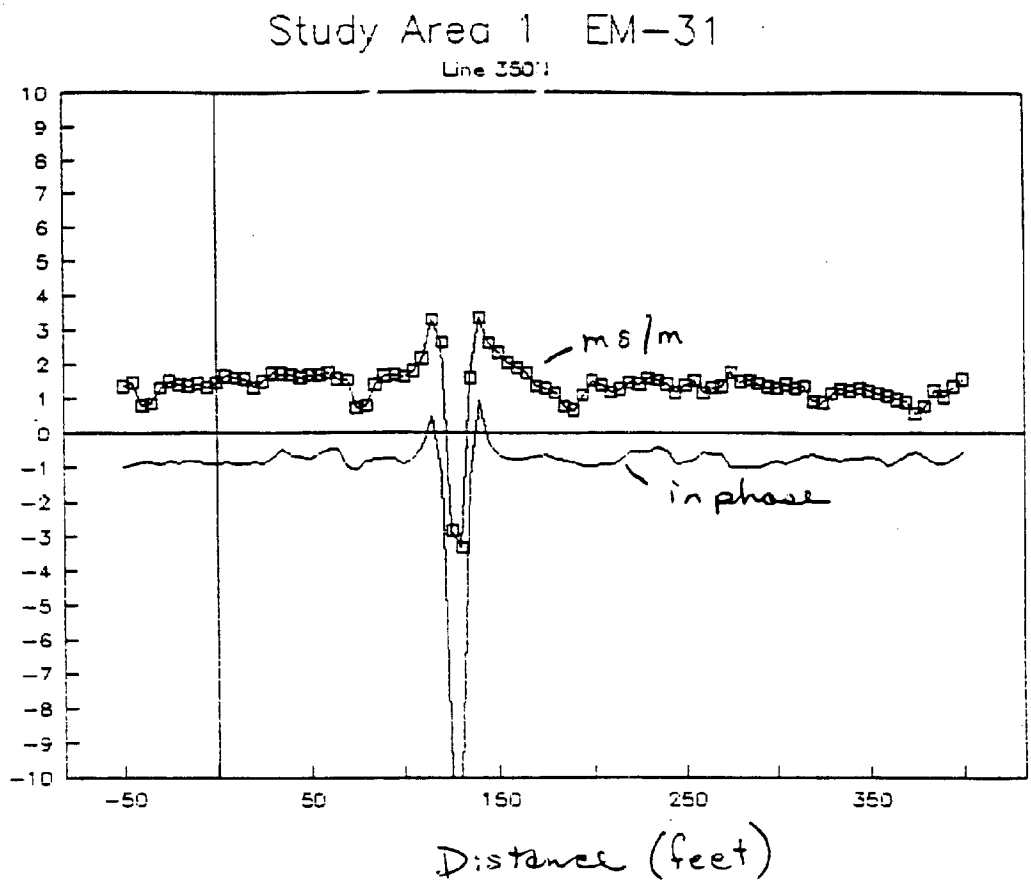

Study Area 1 EM-31
Line 100N
mS/m
inphase

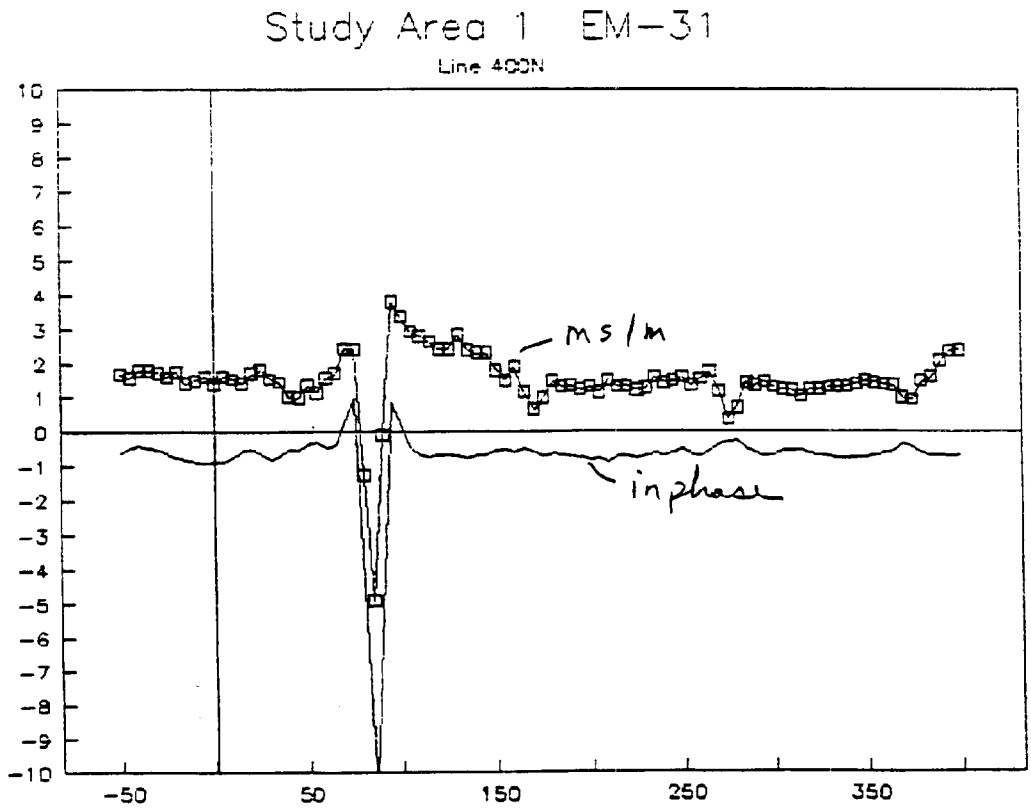

Study Area 1 EM-31
Line 150N
mS/m
inphase
Distance (feet)

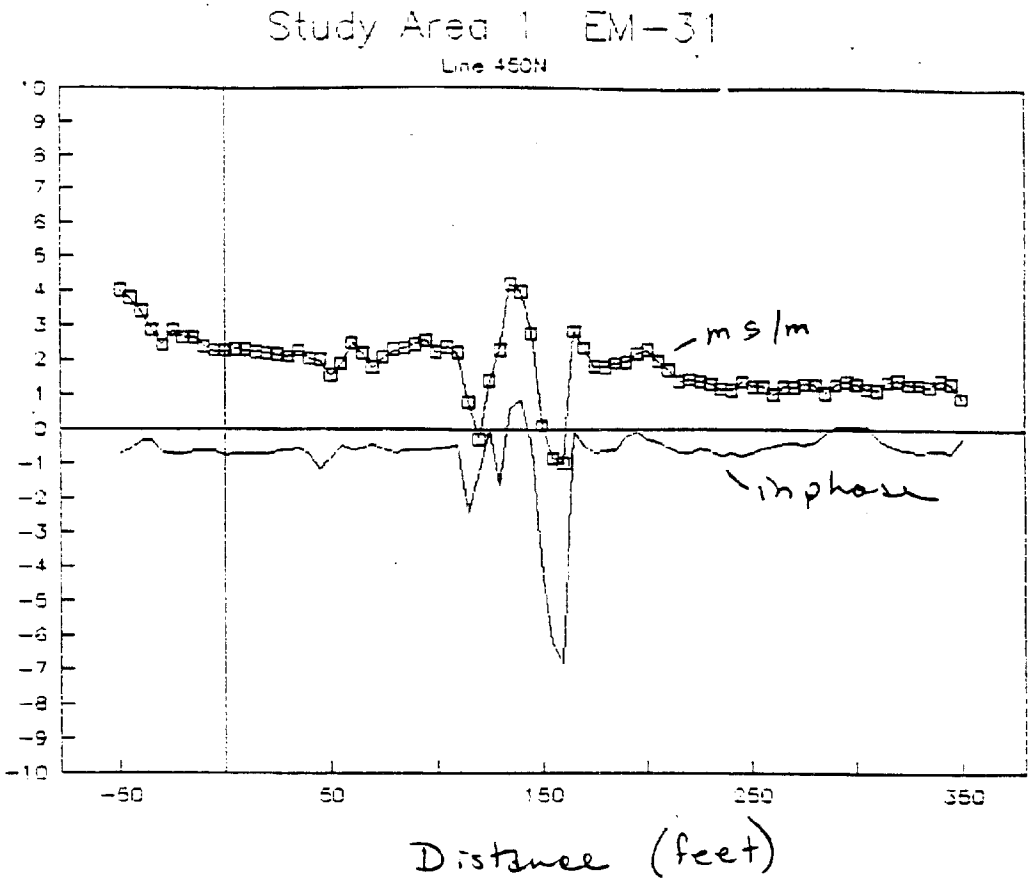

Study Area 1 EM-31
Line 200N
mS/m
inphase

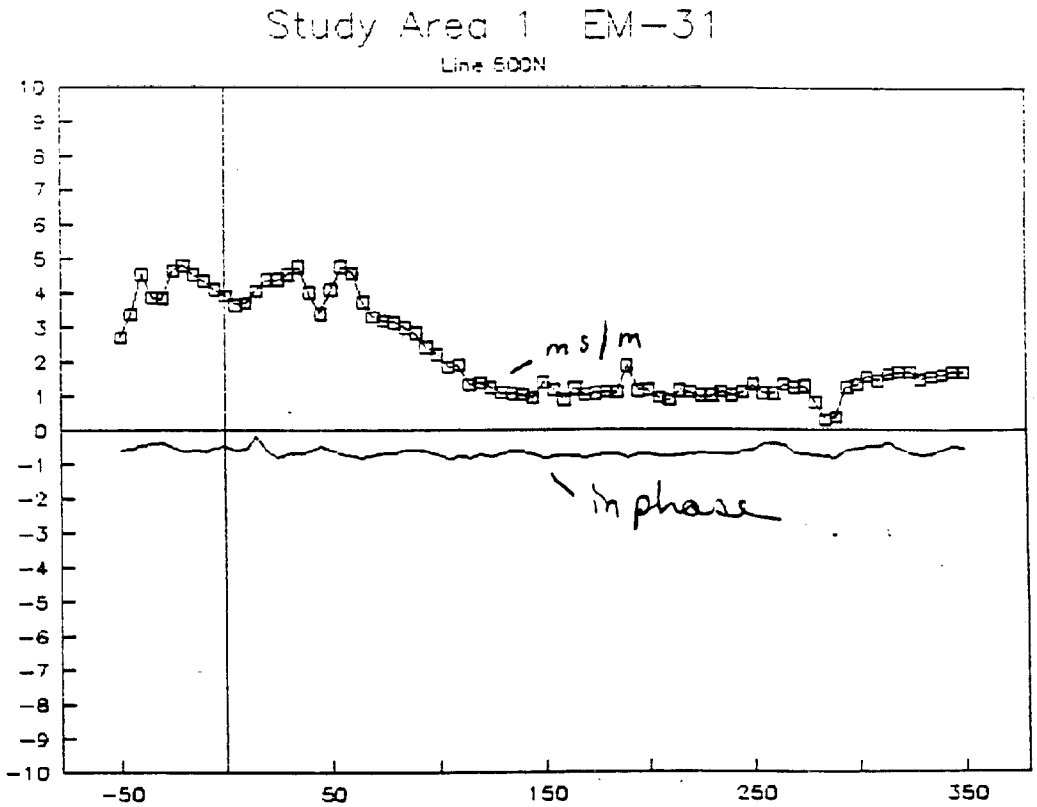

Area 1 EM-31
Line 250N
ms/m
in phase
Distance (feet)


Study Area 1 EM-31
Line 300N
ms/m
in phase


Study Area 1 EM-31
Line 350N
ms/m
inphase
Distance (feet)

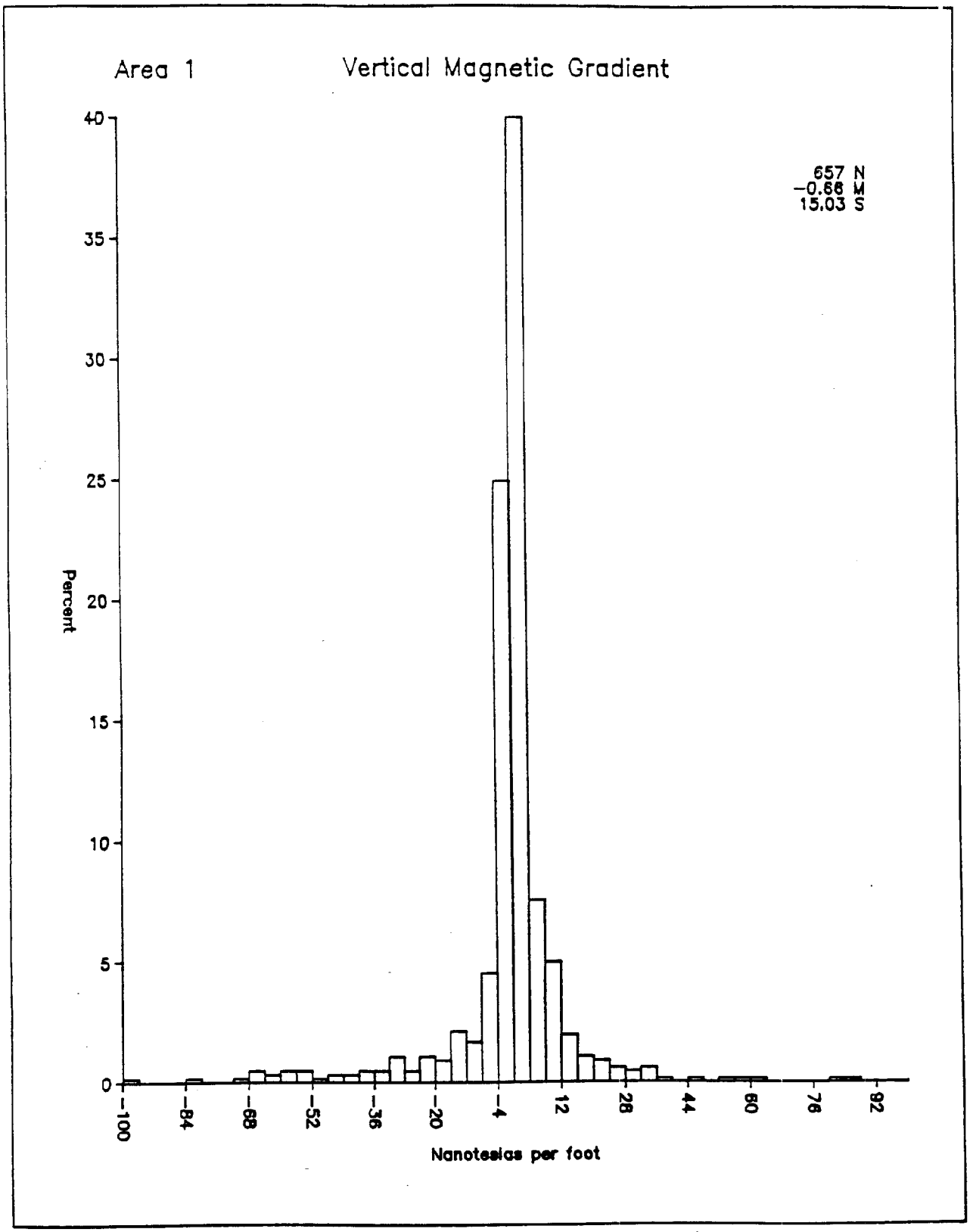

Study Area 1 EM-31
Line 400N
ms/m
inphase


Study Area 1 EM-31
Line 450N
ms/m
inphase
Distance (feet)


Study Area 1 EM-31
Line 500N
ms/m
inphase

APPENDIX C

STUDY AREA 01 - CED DRUM STORAGE AREA
HISTOGRAM OF MAGNETIC GRADIENT DATA
MAGNETIC GRADIENT PROFILES


Area 1
Vertical Magnetic Gradient
657 N
-0.66 M
15.03 S
Percent
40
35
30
25
20
15
10
5
0
-100
-84
-68
-52
-36
-20
-4
12
28
44
60
76
92
Nanoteslas per foot

Study Area 01 - CED Drum Storage Area 6/93
Histogram of Vertical Magnetic Gradient Data

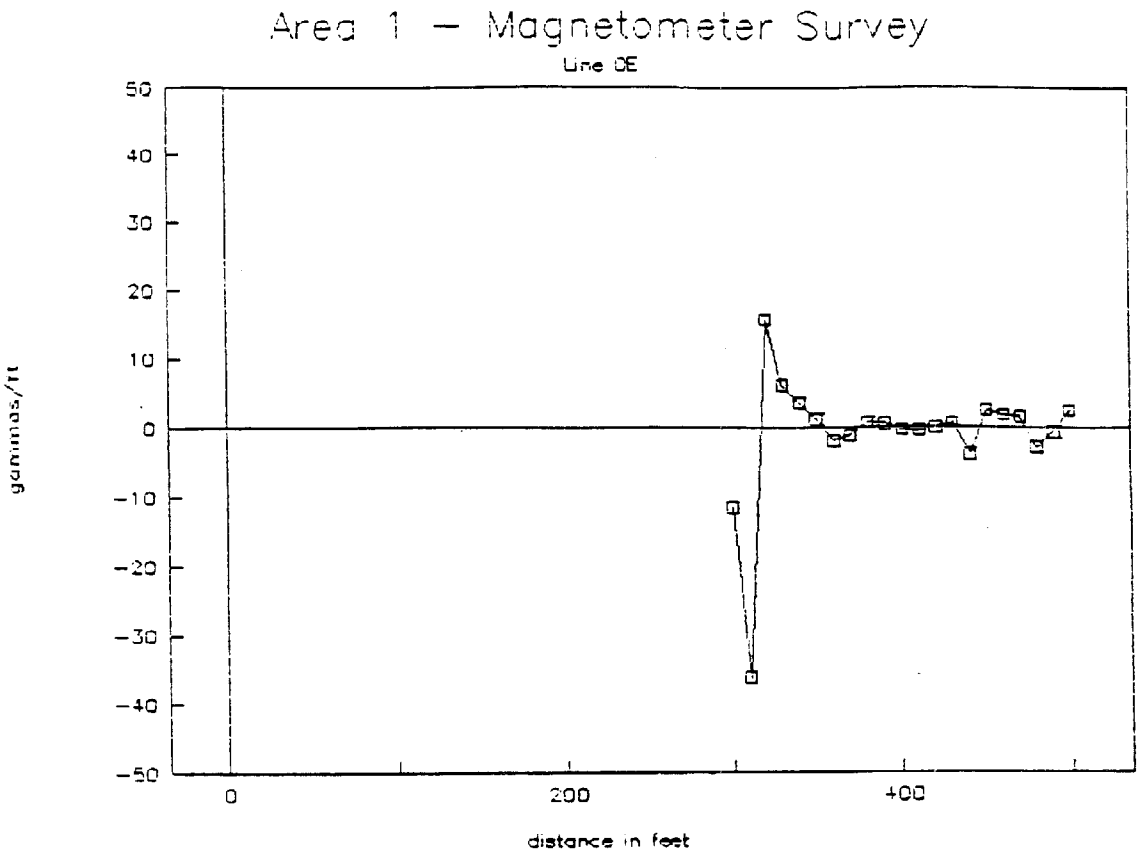
Linear classes

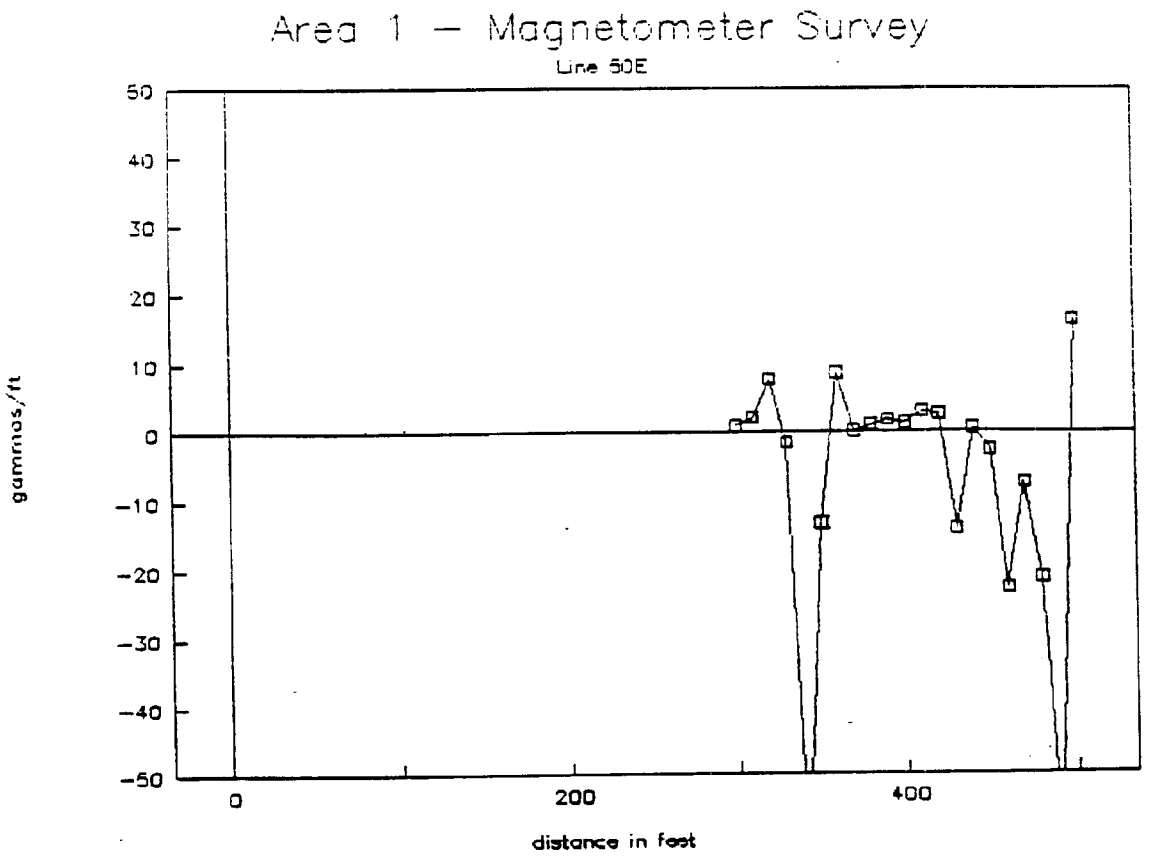
Class #	class min	class max	mean	count	percent	cum % <
1	-100.00	-96.00	-97.300	1	0.15	1.49
5	-84.00	-80.00	-80.100	1	0.15	1.64
8	-72.00	-68.00	-69.700	1	0.15	1.79
9	-68.00	-64.00	-66.933	3	0.45	2.24
10	-64.00	-60.00	-61.600	2	0.30	2.54
11	-60.00	-56.00	-57.767	3	0.45	2.99
12	-56.00	-52.00	-53.700	3	0.45	3.43
13	-52.00	-48.00	-48.100	1	0.15	3.58
14	-48.00	-44.00	-44.750	2	0.30	3.88
15	-44.00	-40.00	-40.400	2	0.30	4.18
16	-40.00	-36.00	-36.900	3	0.45	4.63
17	-36.00	-32.00	-33.500	3	0.45	5.07
18	-32.00	-28.00	-30.214	7	1.04	6.12
19	-28.00	-24.00	-26.467	3	0.45	6.57
20	-24.00	-20.00	-22.114	7	1.04	7.61
21	-20.00	-16.00	-18.767	6	0.90	8.51
22	-16.00	-12.00	-13.979	14	2.09	10.60
23	-12.00	-8.00	-9.955	11	1.64	12.24
24	-8.00	-4.00	-5.757	30	4.48	16.72
25	-4.00	0.00	-1.463	164	24.48	41.19
26	0.00	4.00	1.387	263	39.25	80.45
27	4.00	8.00	5.872	50	7.46	87.91
28	8.00	12.00	9.958	33	4.93	92.84
29	12.00	16.00	13.608	13	1.94	94.78
30	16.00	20.00	17.471	7	1.04	95.82
31	20.00	24.00	22.200	6	0.90	96.72
32	24.00	28.00	26.100	4	0.60	97.31
33	28.00	32.00	29.600	3	0.45	97.76
34	32.00	36.00	33.675	4	0.60	98.36
35	36.00	40.00	39.300	1	0.15	98.51
37	44.00	48.00	45.600	1	0.15	98.66
39	52.00	56.00	53.100	1	0.15	98.81
40	56.00	60.00	57.500	1	0.15	98.96
41	60.00	64.00	61.500	1	0.15	99.10
46	80.00	84.00	83.900	1	0.15	99.25
47	84.00	88.00	86.800	1	0.15	99.40
				=======	========	
				657	98.06	

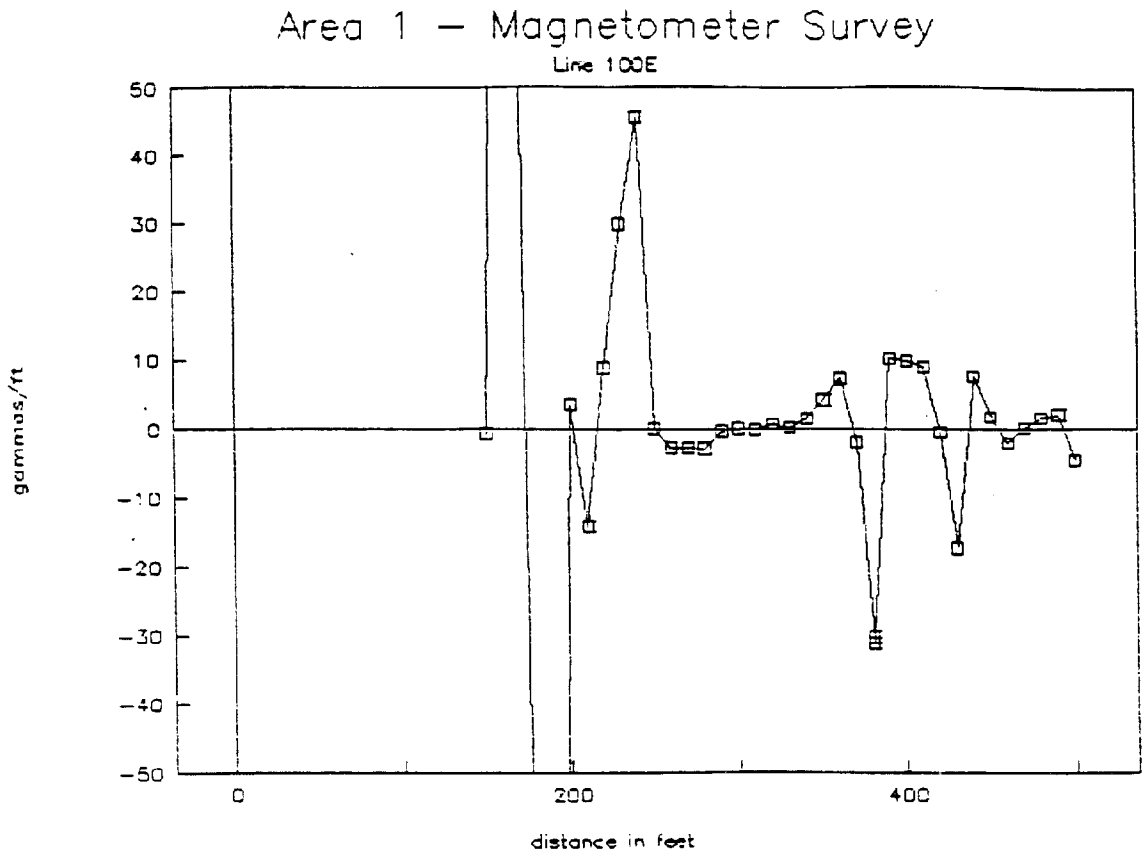
Study Area 01- DED Drum Storage Area 6/93
Instrument: Geometrics G-856 Gradiometer

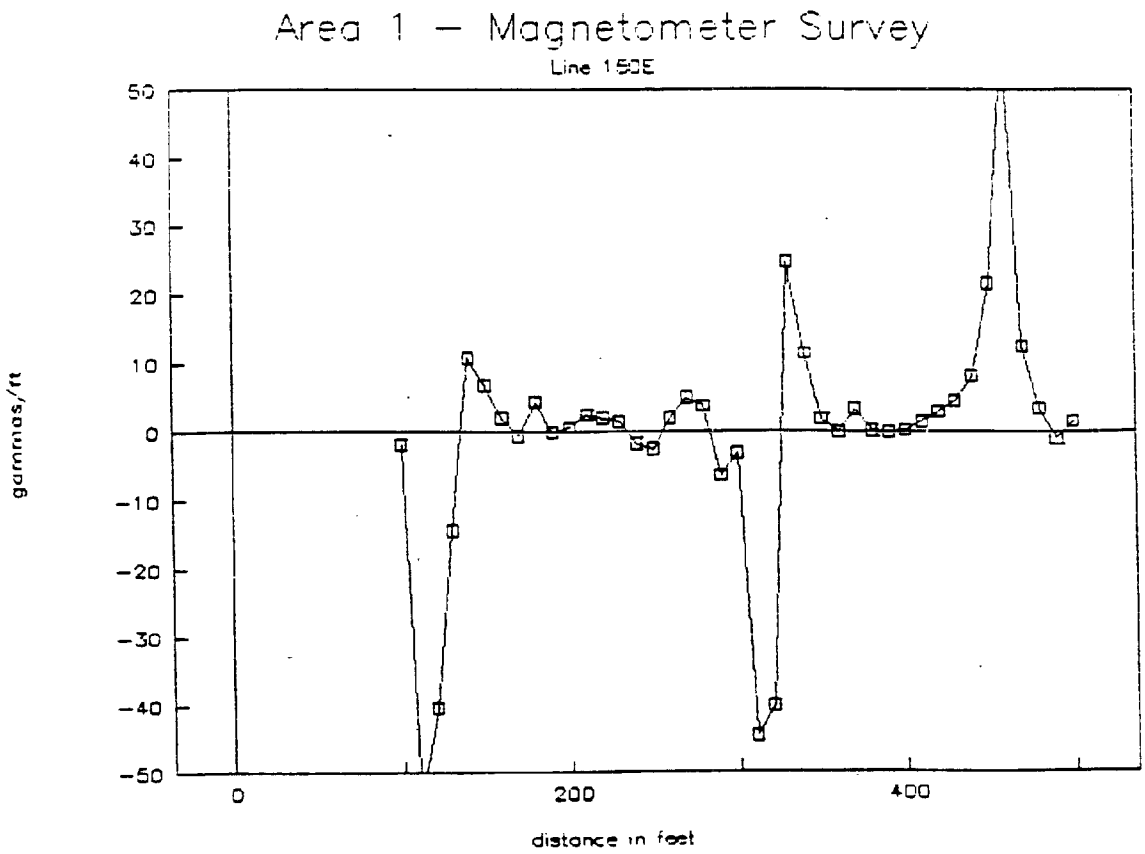
Summary Statistics of Magnetic Data

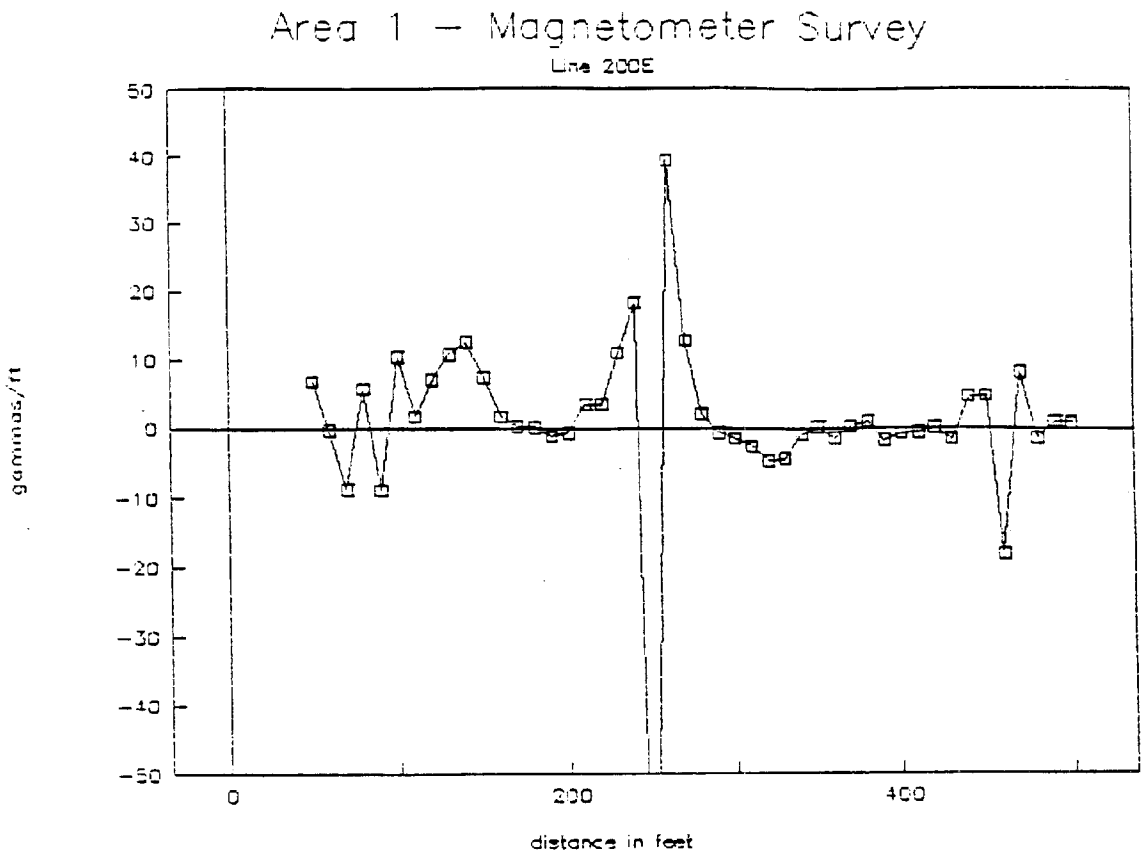
	Gradient (Nanoteslas/ foot)	Bottom Sensor (Nanoteslas)	Top Sensor (Nanoteslas)
Number	670	670	670
Mean	-9.25	54381.950	54357.998
Std Dev	930.51	1369.761	1906.011
Variance	865843	1876245.7	3632876.1
Maximum	14884	56504.0	57976.1
Minimum	-18887	19425.9	5442.0
Range	33771	37078.1	52534.1
Median	0.3	54416.25	54418.75
Mode	0	54404.9	54423.4

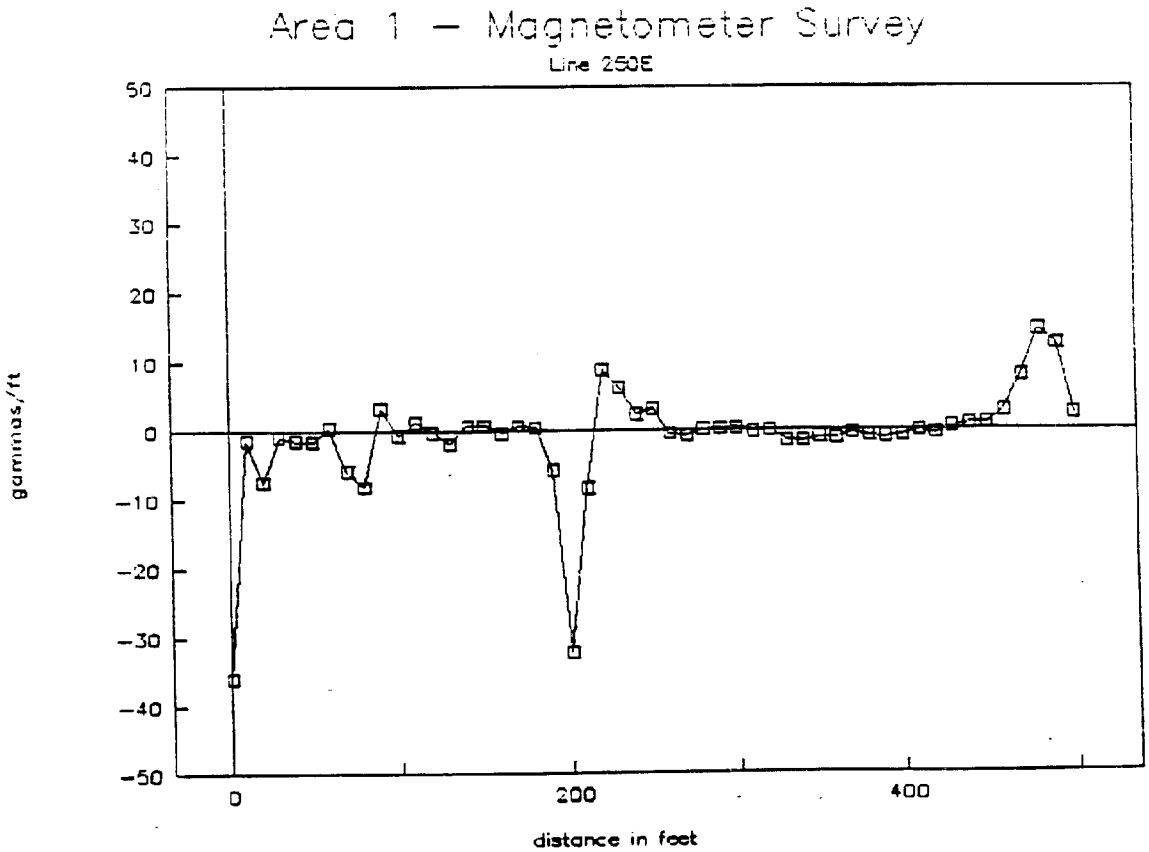

Area 1 — Magnetometer Survey
Line 0E
50
40
30
20
10
0
-10
-20
-30
-40
-50
gammas/ft
0
200
400
distance in feet

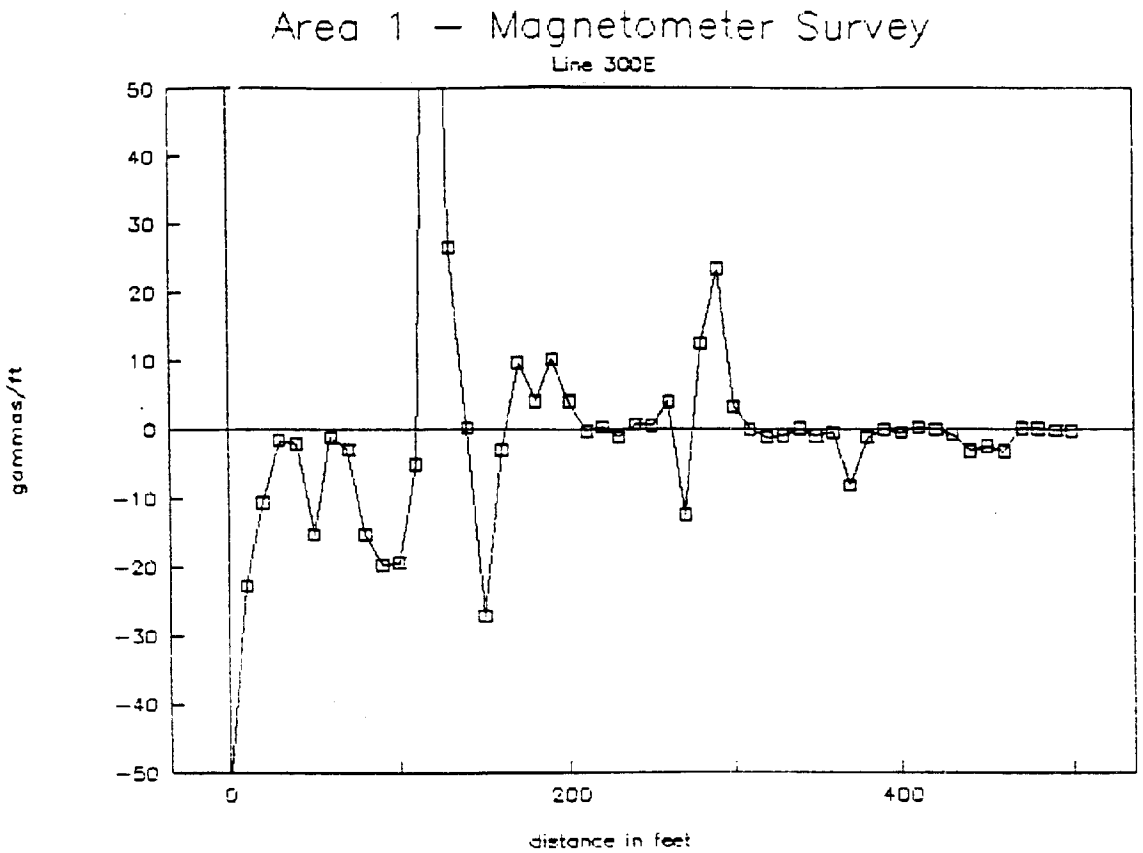

Area 1 — Magnetometer Survey
Line 50E
50
40
30
20
10
0
-10
-20
-30
-40
-50
gammas/ft
0
200
400
distance in feet

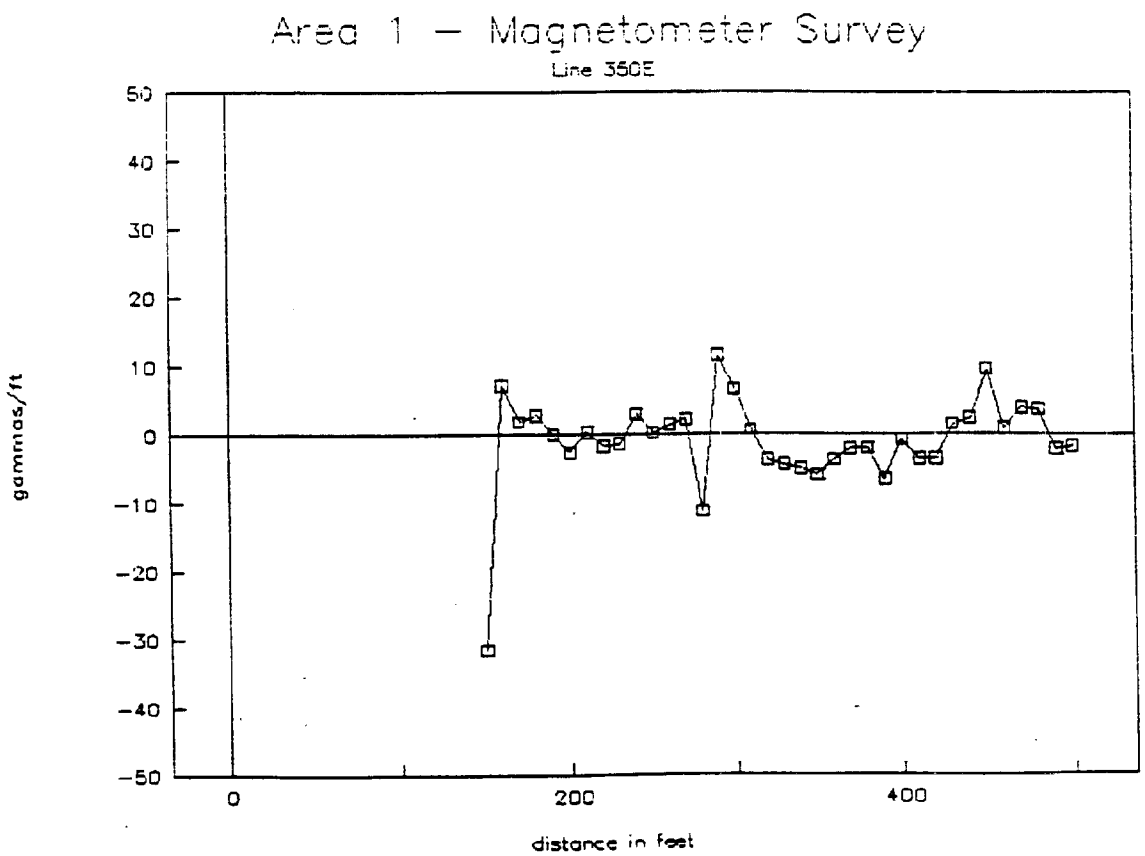

Area 1 — Magnetometer Survey
Line 100E
50
40
30
20
10
0
-10
-20
-30
-40
-50
gammas/ft
0
200
400
distance in feet

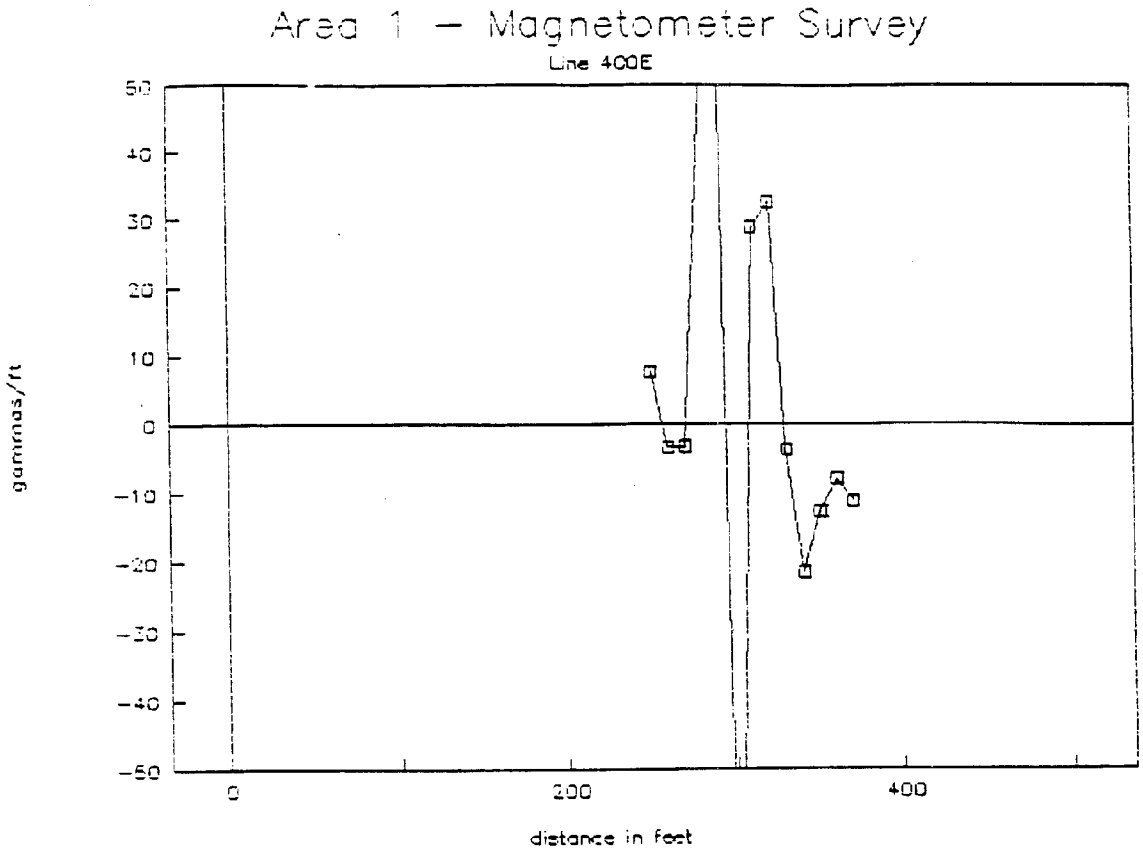

Area 1 — Magnetometer Survey
Line 150E
50
40
30
20
10
0
-10
-20
-30
-40
-50
gammas/ft
0
200
400
distance in feet

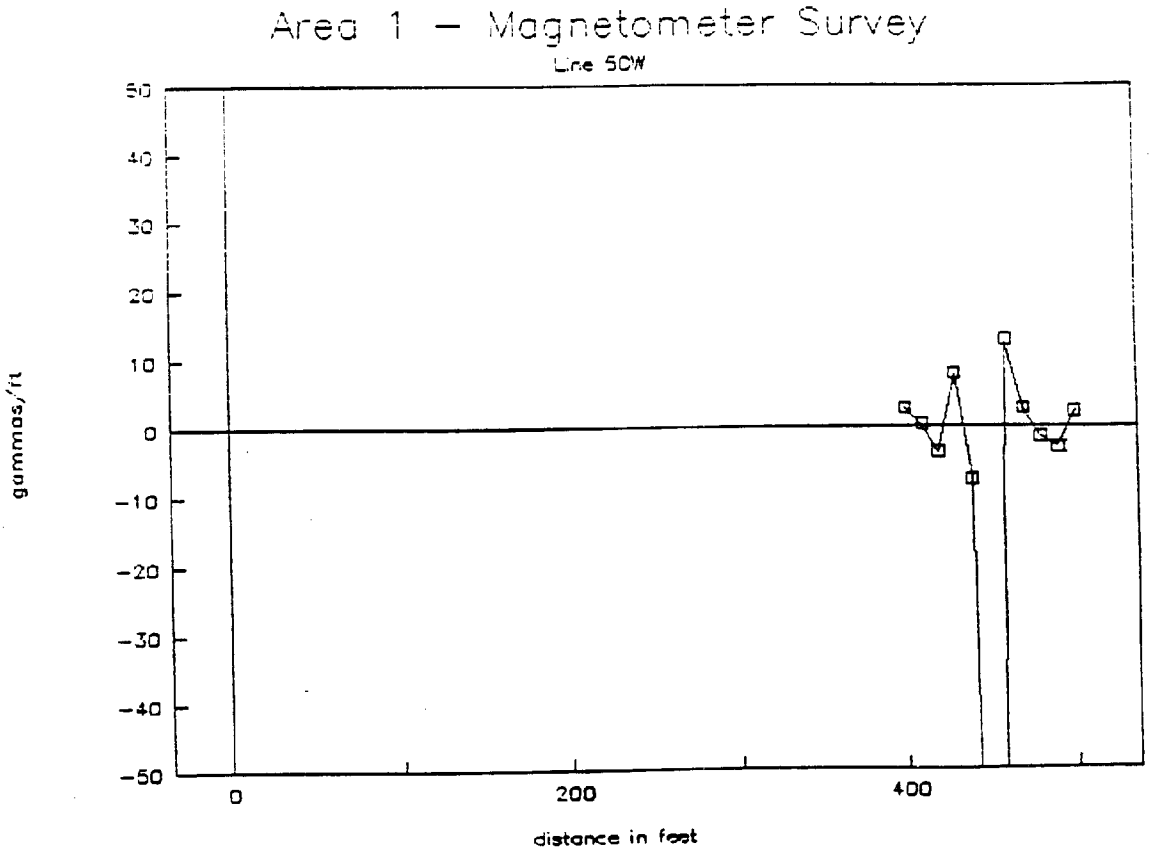

Area 1 — Magnetometer Survey
Line 200E
50
40
30
20
10
0
-10
-20
-30
-40
-50
gammas/ft
0
200
400
distance in feet

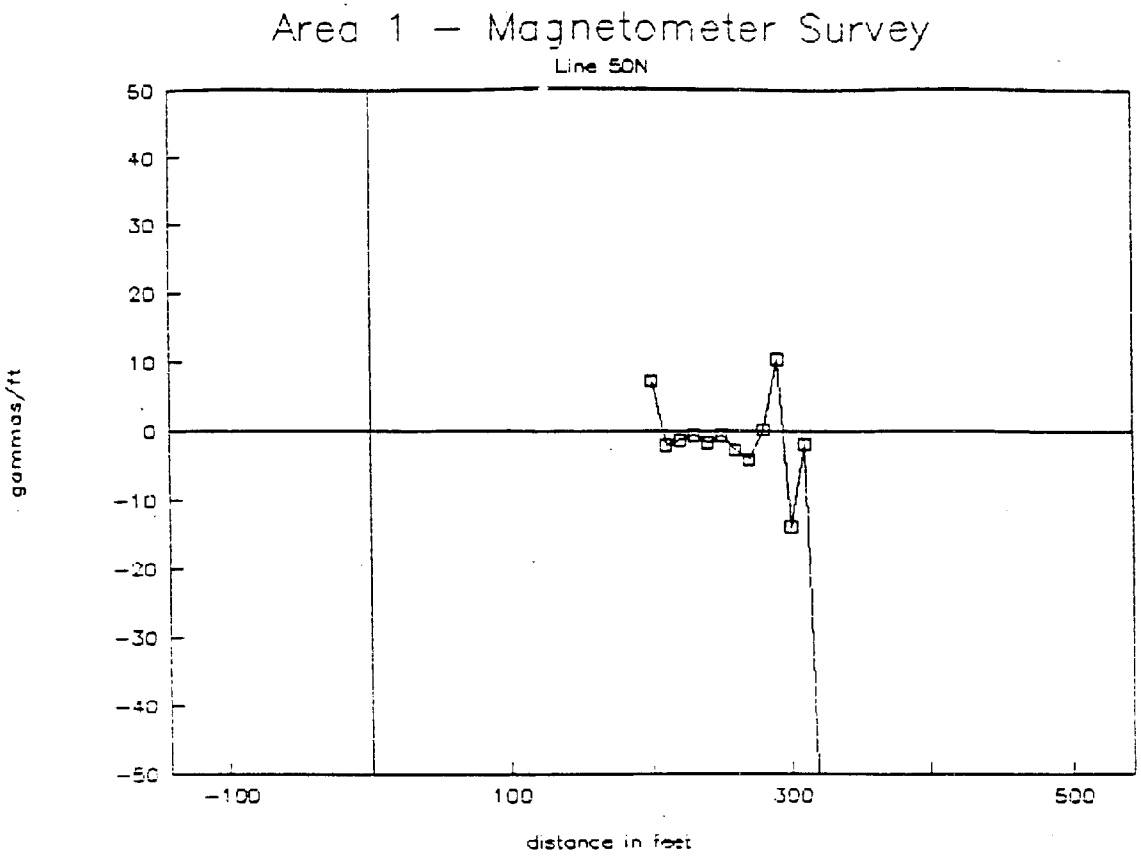

Area 1 — Magnetometer Survey
Line 250E
50
40
30
20
10
0
-10
-20
-30
-40
-50
gammas/ft
0
200
400
distance in feet

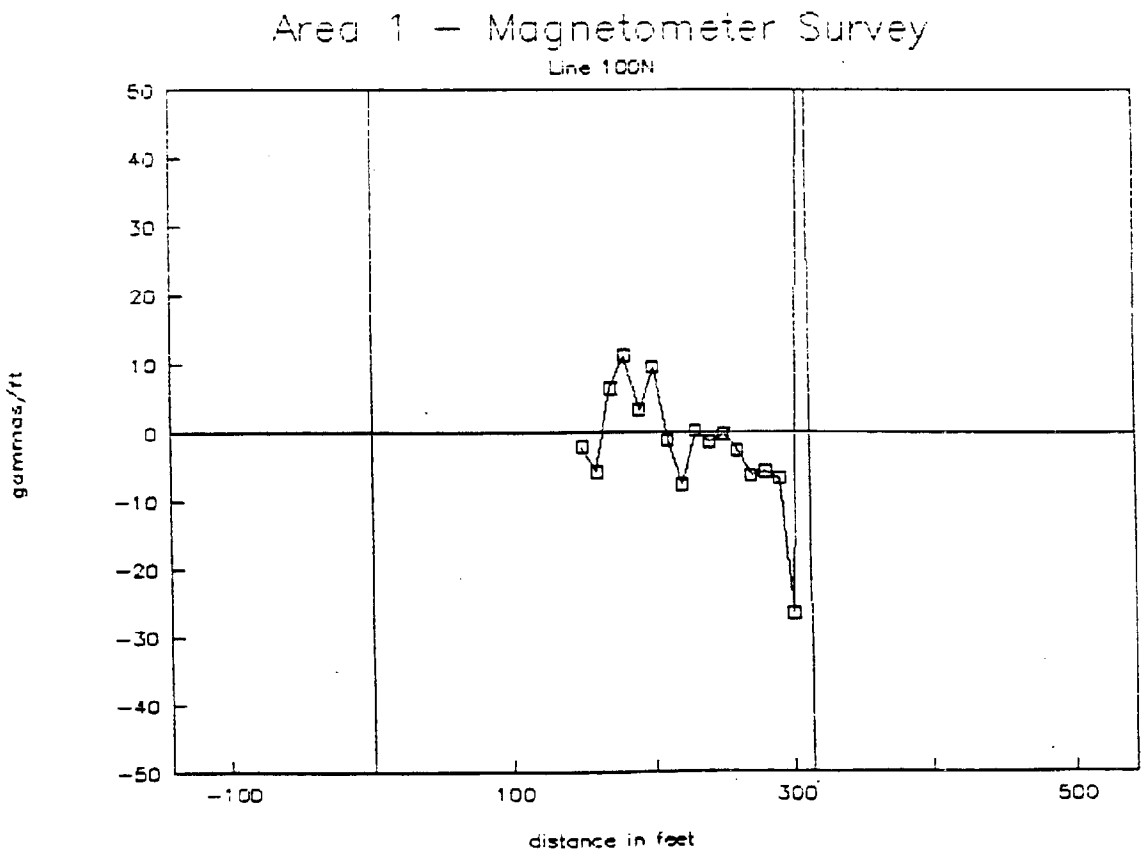

Area 1 — Magnetometer Survey
Line 300E
50
40
30
20
10
0
−10
−20
−30
−40
−50
gammas/ft
0
200
400
distance in feet

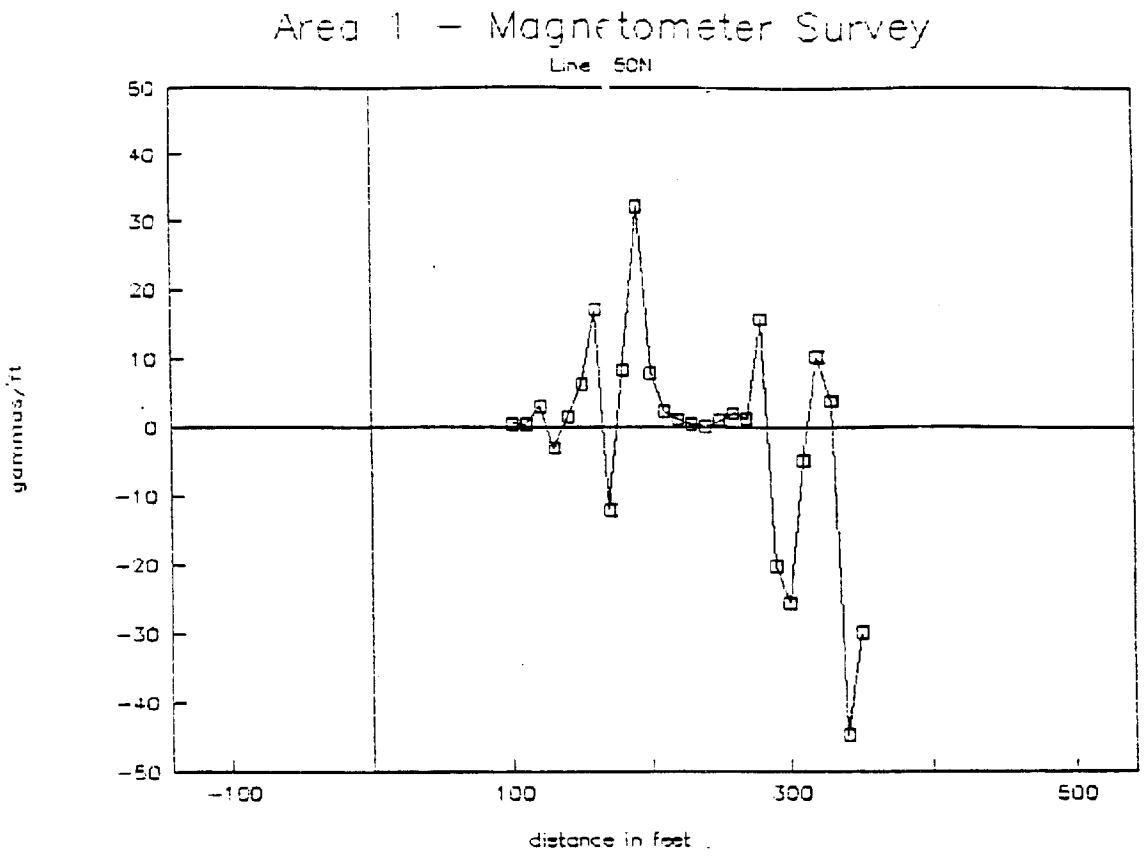

Area 1 — Magnetometer Survey
Line 350E
50
40
30
20
10
0
−10
−20
−30
−40
−50
gammas/ft
0
200
400
distance in feet

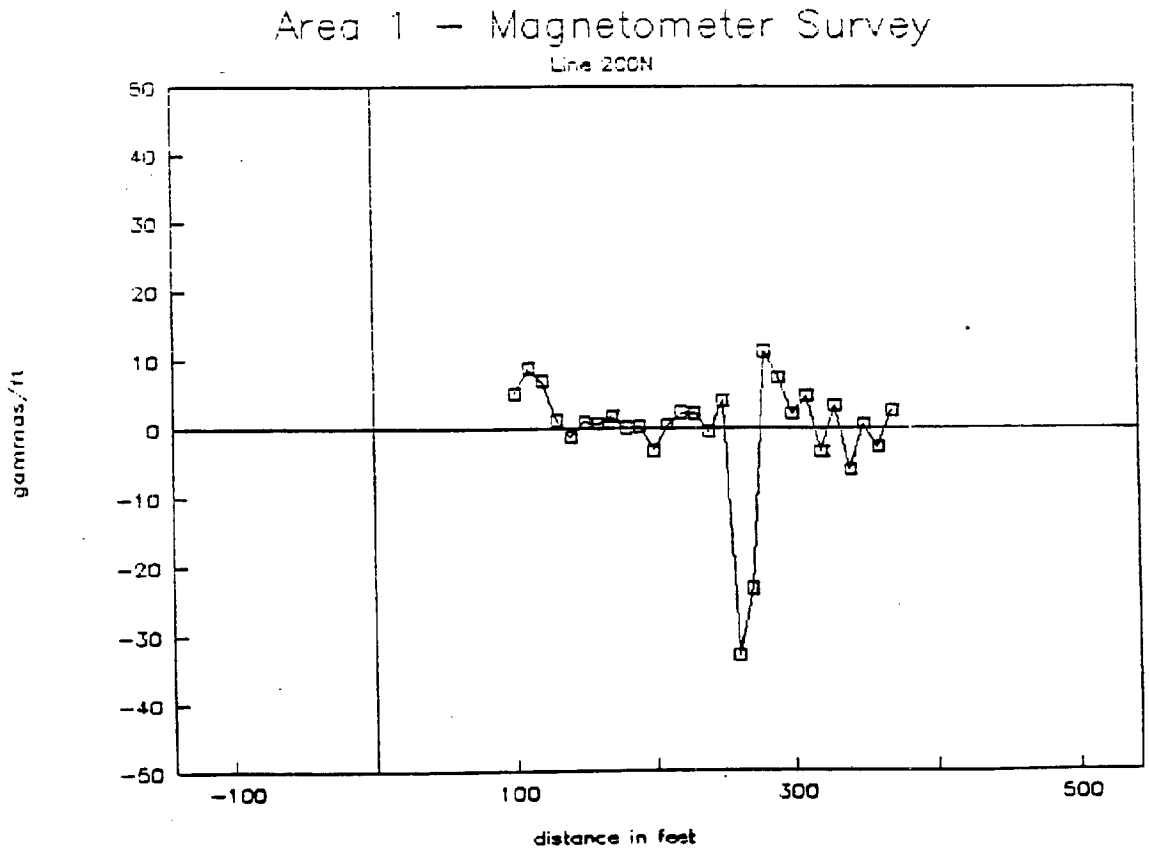

Area 1 — Magnetometer Survey
Line 400E
50
40
30
20
10
0
-10
-20
-30
-40
-50
gammas/ft
0
200
400
distance in feet

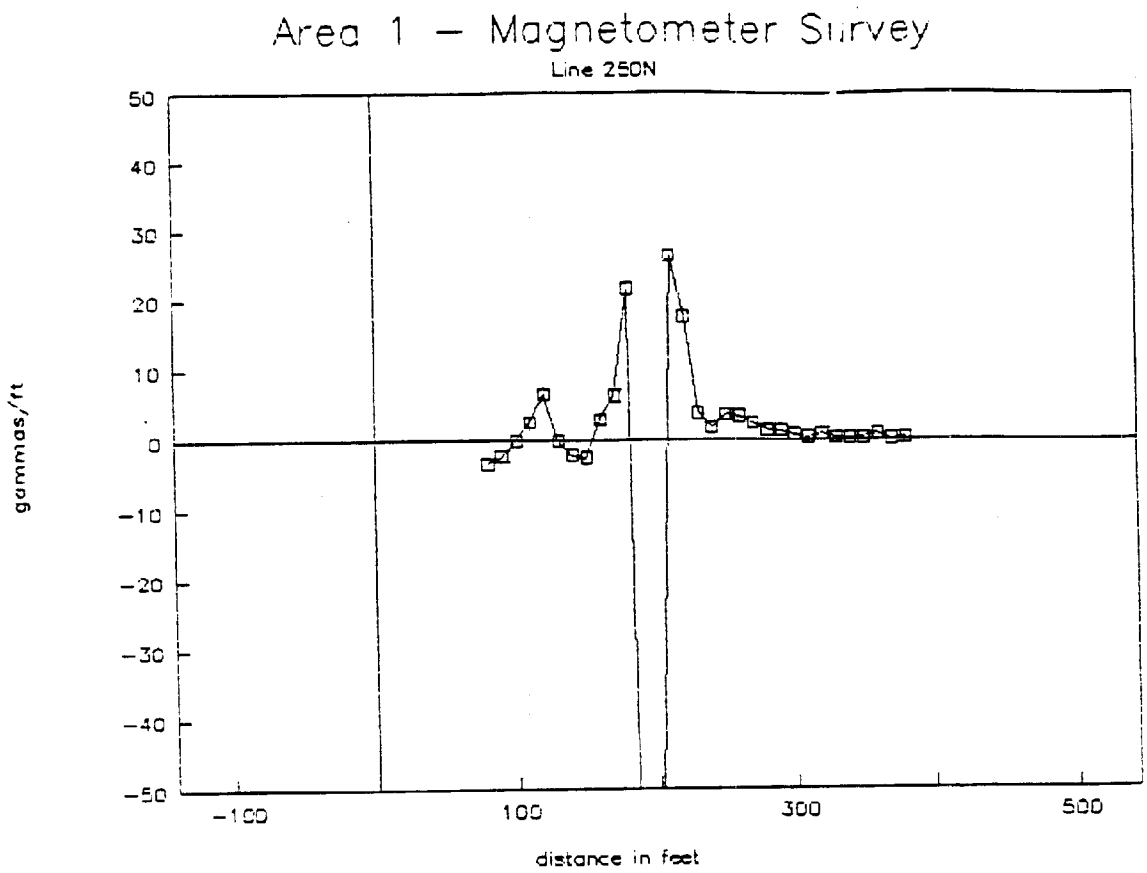

Area 1 — Magnetometer Survey
Line 50W
50
40
30
20
10
0
-10
-20
-30
-40
-50
gammas/ft
0
200
400
distance in feet

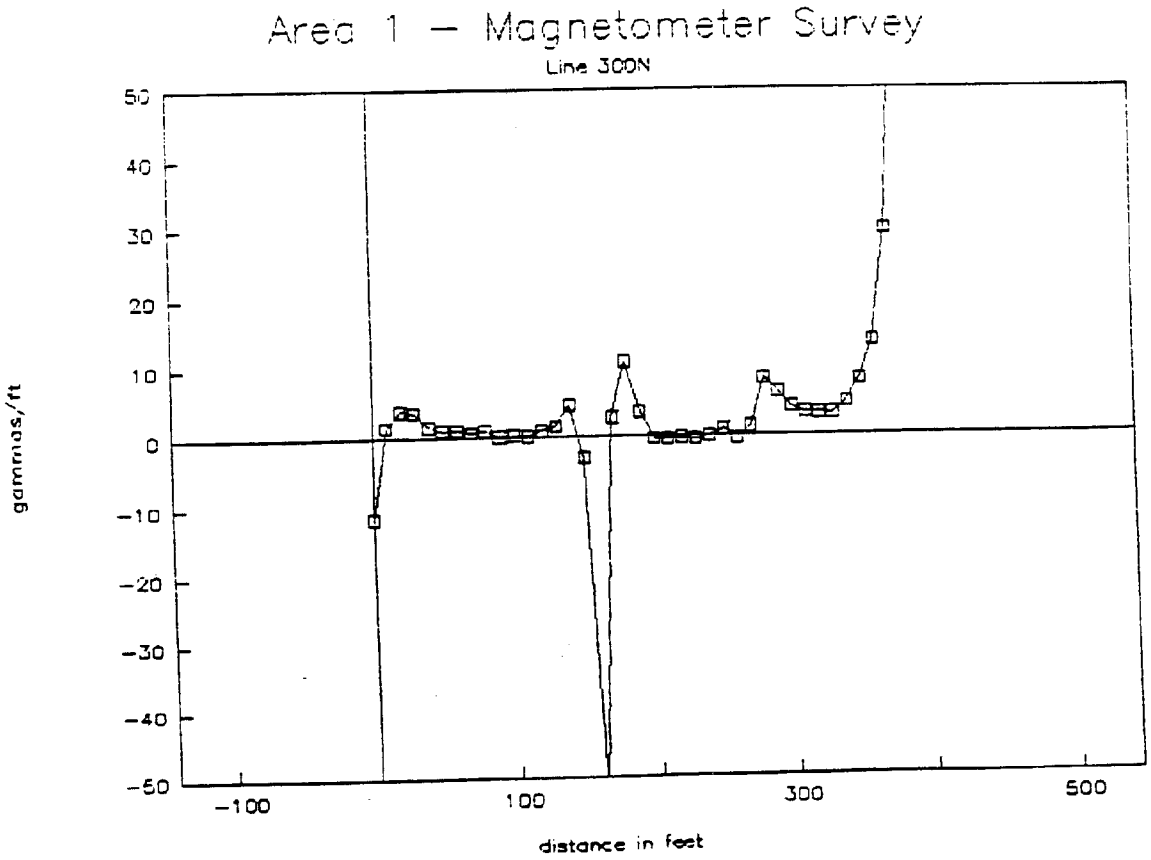

Area 1 — Magnetometer Survey
Line 50N
50
40
30
20
10
0
-10
-20
-30
-40
-50
gammas/ft
-100
100
300
500
distance in feet

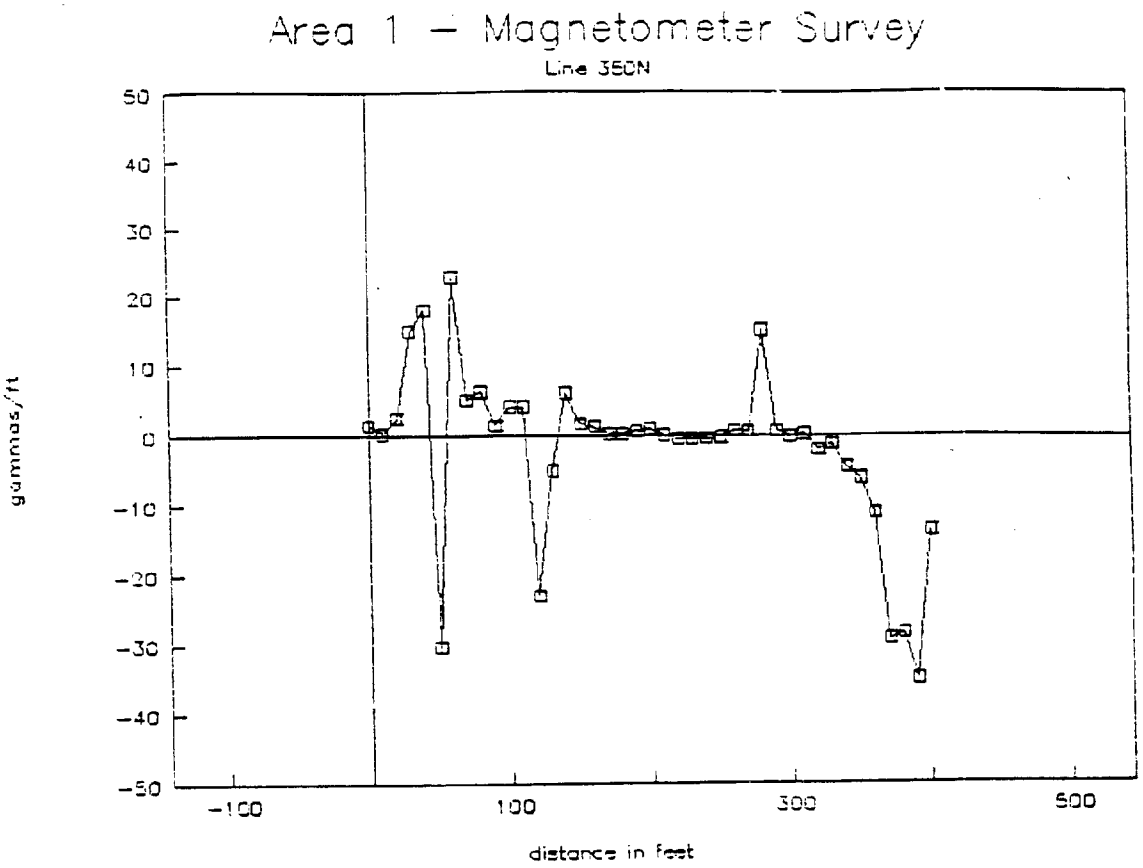

Area 1 — Magnetometer Survey
Line 100N
50
40
30
20
10
0
-10
-20
-30
-40
-50
gammas/ft
-100
100
300
500
distance in feet

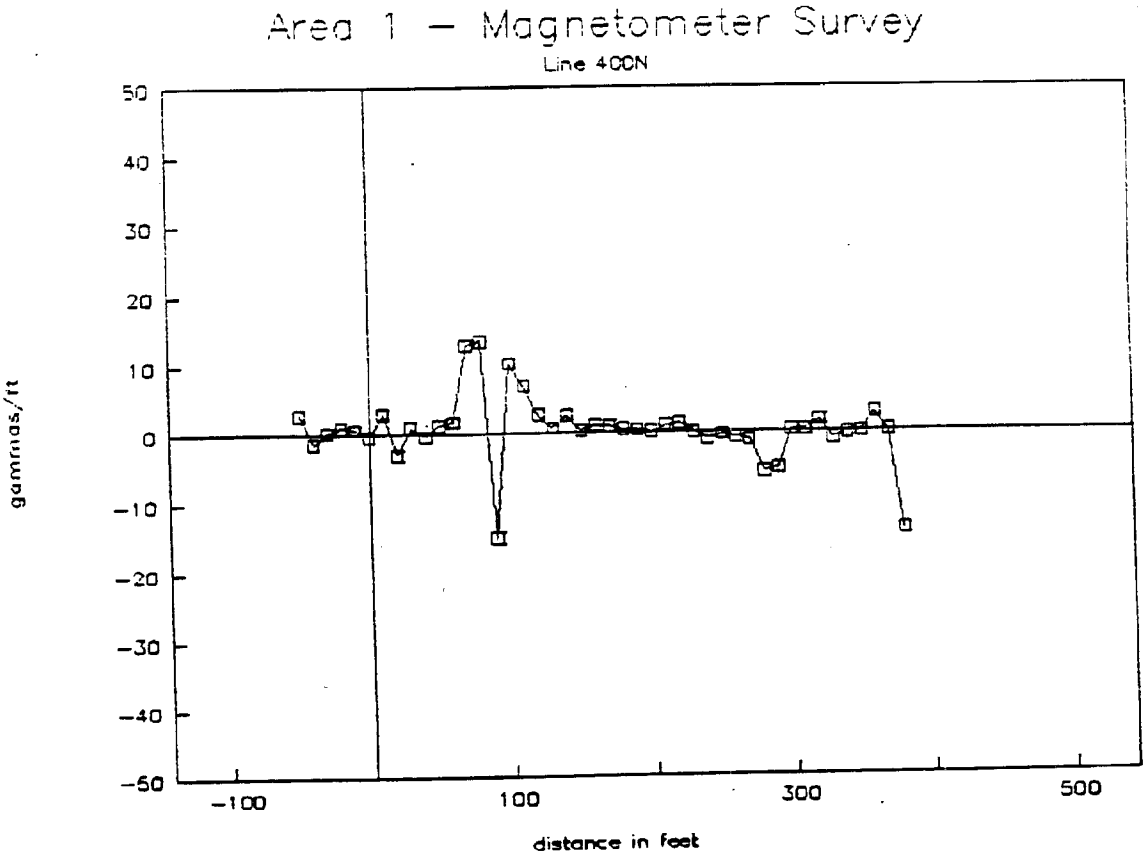

Area 1 — Magnetometer Survey
Line 50N
gammas/ft
50
40
30
20
10
0
-10
-20
-30
-40
-50
-100
100
300
500
distance in feet

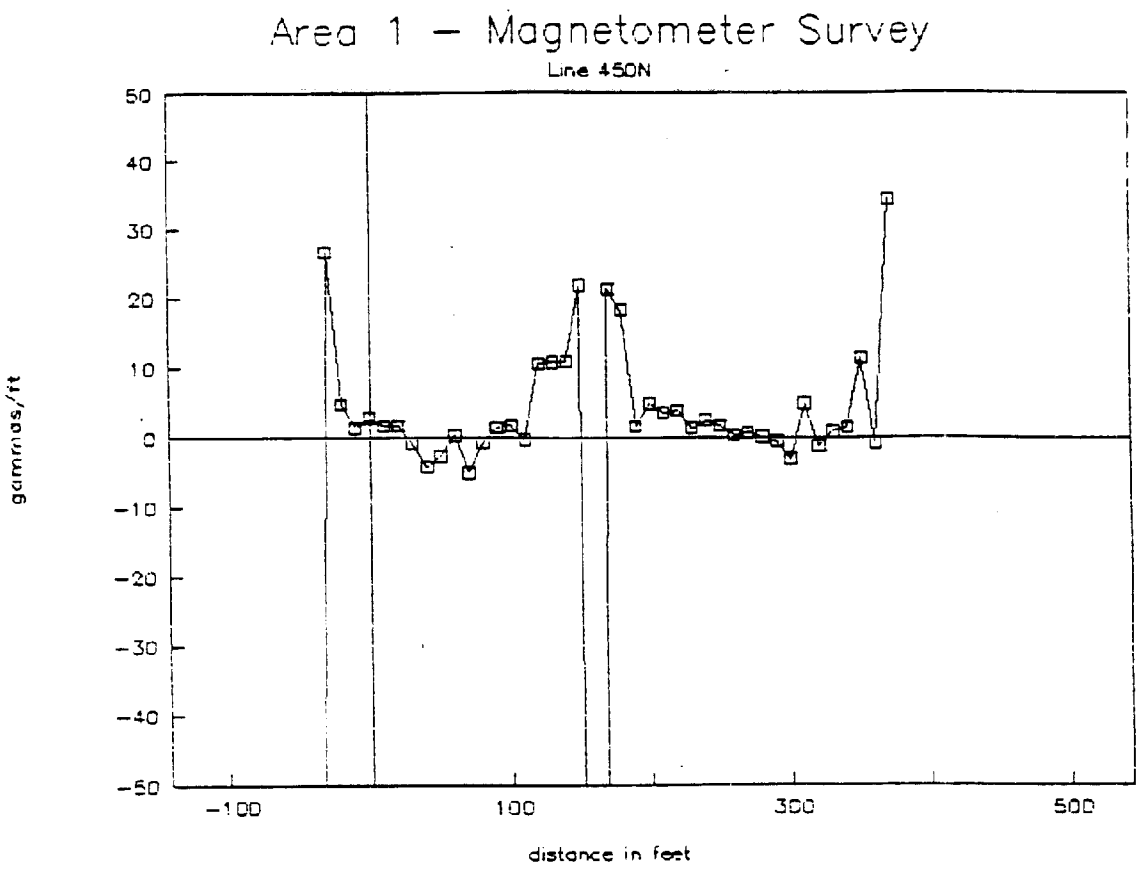

Area 1 — Magnetometer Survey
Line 200N
gammas/ft
50
40
30
20
10
0
-10
-20
-30
-40
-50
-100
100
300
500
distance in feet

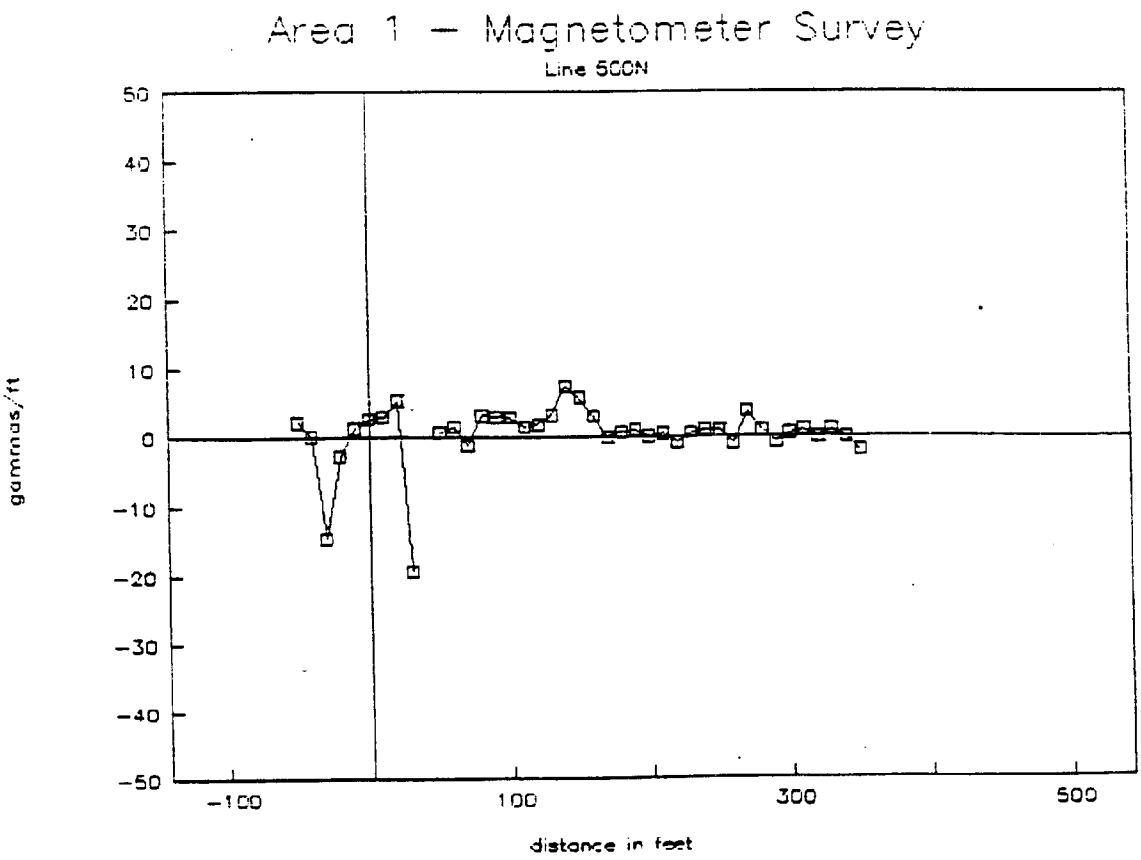

Area 1 — Magnetometer Survey
Line 250N
50
40
30
20
10
0
-10
-20
-30
-40
-50
gammas/ft
-100
100
300
500
distance in feet


Area 1 — Magnetometer Survey
Line 300N
50
40
30
20
10
0
-10
-20
-30
-40
-50
gammas/ft
-100
100
300
500
distance in feet


Area 1 — Magnetometer Survey
Line 350N
gammas/ft
50
40
30
20
10
0
-10
-20
-30
-40
-50
-100
100
300
500
distance in feet


Area 1 — Magnetometer Survey
Line 400N
gammas/ft
50
40
30
20
10
0
-10
-20
-30
-40
-50
-100
100
300
500
distance in feet


Area 1 — Magnetometer Survey
Line 450N
gamrnas/ft
50
40
30
20
10
0
-10
-20
-30
-40
-50
-100
100
300
500
distance in feet


Area 1 — Magnetometer Survey
Line 500N
gamrnas/ft
50
40
30
20
10
0
-10
-20
-30
-40
-50
-100
100
300
500
distance in feet

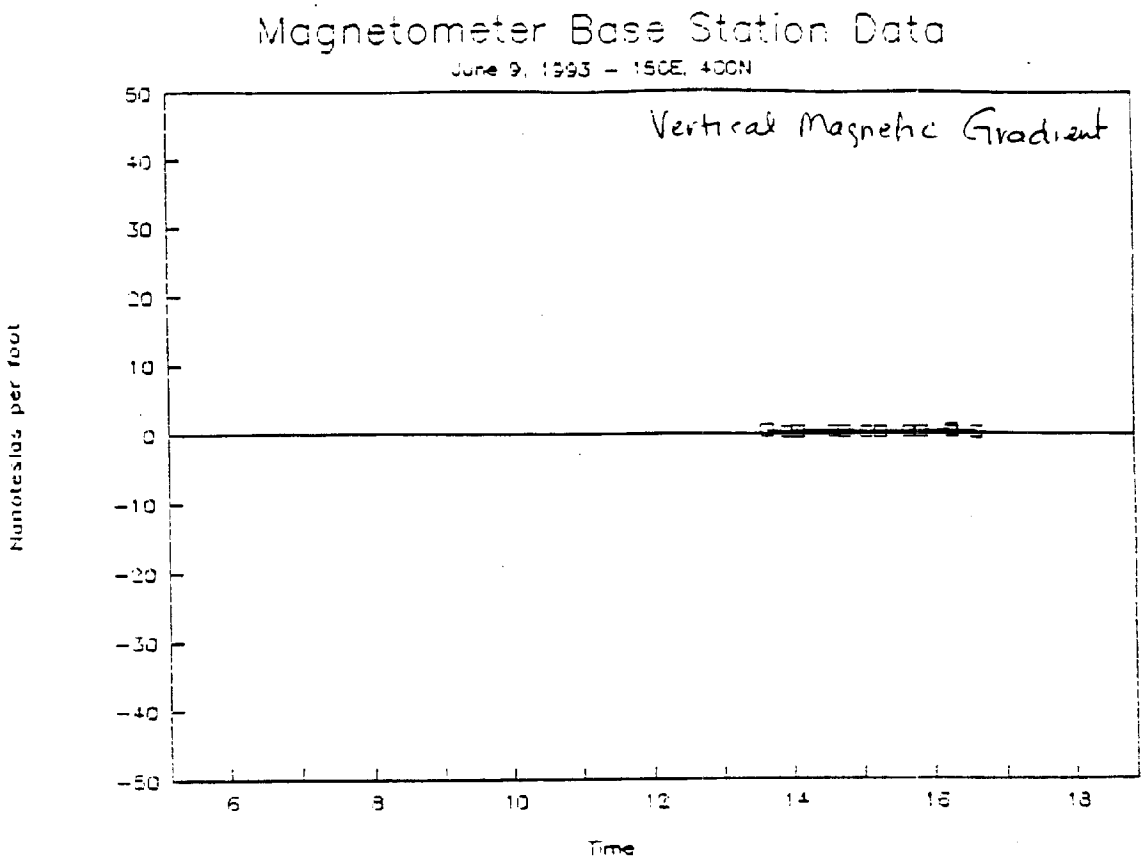
APPENDIX D

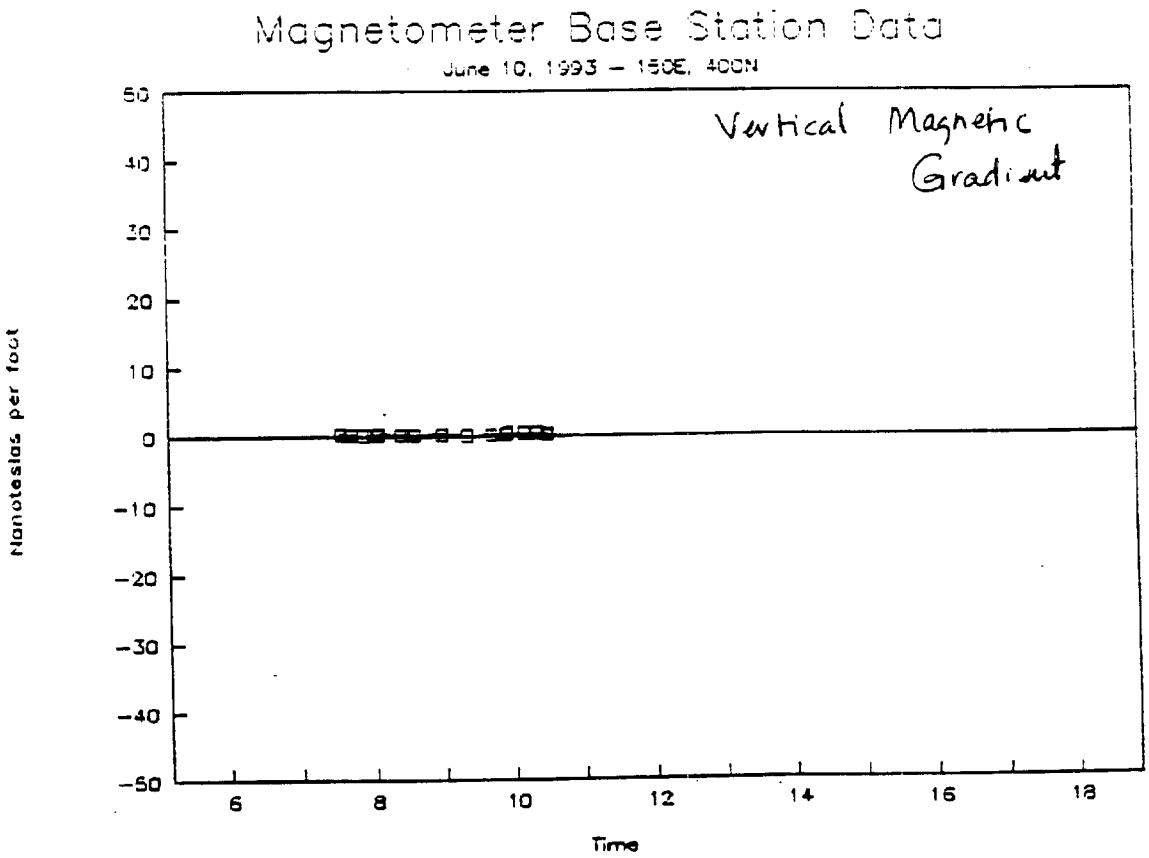
STUDY AREA 01 - CED DRUM STORAGE AREA
MAGNETIC BASE STATION DATA AND PROFILES

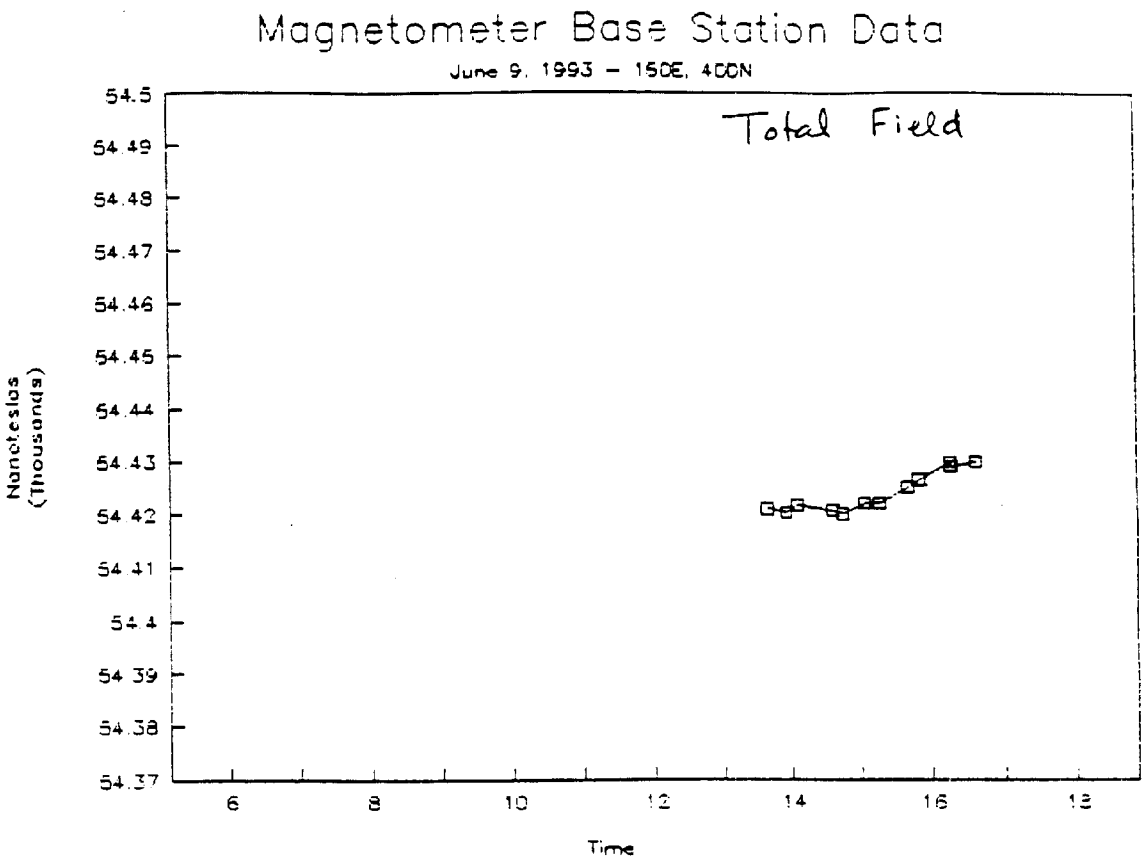
HNUS - DAVISVILLE, RI - NAVAL CONSTRUCTION BATALLION CENTER

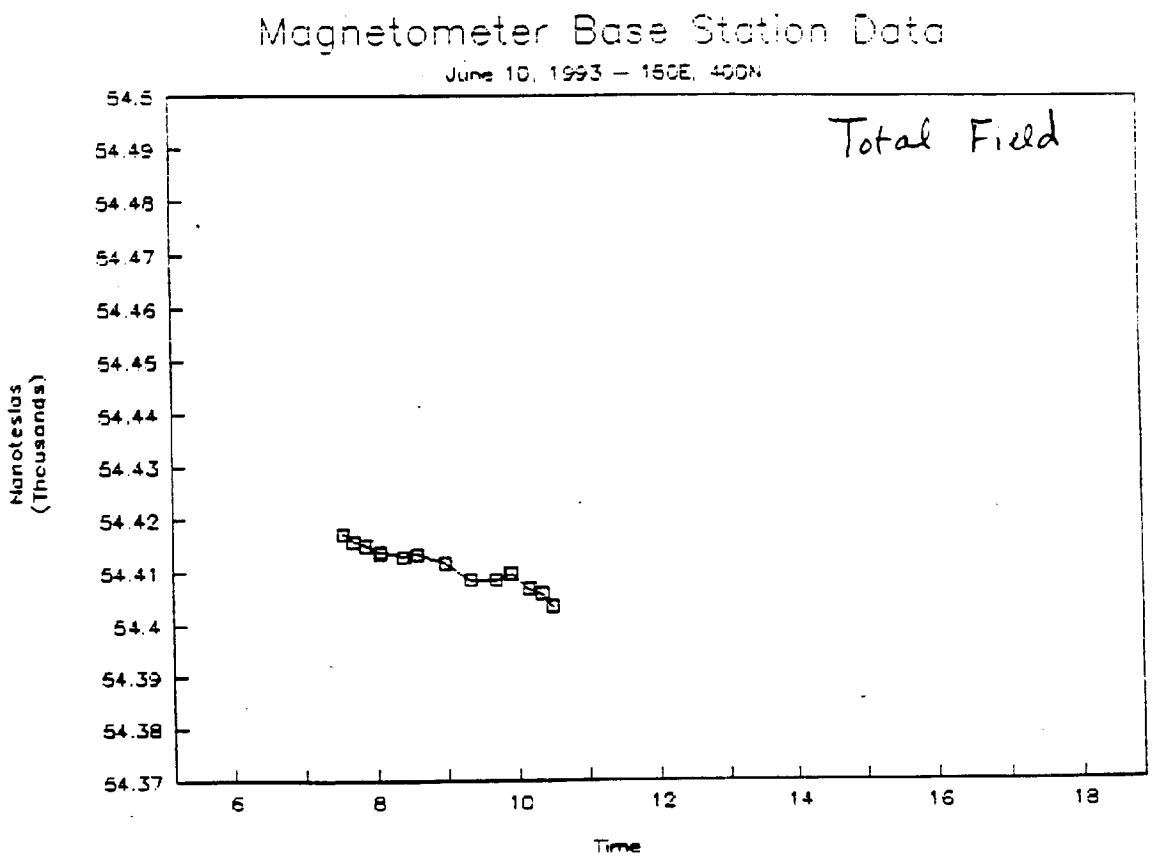
STUDY AREA 1: MAGNETOMETER SURVEY BASE STATION DATA, 6/9-10/1993

X	Y	JULIAN DAY	DECIMAL TIME	READ #	- NANOTESLAS - BOTTOM SENSOR	TOP SENSOR	NANOTESLAS PER FOOT GRADIENT
150	400	160	13.64	84	54419.8	54420.9	0.4
150	400	160	13.92	132	54419.8	54420.3	0.2
150	400	160	14.09	178	54420.8	54421.6	0.3
150	400	160	14.59	180	54419.6	54420.6	0.4
150	400	160	14.74	222	54419.2	54420	0.3
150	400	160	15.05	332	54421.5	54422	0.2
150	400	160	15.26	386	54421.5	54422	0.2
150	400	160	15.66	486	54424.4	54425	0.2
150	400	160	15.82	514	54425.8	54426.4	0.2
150	400	160	16.25	612	54428.6	54429.7	0.4
150	400	160	16.26	614	54428.5	54429	0.2
150	400	160	16.59	700	54429.3	54429.7	0.2
150	400	160	16.61	702	54429.2	54429.8	0.2
150	400	161	7.548	0	54416.4	54417.2	0.3
150	400	161	7.557	2	54416.4	54417.3	0.3
150	400	161	7.698	26	54415.2	54415.8	0.2
150	400	161	7.867	70	54414.8	54415.1	0.1
150	400	161	8.072	114	54413.2	54413.7	0.2
150	400	161	8.091	116	54413.1	54413.9	0.3
150	400	161	8.391	192	54412.4	54413	0.2
150	400	161	8.588	254	54412.8	54413.4	0.2
150	400	161	8.989	374	54410.9	54411.7	0.3
150	400	161	9.336	482	54408.3	54408.5	0.1
150	400	161	9.697	590	54407.9	54408.5	0.2
150	400	161	9.910	618	54408.9	54409.7	0.3
150	400	161	9.921	620	54408.6	54409.7	0.4
150	400	161	10.156	694	54405.6	54406.8	0.5
150	400	161	10.348	722	54404.7	54405.8	0.4
150	400	161	10.489	766	54402.7	54403.5	0.3
150	400	161	10.494	768	54402.9	54403.4	0.2


Magnetometer Base Station Data
June 9, 1993 – 150E, 400N
Vertical Magnetic Gradient
Nanoteslas per foot
50
40
30
20
10
0
-10
-20
-30
-40
-50
6
8
10
12
14
16
18
Time


Magnetometer Base Station Data
June 10, 1993 – 150E, 400N
Vertical Magnetic Gradient
Nanoteslas per foot
50
40
30
20
10
0
-10
-20
-30
-40
-50
6
8
10
12
14
16
18
Time

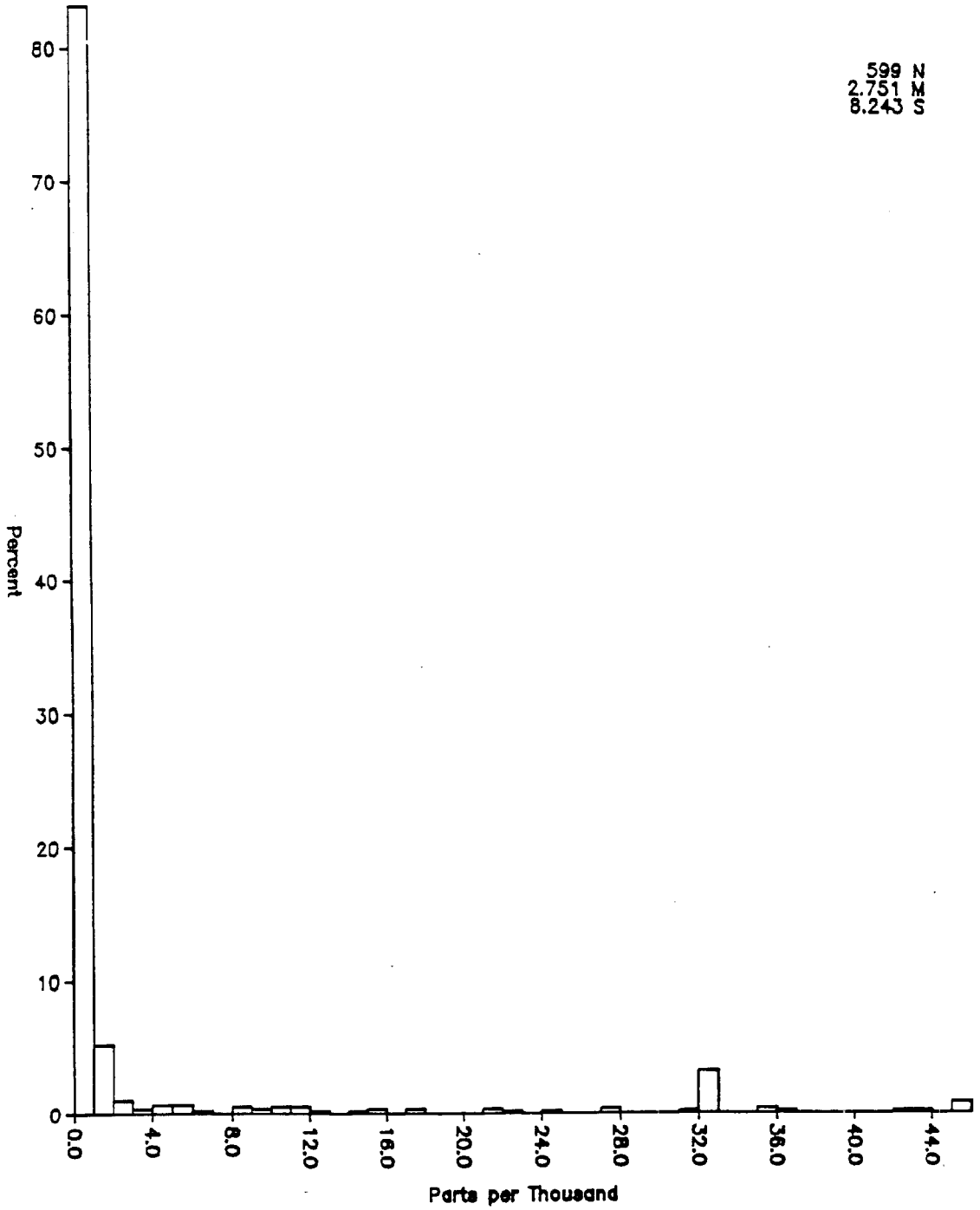

Magnetometer Base Station Data
June 9, 1993 – 150E, 400N
Total Field
Nanoteslas (Thousands)
54.5
54.49
54.48
54.47
54.46
54.45
54.44
54.43
54.42
54.41
54.4
54.39
54.38
54.37
6
8
10
12
14
16
18
Time


Magnetometer Base Station Data
June 10, 1993 – 150E, 400N
Total Field
Nanoteslas (Thousands)
54.5
54.49
54.48
54.47
54.46
54.45
54.44
54.43
54.42
54.41
54.4
54.39
54.38
54.37
6
8
10
12
14
16
18
Time

APPENDIX E

CALF PASTURE POINT MUNITIONS BUNKERS
HISTOGRAM OF ELECTROMAGNETIC DATA
ELECTROMAGNETIC PROFILES - GRIDS A, B AND C

Bunkers Area Electromagnetic (Inphase) Data



Calf Pasture Point Munitions Bunkers Area 6/93
Histogram of Electromagnetic (Inphase) Data

(Values analyzed are absolute value of the inphase minus the statistical mode, -0.2; units are parts per thousand of the total field.)

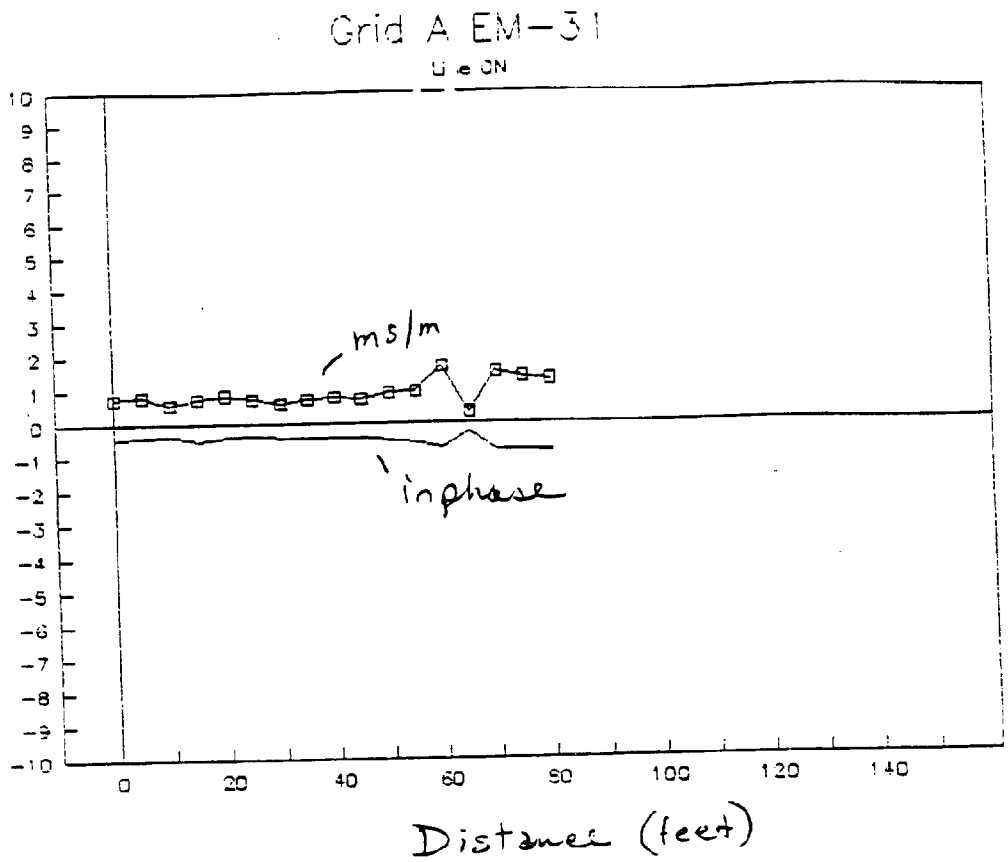
Linear classes

Class #	class min	class max	mean	count	percent	cum % <
1	0.00	1.00	0.244	498	83.14	83.14
2	1.00	2.00	1.437	31	5.18	88.31
3	2.00	3.00	2.518	6	1.00	89.32
4	3.00	4.00	3.493	2	0.33	89.65
5	4.00	5.00	4.366	4	0.67	90.32
6	5.00	6.00	5.528	4	0.67	90.98
7	6.00	7.00	6.606	1	0.17	91.15
9	8.00	9.00	8.721	3	0.50	91.65
10	9.00	10.00	9.604	2	0.33	91.99
11	10.00	11.00	10.596	3	0.50	92.49
12	11.00	12.00	11.370	3	0.50	92.99
13	12.00	13.00	12.410	1	0.17	93.16
15	14.00	15.00	14.830	1	0.17	93.32
16	15.00	16.00	15.836	2	0.33	93.66
18	17.00	18.00	17.642	2	0.33	93.99
22	21.00	22.00	21.429	2	0.33	94.32
23	22.00	23.00	22.619	1	0.17	94.49
25	24.00	25.00	24.560	1	0.17	94.66
28	27.00	28.00	27.342	2	0.33	94.99
32	31.00	32.00	31.171	1	0.17	95.16
33	32.00	33.00	32.091	19	3.17	98.33
36	35.00	36.00	35.723	2	0.33	98.66
37	36.00	37.00	36.807	1	0.17	98.83
43	42.00	43.00	42.442	1	0.17	99.00
44	43.00	44.00	43.418	1	0.17	99.17
46	45.00	46.00	45.728	5	0.83	100.00
				=======	========	
				599	100.00	

Calf Pasture Point Munitions Bunkers 6/93
Instrument: Geonics EM-31

Summary Statistics of Electromagnetic Data

	Quadrature (milliSiemens per meter)	Inphase (parts per thousand)
Number	599	599
Mean	2.992	0.316
Std Dev	7.867	8.676
Variance	61.9	75.3
Maximum	42.7	45.8
Minimum	-31.5	-32.3
Range	74.2	78.1
Median	2.16	-0.19
Mode	1.9	-0.2
Std Dev	7.867	8.676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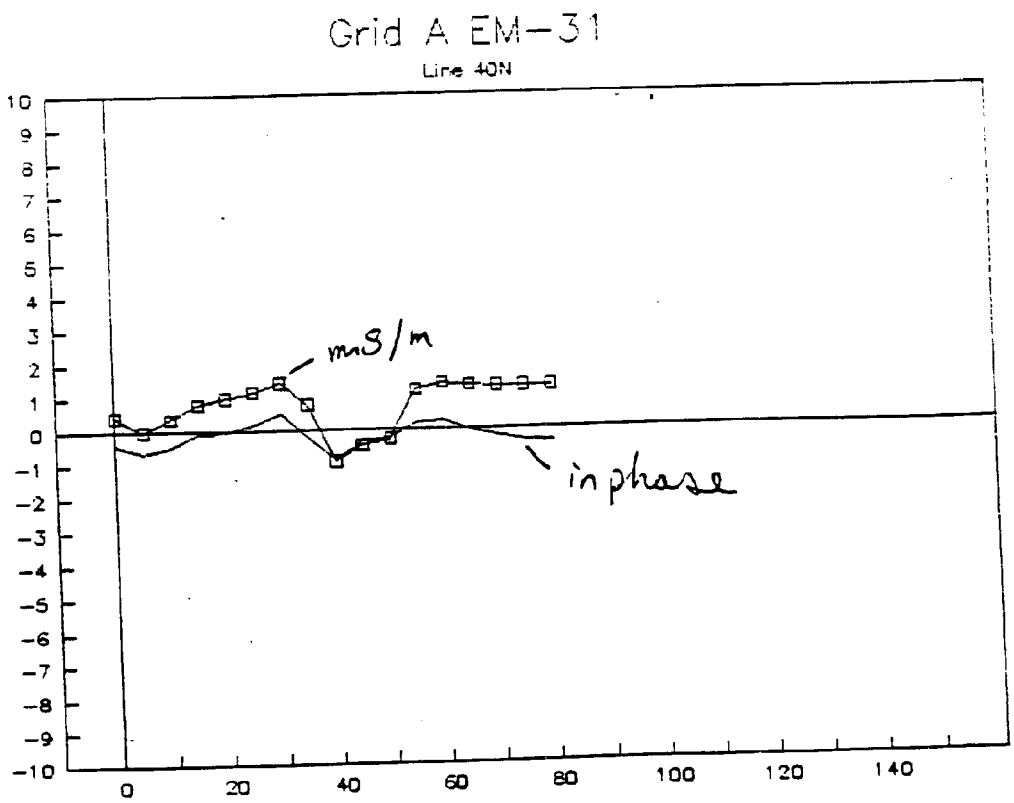
Line 0N
mS/m
inphase
Distance (feet)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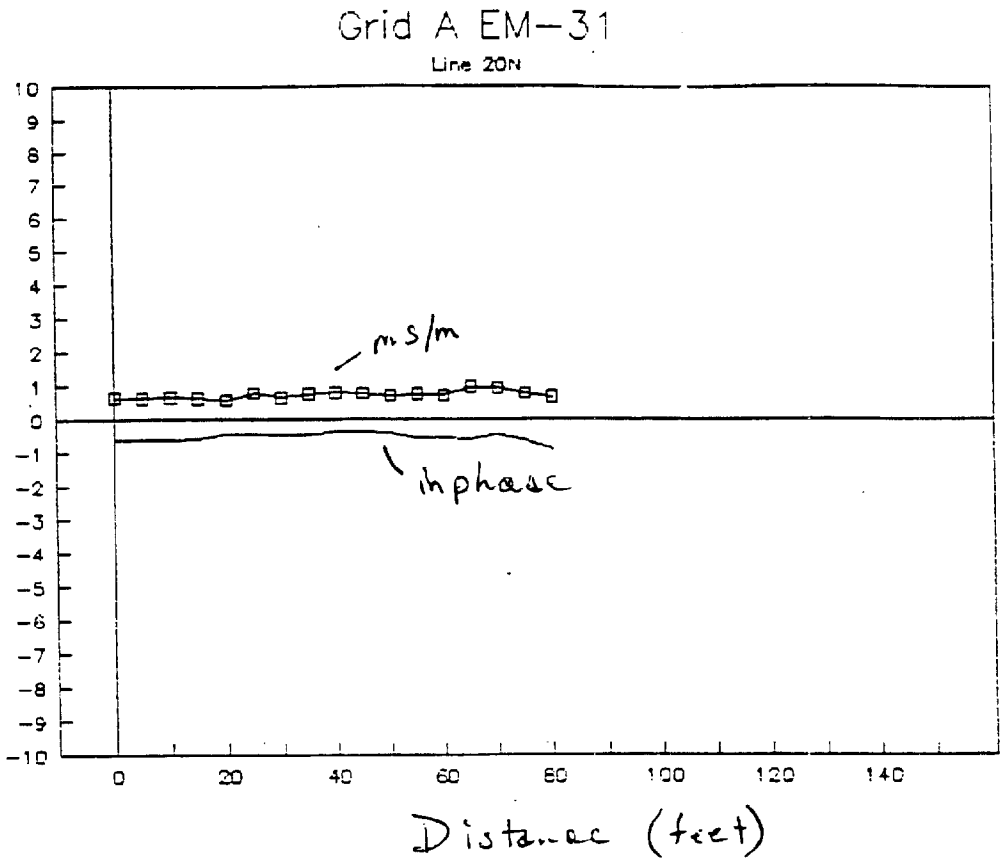
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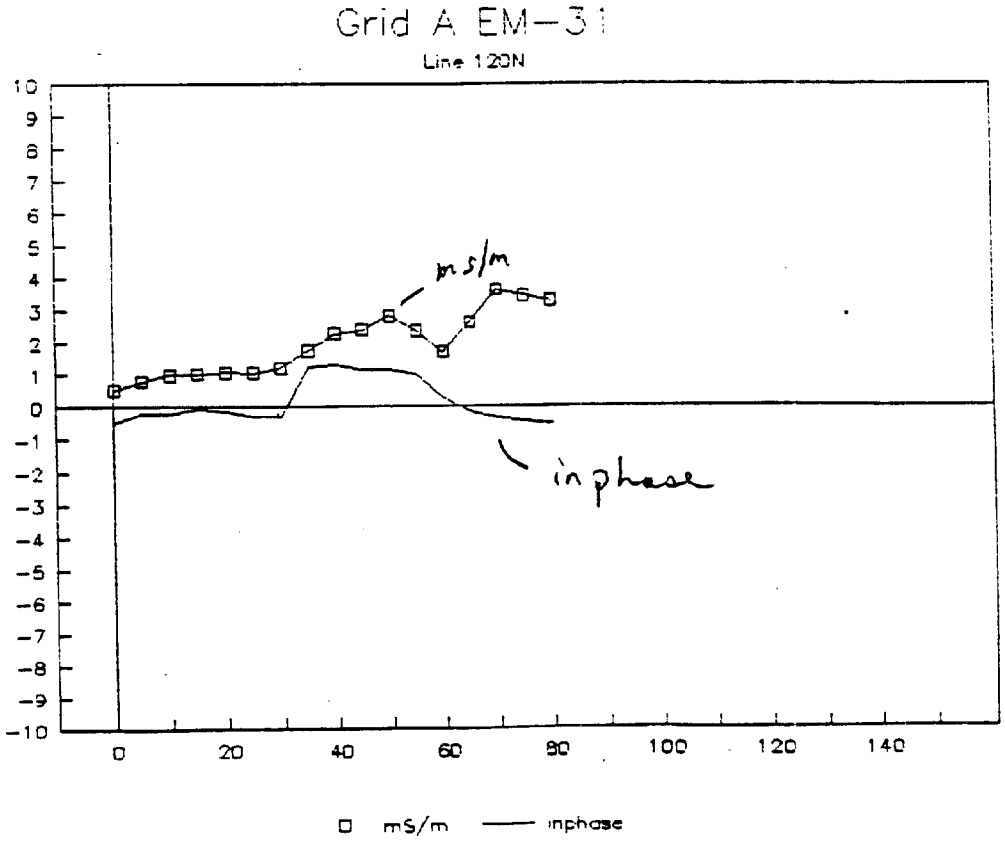
Distance (feet)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mS/m
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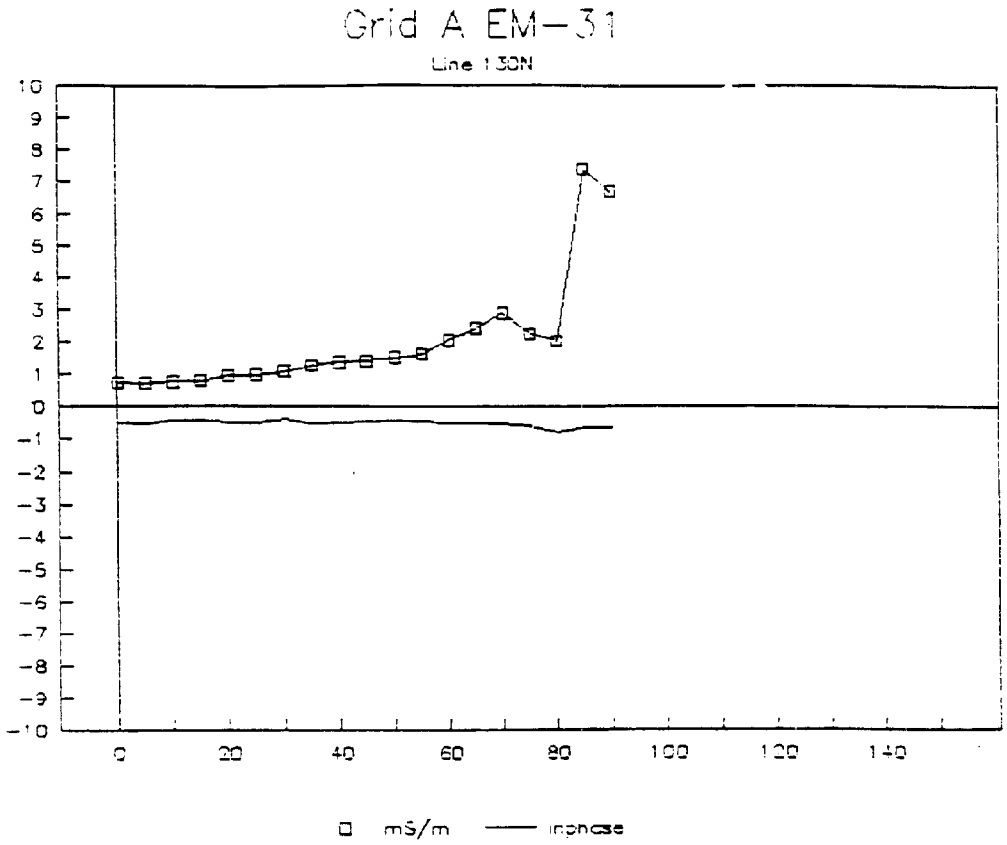
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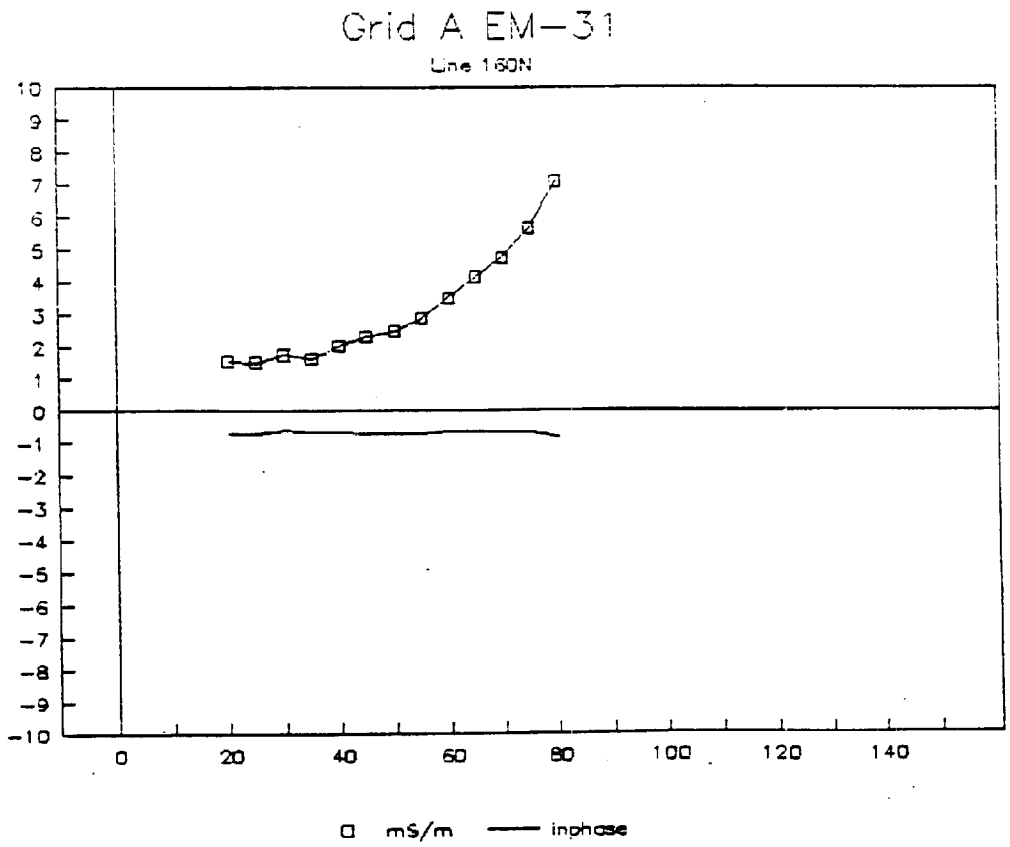
mS/m
inphase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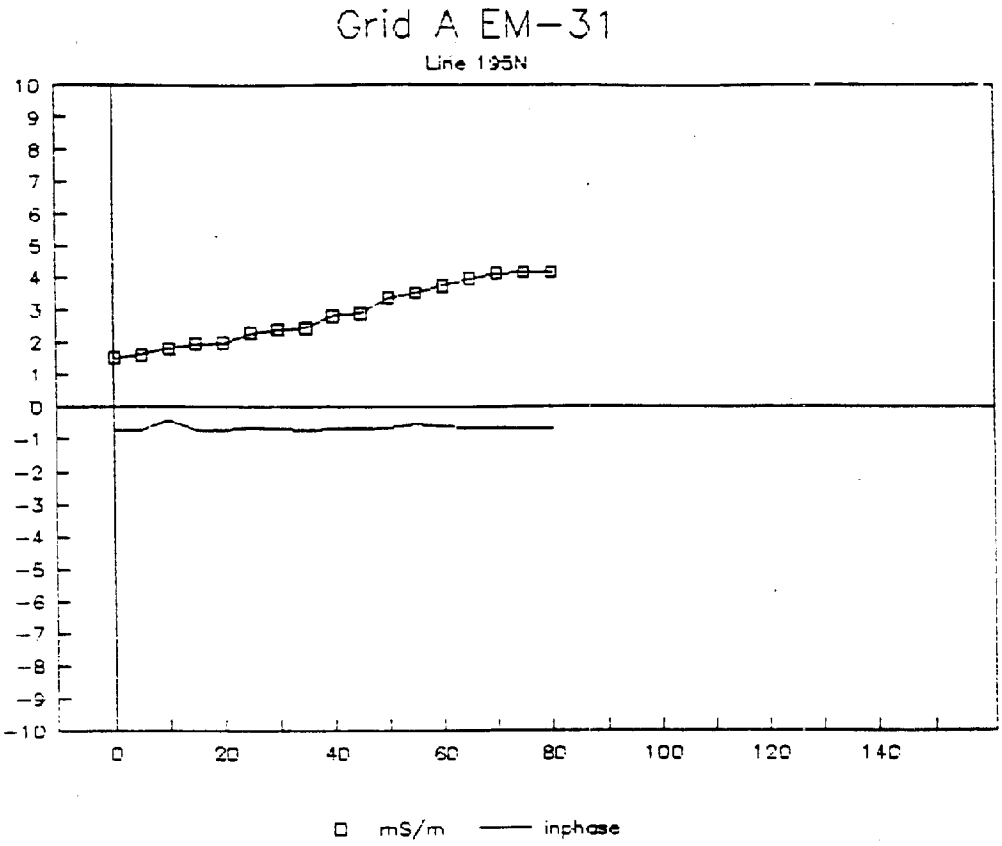
mS/m
inphase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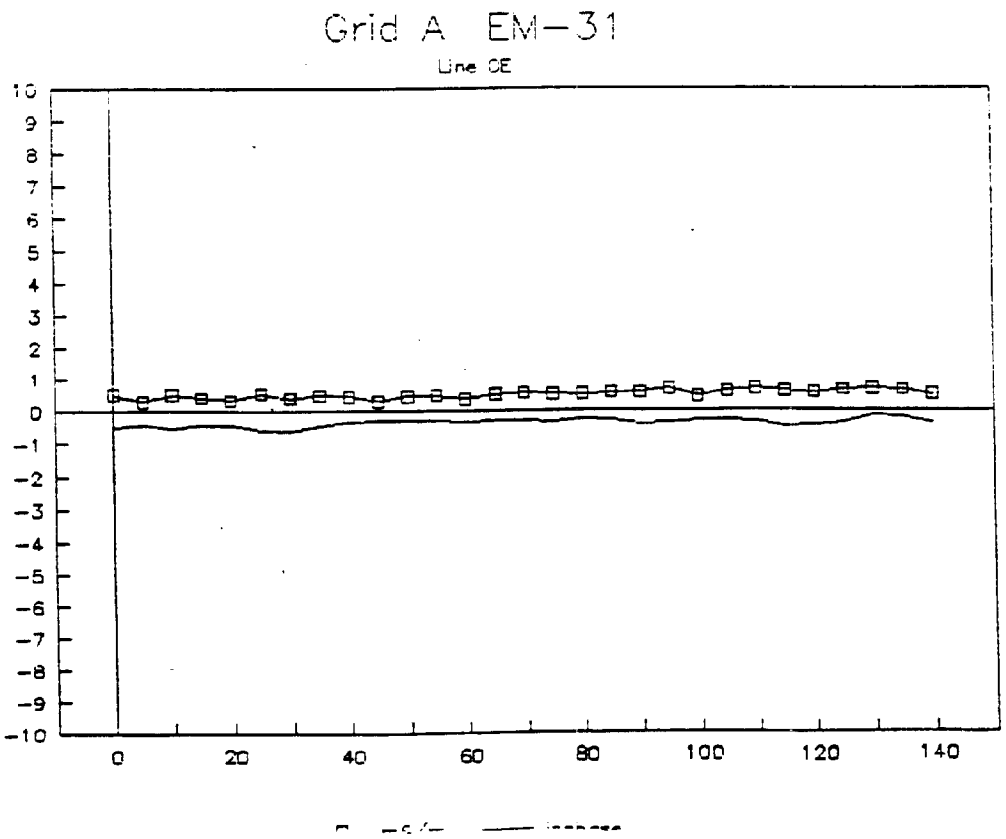
mS/m
inphase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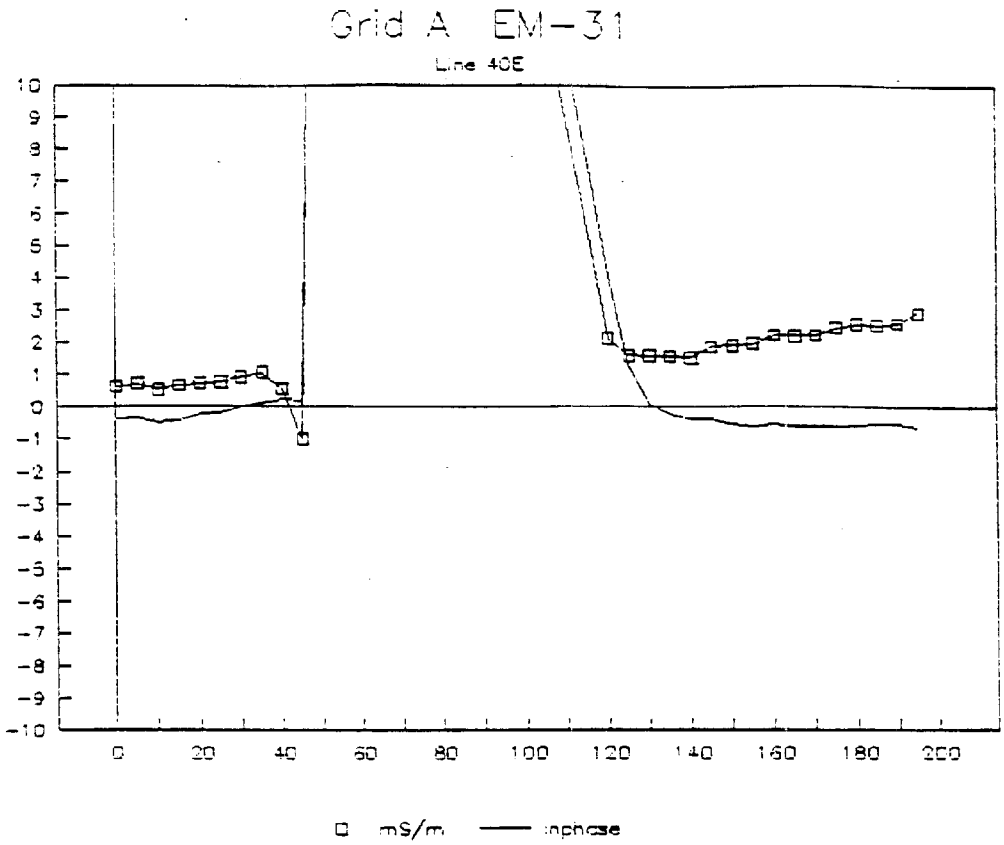
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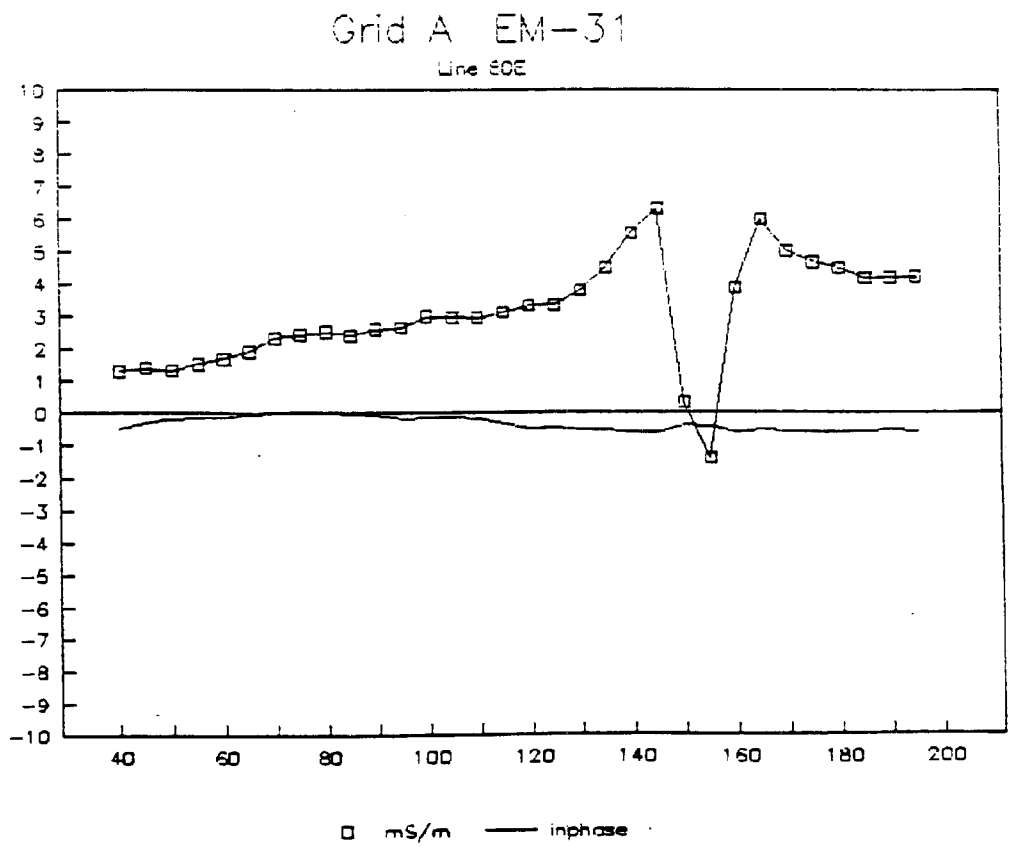
mS/m
inphase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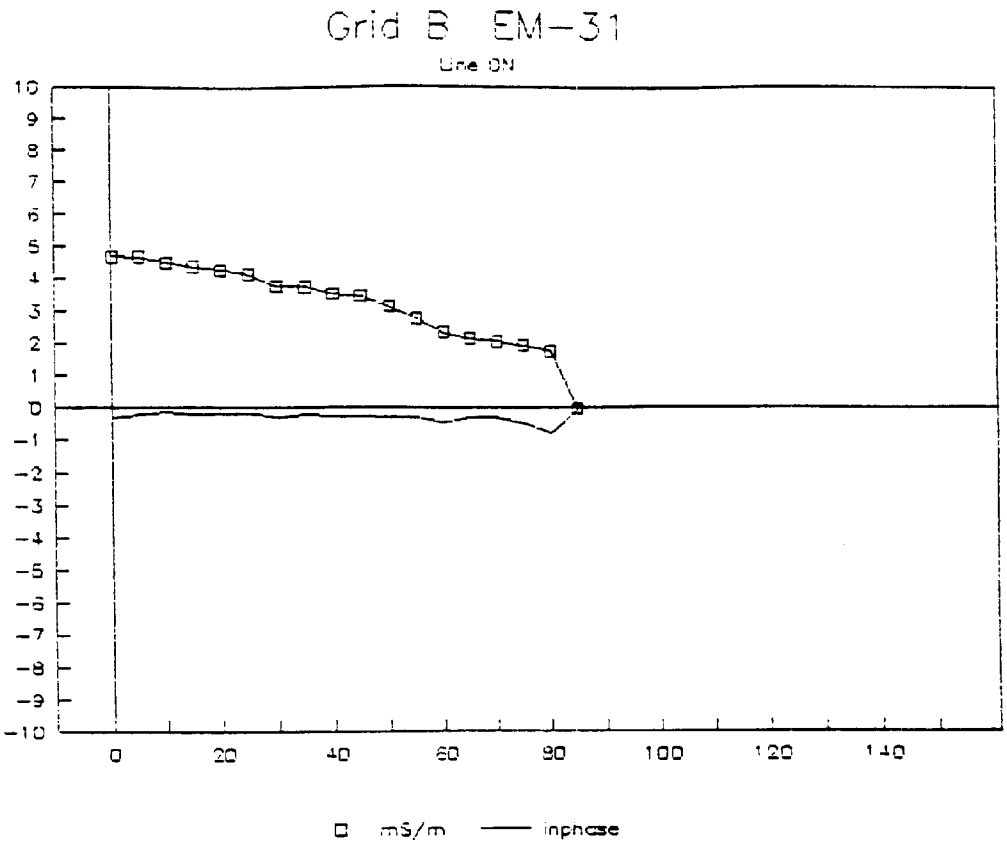
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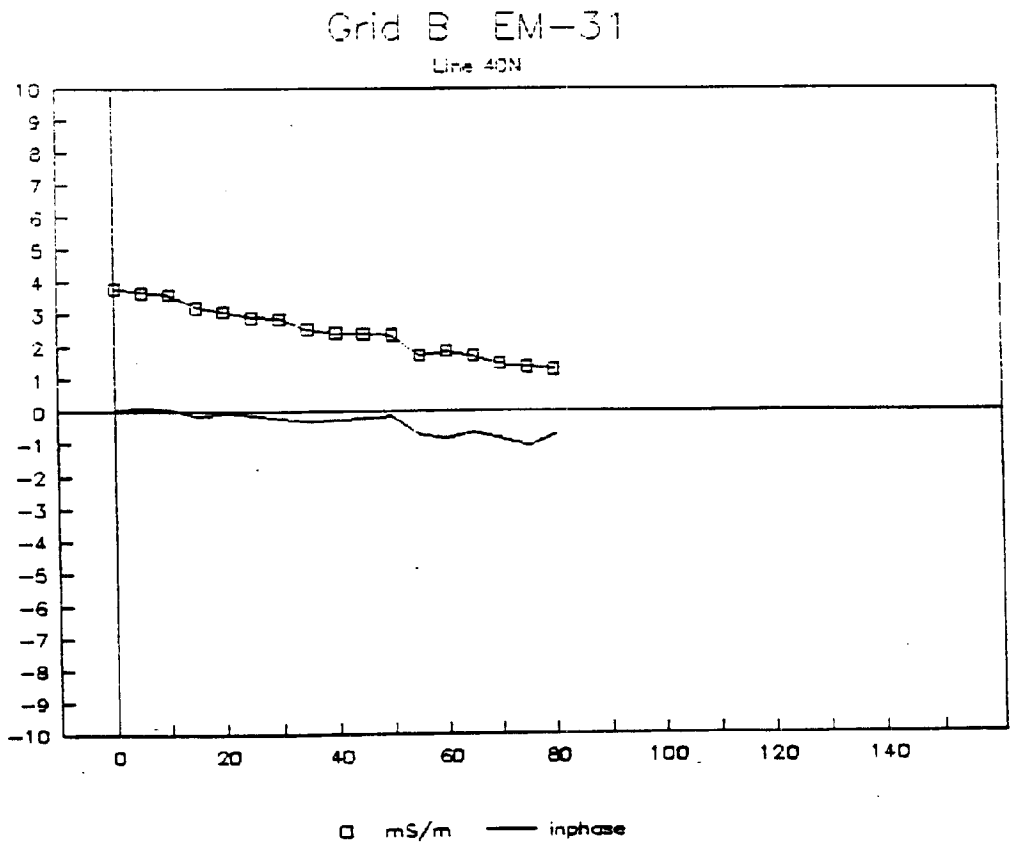
mS/m
inphase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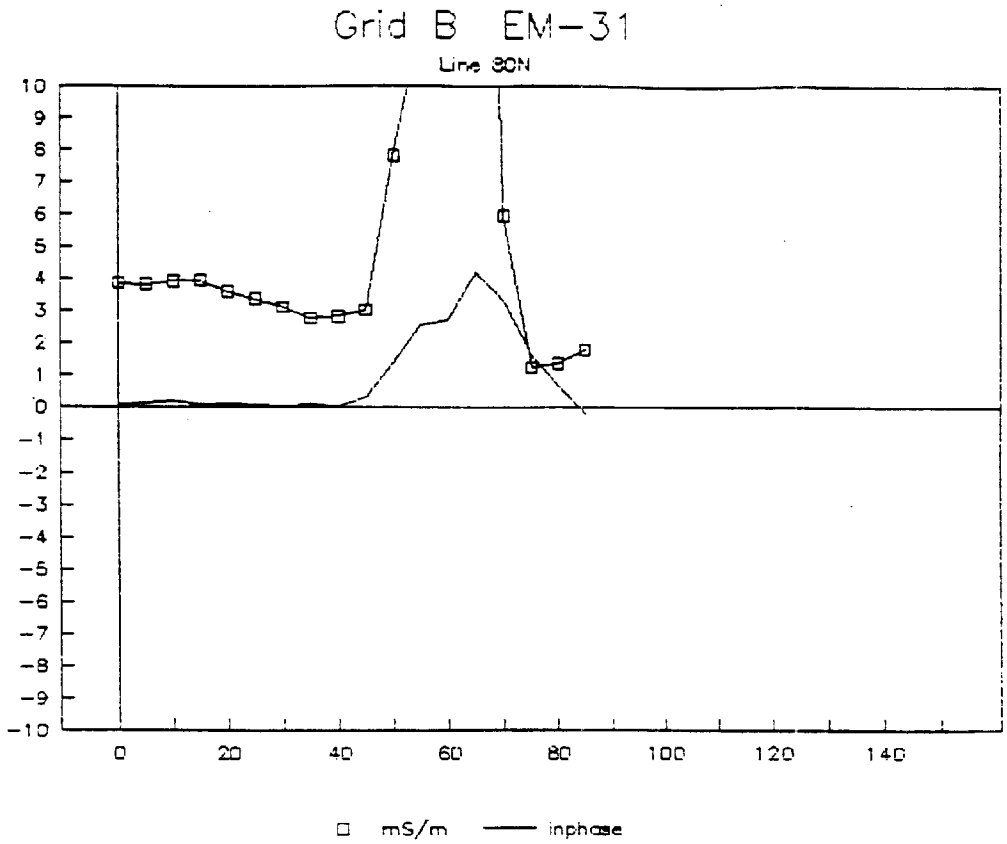
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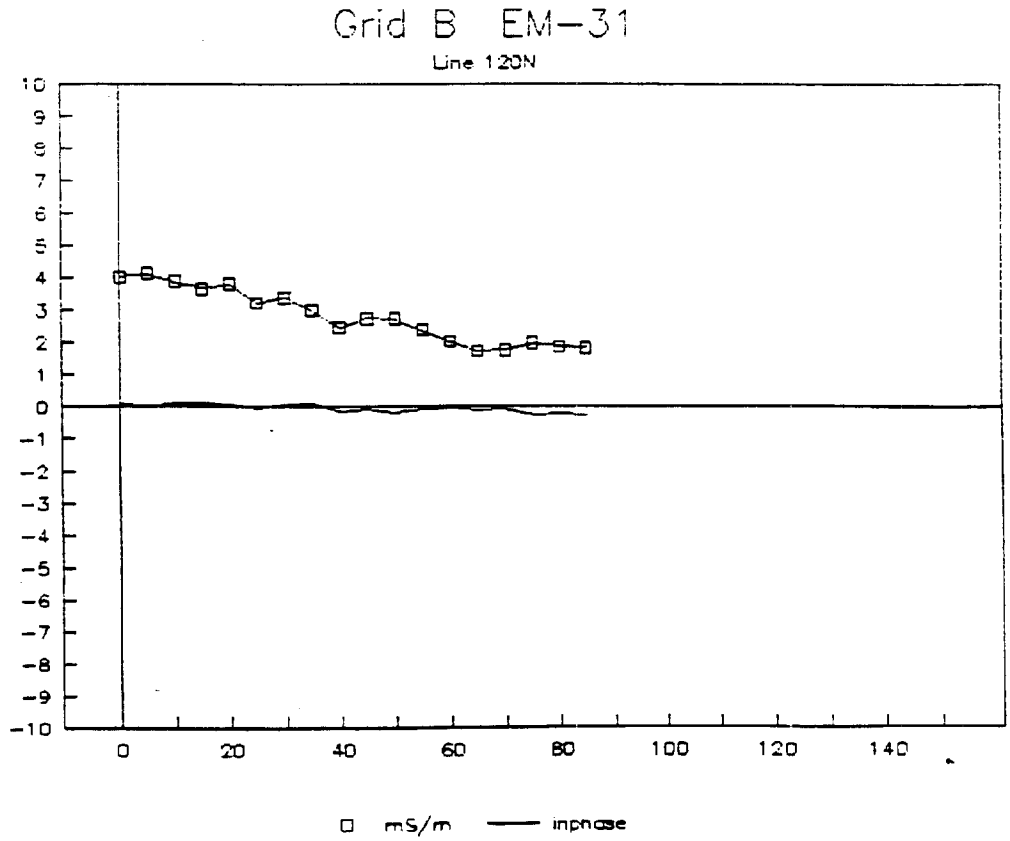
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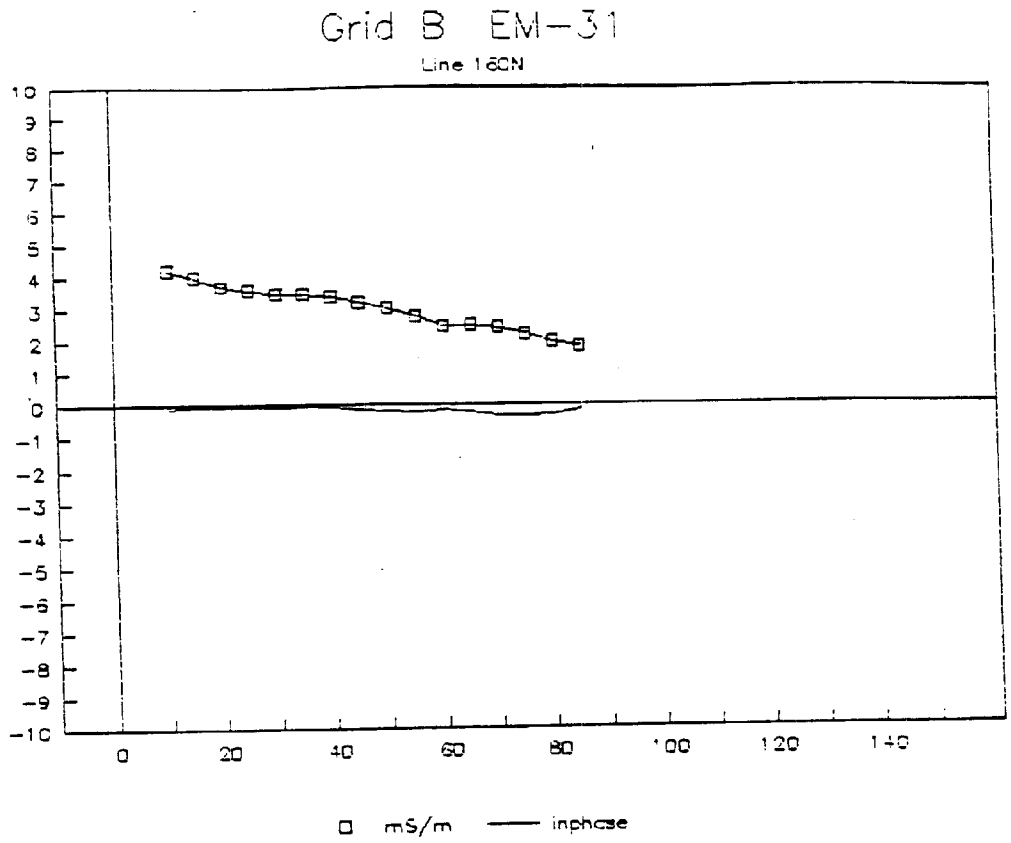
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mS/m
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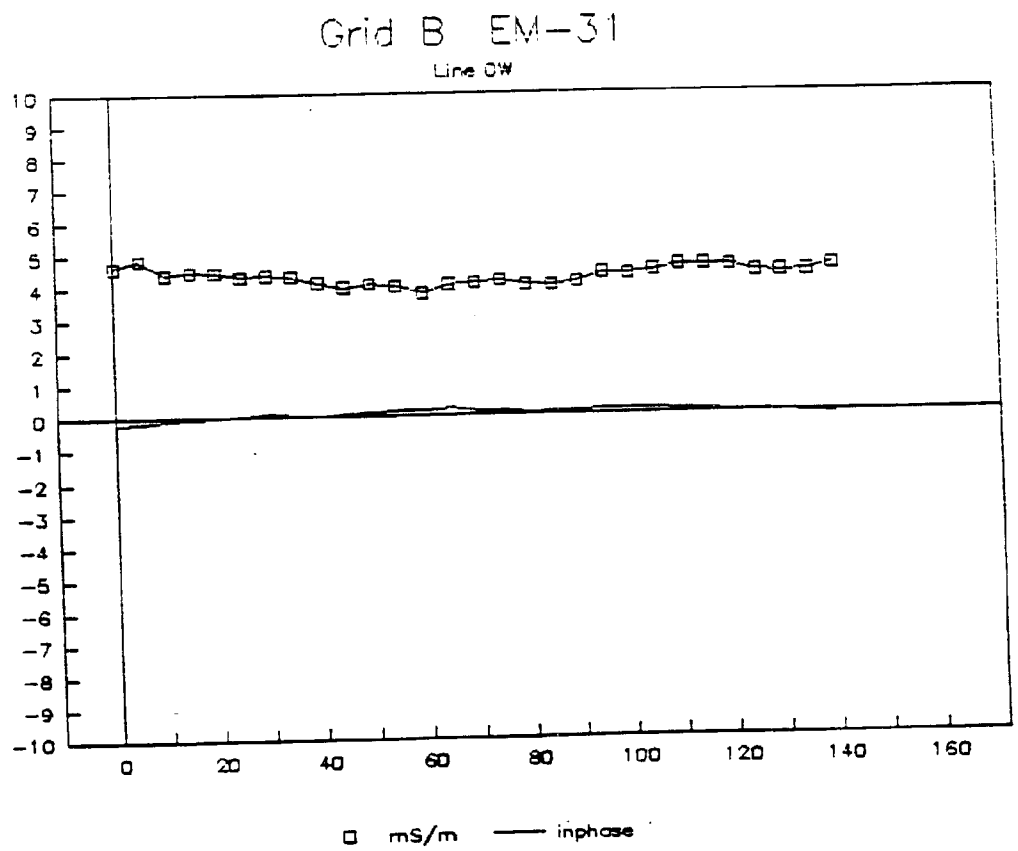
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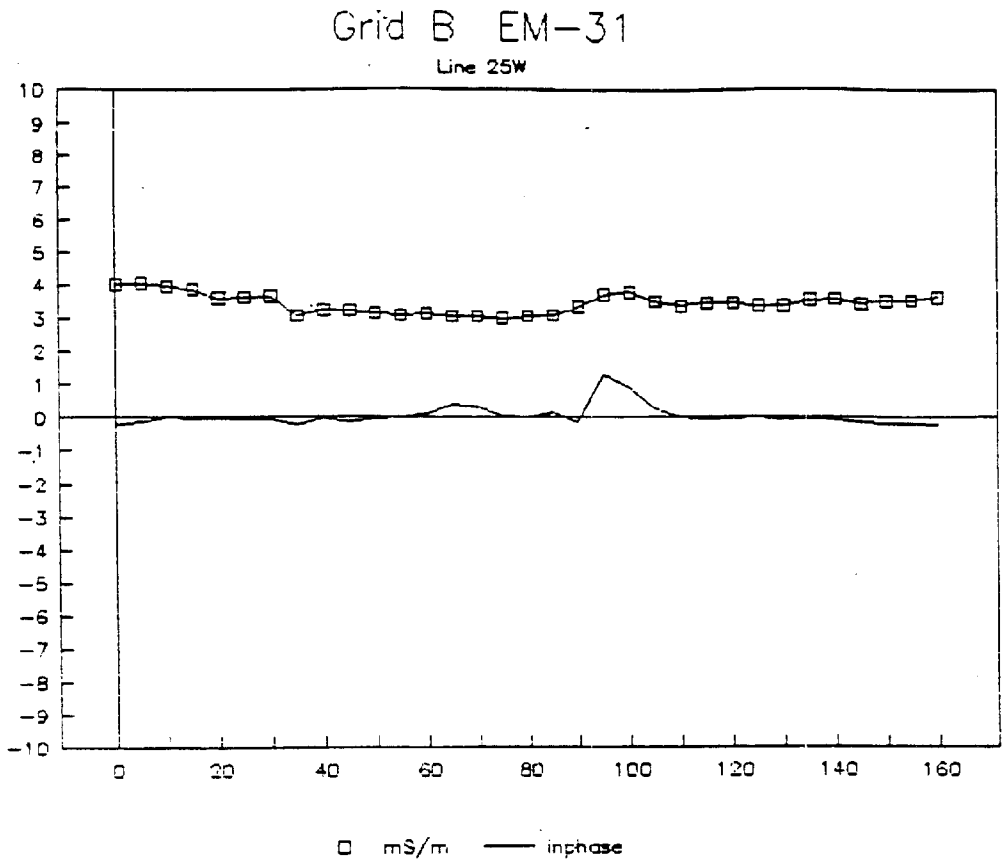
inphase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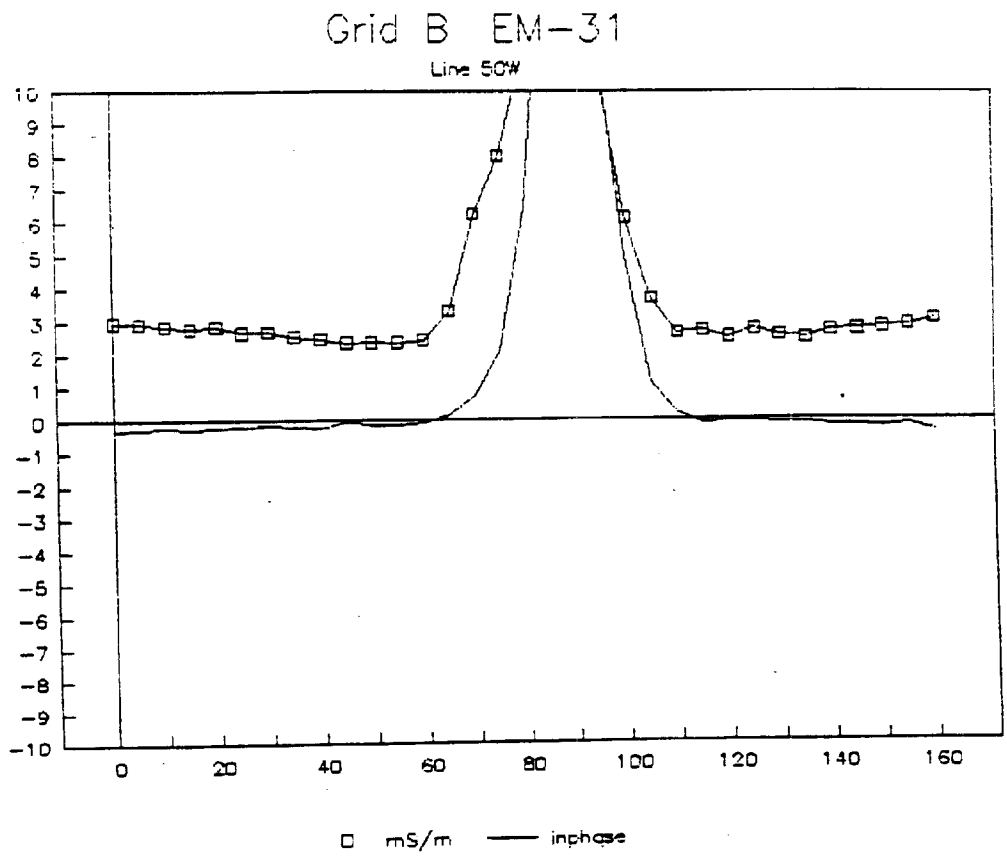
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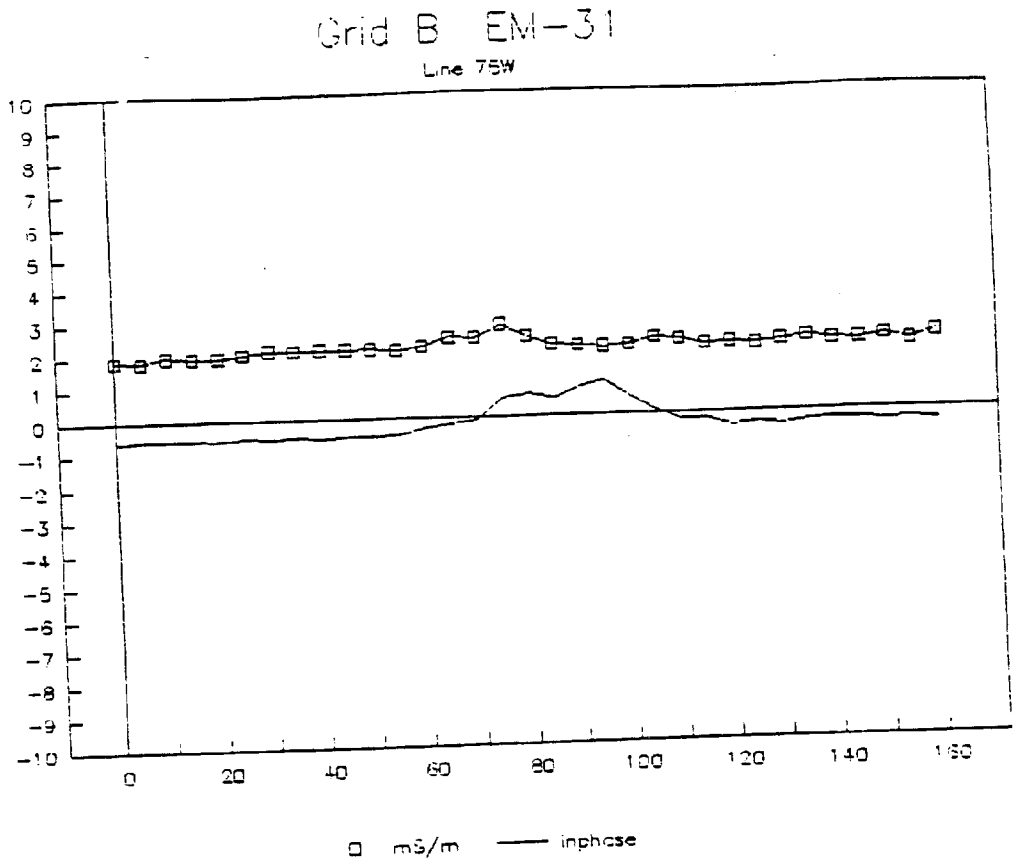
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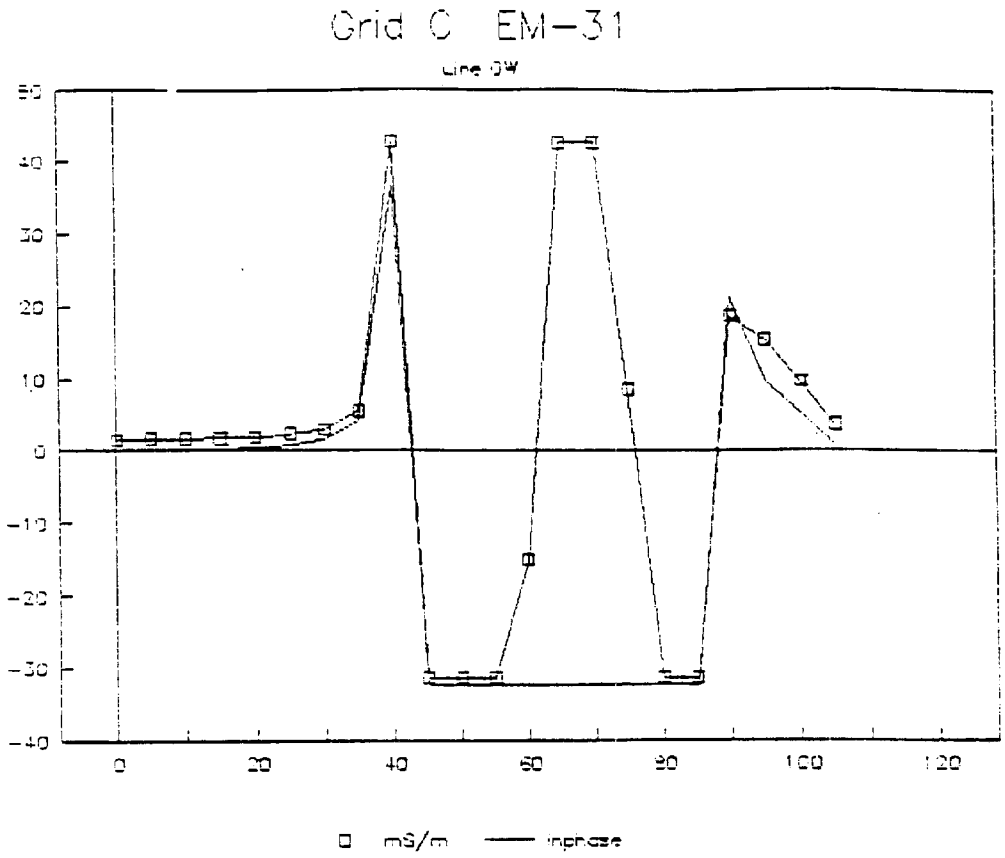
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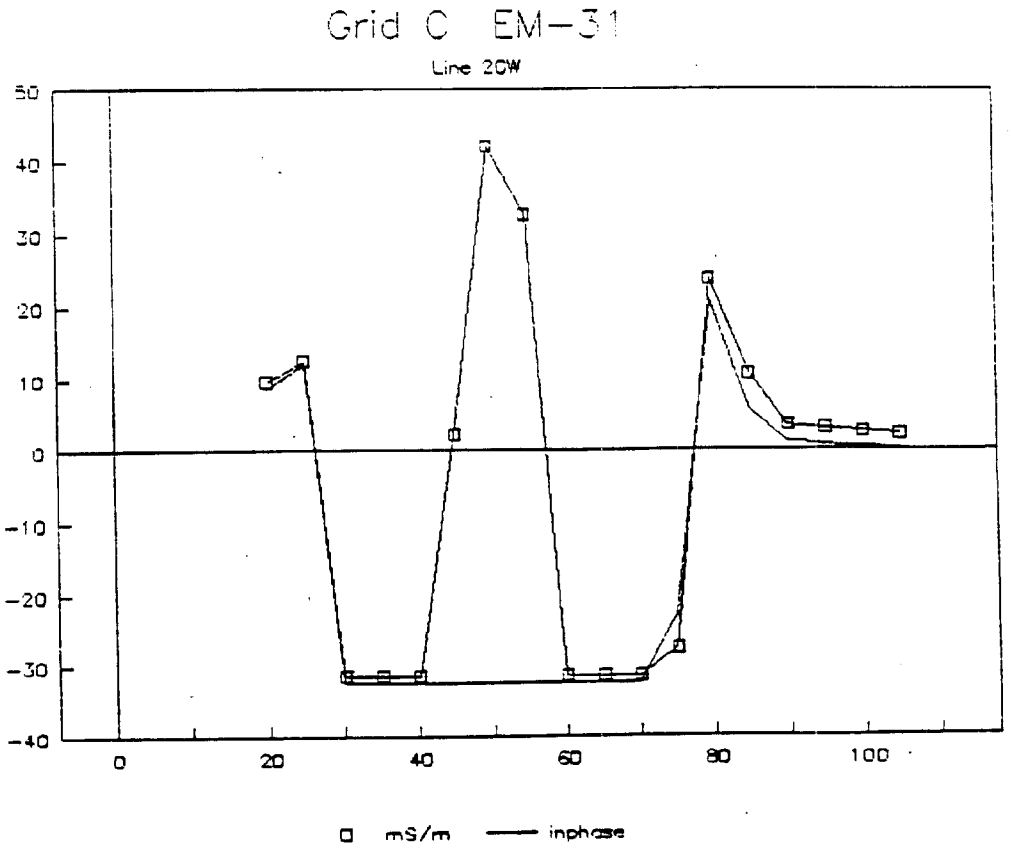
mS/m
inphase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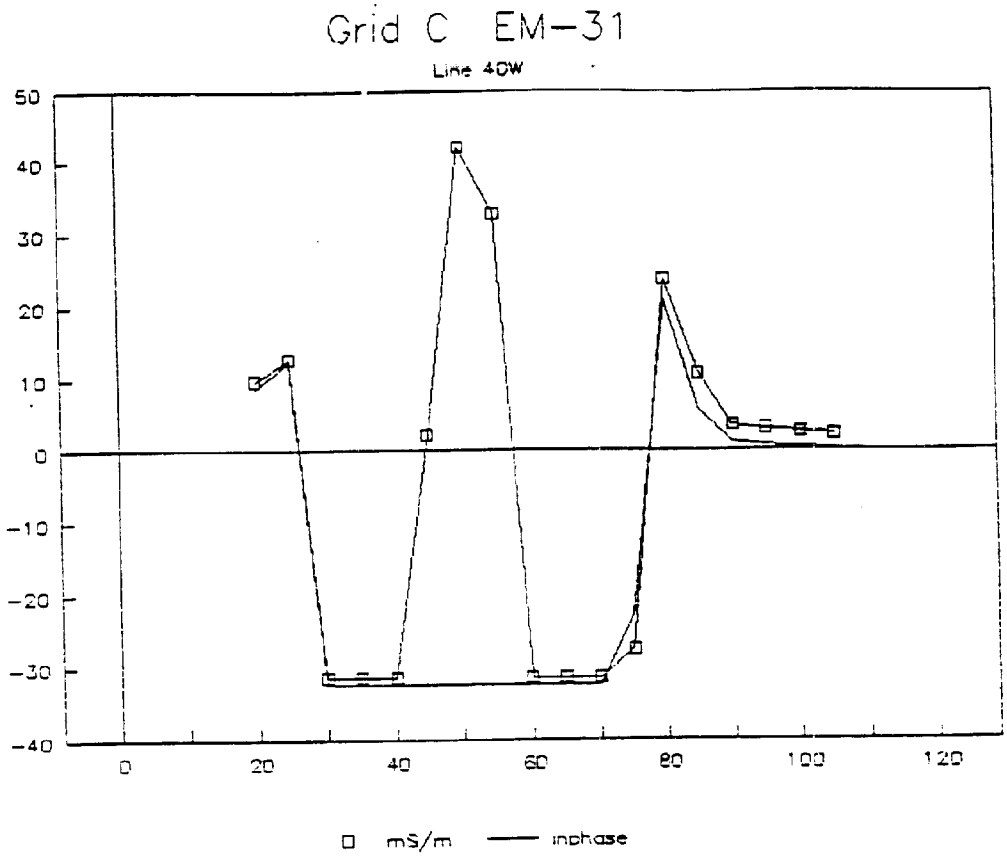
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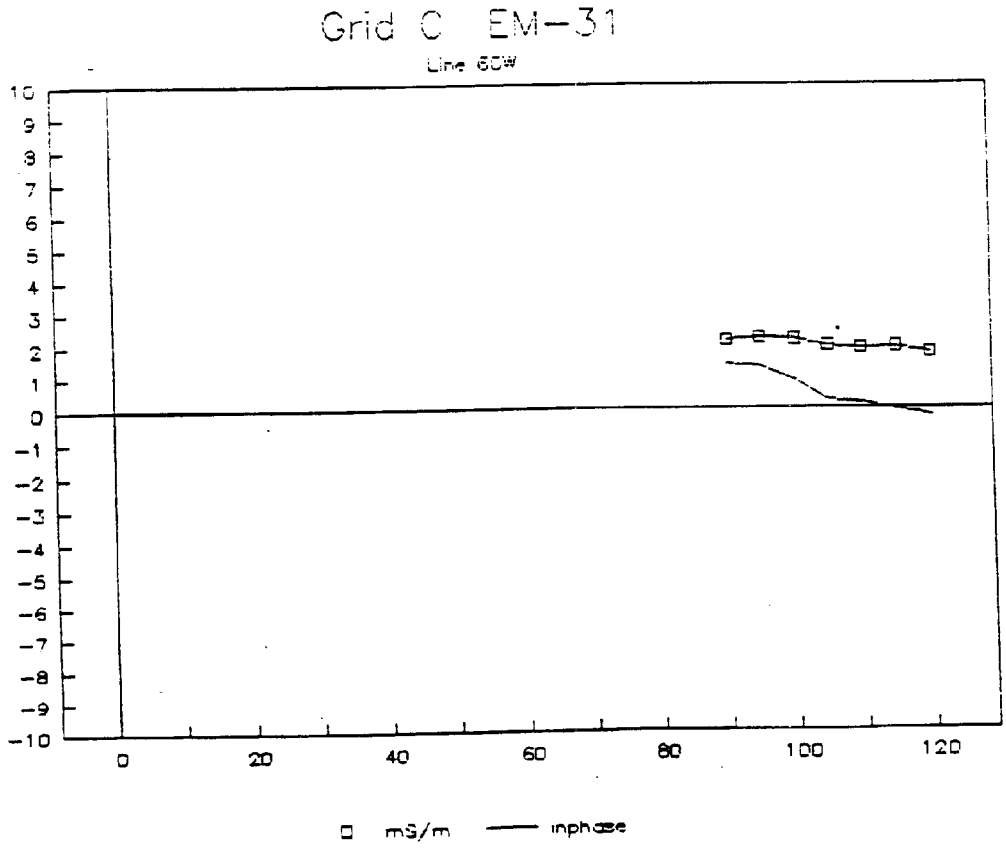
mS/m
inphase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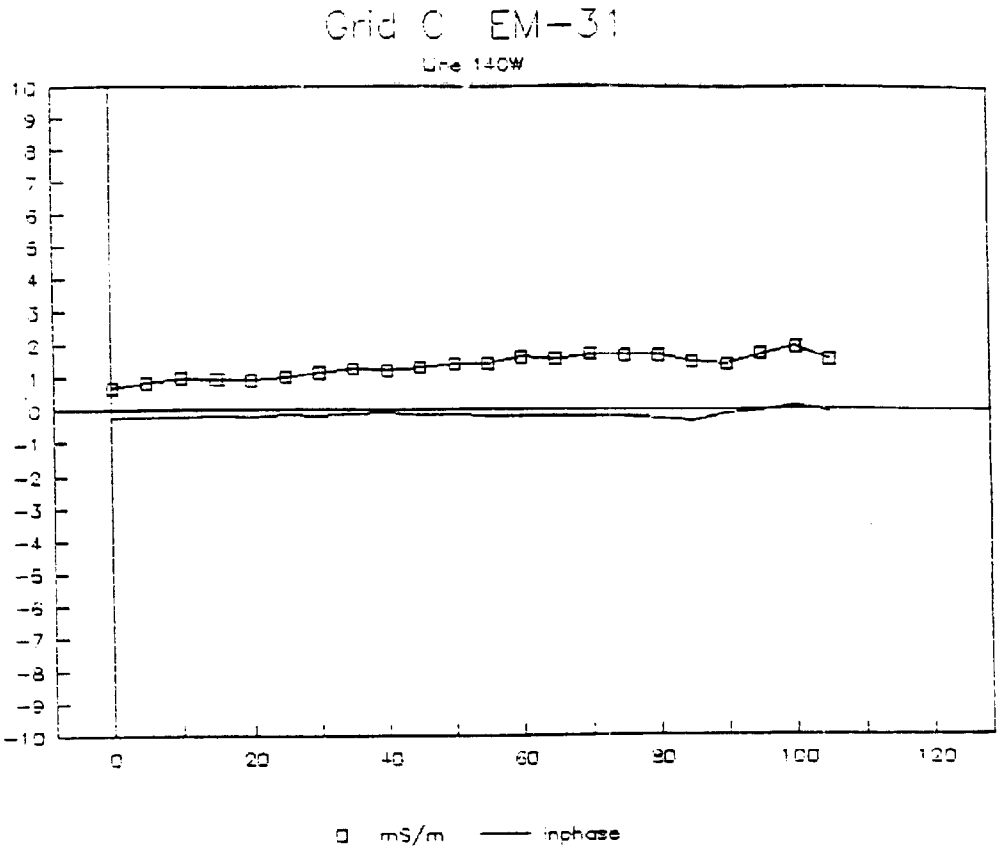
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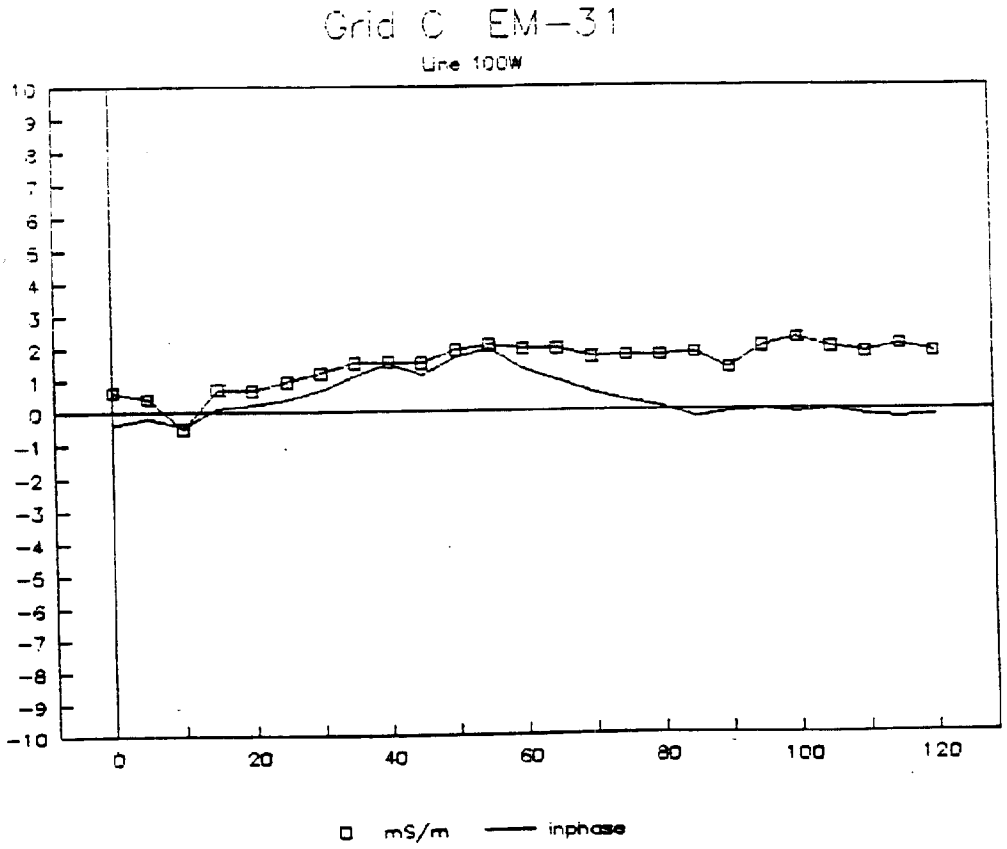
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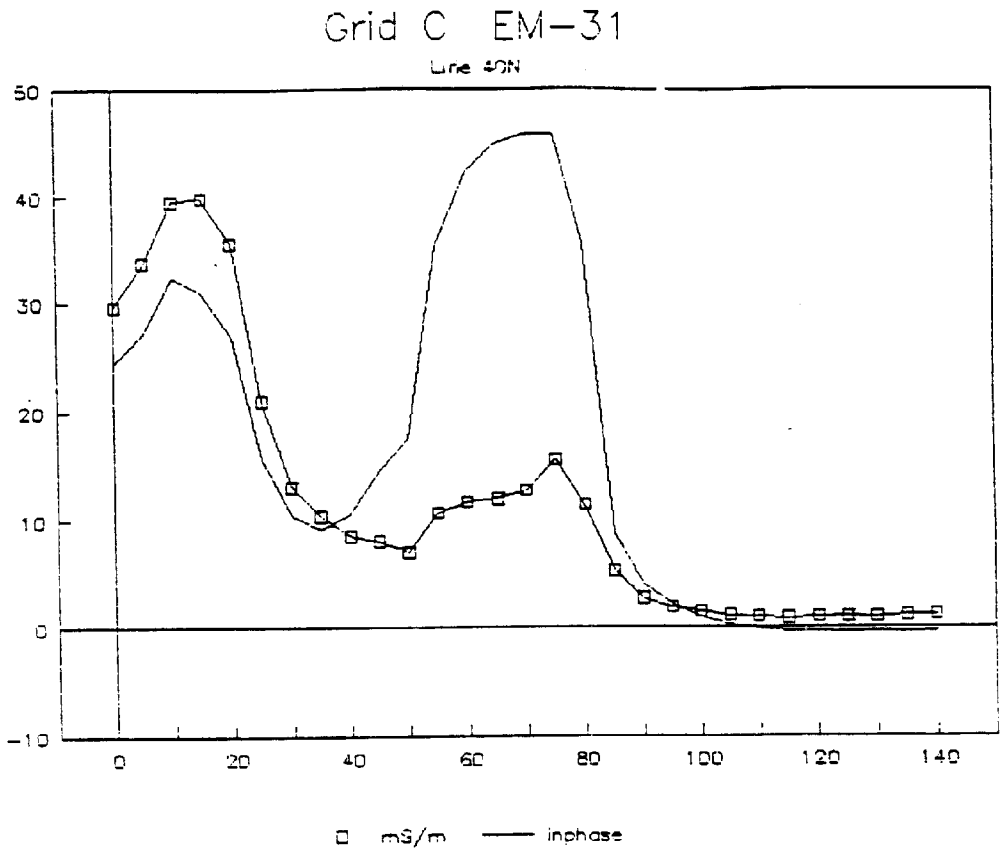
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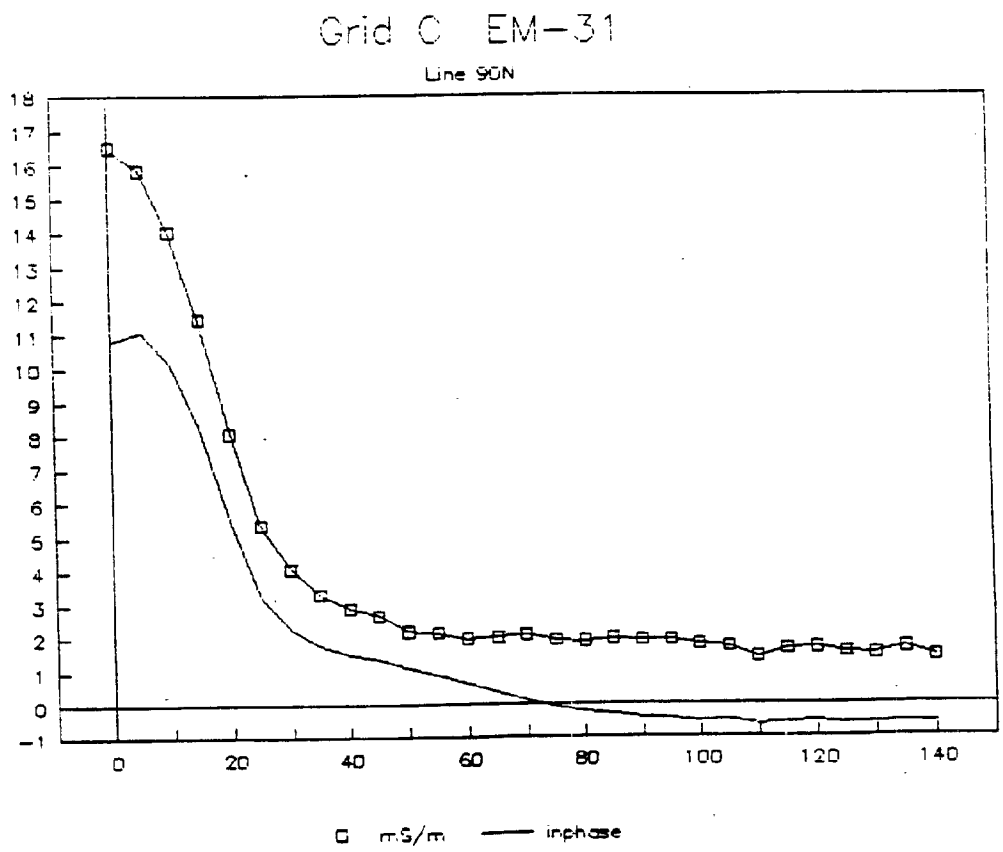
mS/m
inphase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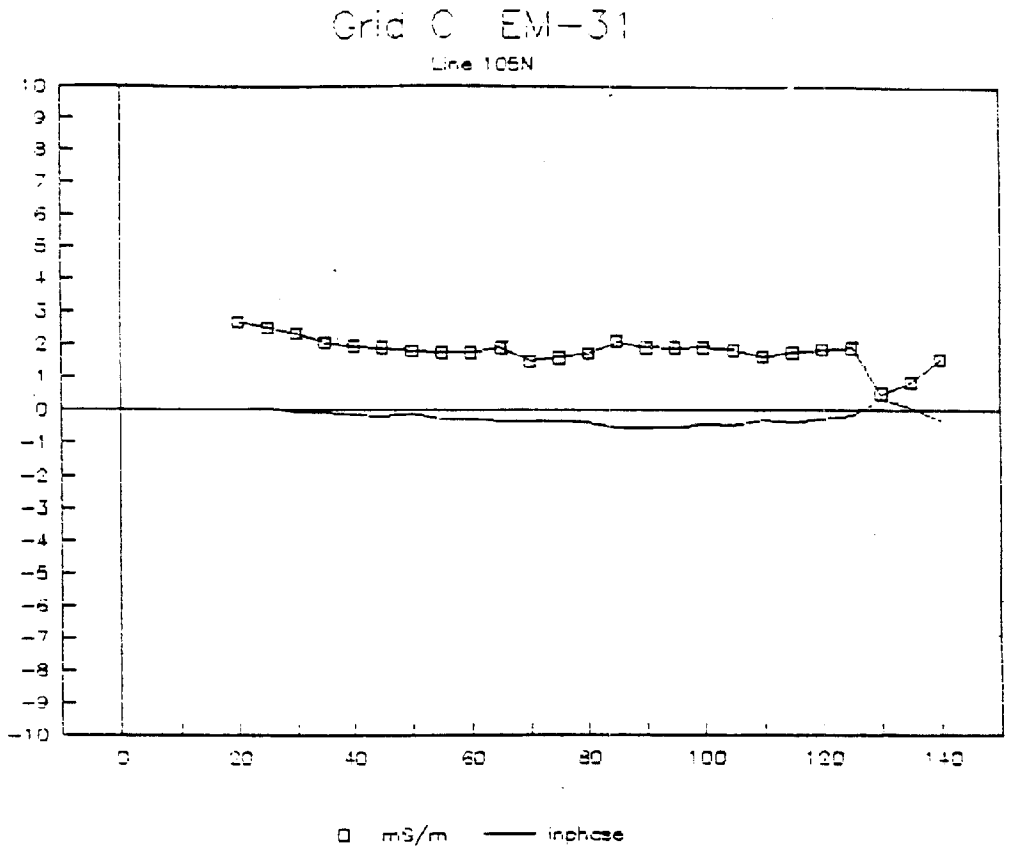
mS/m
inphase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mS/m
inphase

APPENDIX F

ELECTROMAGNETIC DATA AT GRID NODES - ANALISYS OF ANISOTROPY
STUDY AREA 1 - CED DRUM STORAGE SITE
CALF PASTURE POINT MUNITIONS BUNKERS, GRIDS A, B AND C

Area 1 CED Drum Storage Area EM Anisotropy

East	North	N-S orientation mS/m	N-S orientation inphase	E-W orientation mS/m	E-W orientation inphase	mS/m delta	inphase delta
-50 E	400 N	1.7	-0.3	1.7	-0.6	0	0.3
-50 E	450 N	-1.7	-7.5	4	-0.7	5.7	6.8
-50 E	500 N	2.9	-0.3	2.7	-0.6	0.2	0.3
0 E	300 N	2.7	0.6	2.4	0.1	0.3	0.5
0 E	350 N	1.5	-0.6	1.5	-0.9	0	0.3
0 E	400 N	1.8	-0.7	1.4	-0.9	0.4	0.2
0 E	450 N	2.4	-0.4	2.3	-0.7	0.1	0.3
0 E	500 N	3.8	-0.4	3.9	-0.5	0.1	0.1
50 E	250 N	5.3	0.4	2.7	-0.2	2.6	0.6
50 E	300 N	1.8	-0.4	1.2	-0.5	0.6	0.1
50 E	350 N	2.2	-0.1	1.7	-0.8	0.5	0.7
50 E	400 N	1.4	-0.3	1.4	-0.4	0	0.1
50 E	450 N	1.1	-0.1	1.6	-0.8	0.5	0.7
50 E	500 N	5.1	-0.4	4.1	-0.6	1	0.2
100 E	150 N	1.5	-0.5	1.5	-0.7	0	0.2
100 E	200 N	13.1	6.5	12.7	6.2	0.4	0.3
100 E	250 N	1.7	-0.4	1.6	-0.7	0.1	0.3
100 E	300 N	1.8	-0.4	1.8	-0.6	0	0.2
100 E	350 N	2.2	-0.5	1.6	-0.9	0.6	0.4
100 E	400 N	3.7	0.5	3.4	0.2	0.3	0.3
100 E	450 N	2.5	-0.3	2.2	-0.6	0.3	0.3
100 E	500 N	2.5	-0.5	2.2	-0.7	0.3	0.2
150 E	100 N	1.8	-1.1	2.9	0.3	1.1	1.4
150 E	150 N	2.2	-0.5	2.2	-0.7	0	0.2
150 E	200 N	2.3	-0.7	2.5	-0.7	0.2	0
150 E	250 N	2.2	-0.7	2.1	-0.8	0.1	0.1
150 E	300 N	2.6	0.4	2.8	0.9	0.2	0.5
150 E	350 N	2.4	-0.5	2.4	-0.7	0	0.2
150 E	400 N	1.8	-0.5	1.8	-0.5	0	0
150 E	450 N	-3	-7.8	0.1	-4.3	3.1	3.5
150 E	500 N	1.2	-0.6	1.4	-0.8	0.2	0.2
200 E	50 N	1.7	-0.8	2	-1	0.3	0.2
200 E	100 N	2.9	-0.3	0.7	-0.8	2.2	0.5
200 E	150 N	2	-0.6	1.8	-0.5	0.2	0.1
200 E	200 N	2.1	-0.6	1.6	-0.8	0.5	0.2
200 E	250 N	-9.5	-14	-0.9	-8.7	8.6	5.3
200 E	300 N	1.5	-0.6	1.5	-1	0	0.4
200 E	350 N	1.5	-0.7	1.5	-1	0	0.3
200 E	400 N	1.4	-0.6	1.3	-0.8	0.1	0.2
200 E	450 N	2.8	0.7	2.3	-0.3	0.5	1
200 E	500 N	1.2	-0.5	1.2	-0.7	0	0.2
250 E	0 N	2.8	-0.8	3.1	-0.8	0.3	0
250 E	50 N	2.6	-0.7	2.7	-1	0.1	0.3
250 E	100 N	2.3	-0.7	2.4	-0.9	0.1	0.2
250 E	150 N	2	-0.8	1.8	-0.9	0.2	0.1
250 E	200 N	0.6	-2.4	-0.3	-2.7	0.9	0.3
250 E	250 N	1.9	-0.4	1.6	-0.7	0.3	0.3
250 E	300 N	1.4	-0.6	1.5	-0.8	0.1	0.2
250 E	350 N	1.4	-0.5	1.4	-0.9	0	0.4
250 E	400 N	1.4	-0.5	1.6	-0.5	0.2	0

Area 1 CED Drum Storage Area EM Anisotropy

East	North	N-S orientation mS/m	N-S orientation inphase	E-W orientation mS/m	E-W orientation inphase	mS/m delta	inphase delta
250 E	450 N	1.3	-0.4	1.3	-0.7	0	0.3
250 E	500 N	1.3	-0.4	1.3	-0.6	0	0.2
300 E	0 N	4.7	0.7	1.8	-0.6	2.9	1.3
300 E	100 N	2.3	-0.7	2.2	-0.8	0.1	0.1
300 E	150 N	0.6	-3.3	5.8	2.3	5.2	5.6
300 E	200 N	1.2	-0.5	1.4	-0.8	0.2	0.3
300 E	250 N	0.7	-0.4	0.1	-1	0.6	0.6
300 E	300 N	1.3	-0.7	1.2	-0.8	0.1	0.1
300 E	350 N	1.3	-0.7	1.3	-0.8	0	0.1
300 E	400 N	1.5	-0.7	1.3	-0.7	0.2	0
300 E	450 N	1.3	0.3	1.3	0.1	0	0.2
300 E	500 N	1.2	-0.3	1.3	-0.5	0.1	0.2
350 E	150 N	2	-0.3	2.2	-0.1	0.2	0.2
350 E	200 N	0.8	-0.6	1	-0.9	0.2	0.3
350 E	250 N	0.9	-0.7	0.9	-0.5	0	0.2
350 E	300 N	1.5	-0.4	1.6	-0.6	0.1	0.2
350 E	350 N	0.7	-1	1.3	-0.7	0.6	0.3
350 E	400 N	1.2	-0.7	1.5	-0.7	0.3	0
350 E	450 N	1	-0.4	0.9	-0.2	0.1	0.2
350 E	500 N	1.6	-0.4	1.7	-0.5	0.1	0.1

Calf Pasture Grid A EM Anisotropy 6-93

Location		N-S orientation		E-W orientation			
East	North	mS/m	inphase	mS/m	inphase	mS/m delta	inphase delta
0	0	0.52	-0.469	0.74	-0.457	0.22	0.01
0	20	0.36	-0.421	0.64	-0.638	0.28	0.22
0	40	0.46	-0.349	0.44	-0.397	0.02	0.05
0	120	0.56	-0.445	0.52	-0.493	0.04	0.05
0	130	0.68	-0.156	0.74	-0.469	0.06	0.31
40	195	2.96	-0.65	2.84	-0.674	0.12	0.02
40	160	2.24	-0.541	2.04	-0.662	0.2	0.12
40	130	1.6	0.096	1.38	-0.493	0.22	0.59
40	120	2.14	4.082	2.28	1.312	0.14	2.77
40	40	0.56	0.24	-0.939	-0.903	1.499	1.14
40	20	0.72	-0.204	0.82	-0.385	0.1	0.18
40	0	0.64	-0.361	0.78	-0.421	0.14	0.06
80	40	1.3	-0.481	1.28	-0.409	0.02	0.07
80	120	3.32	-0.469	3.28	-0.517	0.04	0.05
80	130	3.79	-0.505	2.04	-0.794	1.74	0.29
80	160	3.86	-0.602	7.1	-0.842	3.24	0.24
80	195	4.2	-0.565	4.16	-0.686	0.04	0.12

Calf Pasture Grid C EM Anisotropy 6-93

Location		N-S orientation		E-W orientation			
West	North	mS/m	inphase	mS/m	inphase	mS/m delta	inphase delta
0	40	42.74	36.607	29.62	24.36	13.12	12.25
0	90	18.78	21.53	16.48	10.825	2.3	10.71
20	40	-31.46	-32.272	35.52	26.973	66.98	59.25
20	90	3.52	1.3	8.059	5.406	4.539	4.11
20	105	2.24	0.168	2.66	0.012	0.42	0.16
60	90	2.12	1.396	1.96	0.626	0.16	0.77
60	105	1.94	0.24	1.76	-0.24	0.18	0.48
100	40	1.56	1.493	1.52	0.999	0.04	0.49
100	90	1.32	-0.084	1.78	-0.505	0.46	0.42
100	105	1.96	0	1.92	-0.397	0.04	0.40
140	40	1.24	-0.072	1.26	-0.325	0.02	0.25
140	90	1.42	-0.096	1.42	-0.573	0	0.48
140	105	1.54	-0.06	1.58	-0.239	0.04	0.23

APPENDIX B

TEST PIT SOIL SAMPLE ANALYTICAL RESULTS

DATA QUALIFIER DEFINITIONS

J	-	Quantitation is approximate due to limitations identified during data validation.
U	-	Result is non-detected at the indicated detection limit/quantitation limit.
UJ	-	Result is non-detected and the indicated detection limit is estimated.
R or UR	-	Rejected.

SITE: CTO 127, NCBC, DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS TEST PIT RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-TP1-S1-062493		4-TP1-S2-062493		4-TP2-S1-062493		4-TP2-S2-062493	
LABORATORY ID:			14317.01		14317.02		14317.03		14317.04	
TCL VOLATILES SOILS (ug/Kg)	CRQL	MDL								
CHLOROMETHANE	10	0.7	11	U	10	U	10	U	10	U
BROMOMETHANE	10	0.7	11	U	10	U	10	U	10	U
VINYL CHLORIDE	10	0.4	11	U	10	U	10	U	10	U
CHLOROETHANE	10	0.4	11	U	10	U	10	U	10	U
METHYLENE CHLORIDE	10	0.7	40	U	37		32		29	
ACETONE	10	4.2	62	J	61	J	64	J	28	U
CARBON DISULFIDE	10	0.7	11	U	10	U	10	U	10	U
1,1-DICHLOROETHENE	10	0.7	11	U	10	U	10	U	10	U
1,1-DICHLOROETHANE	10	0.5	11	U	10	U	10	U	10	U
1,2-DICHLOROETHENE (TOTAL)	10	1	11	U	10	U	10	U	10	U
CHLOROFORM	10	0.6	11	U	10	U	10	U	10	U
1,2-DICHLOROETHANE	10	0.8	11	U	10	U	10	U	10	U
2-BUTANONE	10	3.2	11	U	10	U	10	U	10	U
1,1,1-TRICHLOROETHANE	10	0.5	11	U	10	U	10	U	10	U
CARBON TETRACHLORIDE	10	0.9	11	U	10	U	10	U	10	U
BROMODICHLOROMETHANE	10	0.8	11	U	10	U	10	U	10	U
1,2-DICHLOROPROPANE	10	0.7	11	U	10	U	10	U	10	U
CIS-1,3-DICHLOROPROPENE	10	0.5	11	U	10	U	10	U	10	U
TRICHLOROETHENE	10	2.6	11	U	10	U	10	U	10	U
DIBROMOCHLOROMETHANE	10	1.3	11	U	10	U	10	U	10	U
1,1,2-TRICHLOROETHANE	10	1.4	11	U	10	U	10	U	10	U
BENZENE	10	0.4	11	U	10	U	10	U	10	U
TRANS-1,3-DICHLOROPROPENE	10	0.8	11	U	10	U	10	U	10	U
BROMOFORM	10	1.8	11	U	10	U	10	U	10	U
4-METHYL-2-PENTANONE	10	4.8	11	U	10	U	10	U	10	U
2-HEXANONE	10	4.1	11	U	10	U	10	U	10	U
TETRACHLOROETHENE	10	0.9	11	U	10	U	10	U	10	U
1,1,2,2-TETRACHLOROETHANE	10	2.7	11	U	10	U	10	U	10	U
TOLUENE	10	0.7	11	U	10	U	10	U	10	U
CHLOROBENZENE	10	1	11	U	10	U	10	U	10	U
ETHYLBENZENE	10	0.7	11	U	10	U	10	U	10	U
STYRENE	10	1.1	11	U	10	U	10	U	10	U
XYLENE (TOTAL)	10	1.7	11	U	10	U	10	U	10	U
% SOLIDS:			90.0		98.0		97.0		97.0	

SITE: CTO 127, NCBC, DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS TEST PIT RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-TP3-S1-062493		4-TP3-S3-062493		4-TP3-S2-062493		4-TP3-S4-062493	
LABORATORY ID:			14317.05		14317.07		14317.06		14317.08	
			FIELD DUPLICATE PAIR				FIELD DUPLICATE PAIR			
TCL VOLATILES SOILS (ug/Kg)	CRQL	MDL								
CHLOROMETHANE	10	0.7	10	UJ	12	U	11	U	11	U
BROMOMETHANE	10	0.7	10	UJ	12	U	11	U	11	U
VINYL CHLORIDE	10	0.4	10	UJ	12	U	11	U	11	U
CHLOROETHANE	10	0.4	10	UJ	12	U	11	U	11	U
METHYLENE CHLORIDE	10	0.7	16	U	42		33		32	
ACETONE	10	4.2	17	U	48	J	36	U	48	J
CARBON DISULFIDE	10	0.7	10	UJ	12	U	11	U	11	U
1,1-DICHLOROETHENE	10	0.7	10	UJ	12	U	11	U	11	U
1,1-DICHLOROETHANE	10	0.5	10	UJ	12	U	11	U	11	U
1,2-DICHLOROETHENE (TOTAL)	10	1	10	UJ	12	U	11	U	11	U
CHLOROFORM	10	0.6	10	UJ	12	U	11	U	11	U
1,2-DICHLOROETHANE	10	0.8	10	UJ	12	U	11	U	11	U
2-BUTANONE	10	3.2	10	UJ	12	U	11	U	11	U
1,1,1-TRICHLOROETHANE	10	0.5	10	UJ	12	U	11	U	11	U
CARBON TETRACHLORIDE	10	0.9	10	UJ	12	U	11	U	11	U
BROMODICHLOROMETHANE	10	0.8	10	UJ	12	U	11	U	11	U
1,2-DICHLOROPROPANE	10	0.7	10	UJ	12	U	11	U	11	U
CIS-1,3-DICHLOROPROPENE	10	0.5	10	UJ	12	U	11	U	11	U
TRICHLOROETHENE	10	2.6	10	UJ	12	U	11	U	11	U
DIBROMOCHLOROMETHANE	10	1.3	10	UJ	12	U	11	U	11	U
1,1,2-TRICHLOROETHANE	10	1.4	10	UJ	12	U	11	U	11	U
BENZENE	10	0.4	10	UJ	12	U	11	U	11	U
TRANS-1,3-DICHLOROPROPENE	10	0.8	10	UJ	12	U	11	U	11	U
BROMOFORM	10	1.8	10	UJ	12	U	11	U	11	U
4-METHYL-2-PENTANONE	10	4.8	10	UJ	12	U	11	U	11	U
2-HEXANONE	10	4.1	10	UJ	12	U	11	U	11	U
TETRACHLOROETHENE	10	0.9	10	UJ	12	U	11	U	11	U
1,1,2,2-TETRACHLOROETHANE	10	2.7	10	UJ	12	U	11	U	11	U
TOLUENE	10	0.7	10	UJ	12	U	11	U	11	U
CHLOROBENZENE	10	1	10	UJ	12	U	11	U	11	U
ETHYLBENZENE	10	0.7	10	UJ	12	U	11	U	11	U
STYRENE	10	1.1	10	UJ	12	U	11	U	11	U
XYLENE (TOTAL)	10	1.7	10	UJ	12	U	11	U	11	U
% SOLIDS:			97.0		85.0		89.0		87.0	

SITE: CTO 127, NCBC, DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS TEST PIT RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-TP4-S1-062493		4-TP4-S3-062493		4-TP4-S2-062493		4-TP4-S4-062493	
LABORATORY ID:			14317.09		14317.11		14317.10		14317.12	
			FIELD DUPLICATE PAIR				FIELD DUPLICATE PAIR			
TCL VOLATILES SOILS (ug/Kg)	CRQL	MDL								
CHLOROMETHANE	10	0.7	10	UJ	10	U	10	UJ	11	U
BROMOMETHANE	10	0.7	10	UJ	10	U	10	UJ	11	U
VINYL CHLORIDE	10	0.4	10	UJ	10	U	10	UJ	11	U
CHLOROETHANE	10	0.4	10	UJ	10	U	10	UJ	11	U
METHYLENE CHLORIDE	10	0.7	30	J	33		33	J	25	
ACETONE	10	4.2	50	J	32	U	33	U	28	U
CARBON DISULFIDE	10	0.7	10	UJ	10	U	10	UJ	11	U
1,1-DICHLOROETHENE	10	0.7	10	UJ	10	U	10	UJ	11	U
1,1-DICHLOROETHANE	10	0.5	10	UJ	10	U	10	UJ	11	U
1,2-DICHLOROETHENE (TOTAL)	10	1	10	UJ	10	U	10	UJ	11	U
CHLOROFORM	10	0.6	10	UJ	10	U	10	UJ	11	U
1,2-DICHLOROETHANE	10	0.8	10	UJ	10	U	10	UJ	11	U
2-BUTANONE	10	3.2	10	UJ	10	U	10	UJ	11	U
1,1,1-TRICHLOROETHANE	10	0.5	10	UJ	10	U	10	UJ	11	U
CARBON TETRACHLORIDE	10	0.9	10	UJ	10	U	10	UJ	11	U
BROMODICHLOROMETHANE	10	0.8	10	UJ	10	U	10	UJ	11	U
1,2-DICHLOROPROPANE	10	0.7	10	UJ	10	U	10	UJ	11	U
CIS-1,3-DICHLOROPROPENE	10	0.5	10	UJ	10	U	10	UJ	11	U
TRICHLOROETHENE	10	2.6	10	UJ	10	U	10	UJ	11	U
DIBROMOCHLOROMETHANE	10	1.3	10	UJ	10	U	10	UJ	11	U
1,1,2-TRICHLOROETHANE	10	1.4	10	UJ	10	U	10	UJ	11	U
BENZENE	10	0.4	10	UJ	10	U	10	UJ	11	U
TRANS-1,3-DICHLOROPROPENE	10	0.8	10	UJ	10	U	10	UJ	11	U
BROMOFORM	10	1.8	10	UJ	10	U	10	UJ	11	U
4-METHYL-2-PENTANONE	10	4.8	10	UJ	10	U	10	UJ	11	U
2-HEXANONE	10	4.1	10	UJ	10	U	10	UJ	11	U
TETRACHLOROETHENE	10	0.9	10	UJ	10	U	10	UJ	11	U
1,1,2,2-TETRACHLOROETHANE	10	2.7	10	UJ	10	U	10	UJ	11	U
TOLUENE	10	0.7	10	UJ	10	U	10	UJ	11	U
CHLOROBENZENE	10	1	10	UJ	10	U	10	UJ	11	U
ETHYLBENZENE	10	0.7	10	UJ	10	U	10	UJ	11	U
STYRENE	10	1.1	10	UJ	10	U	10	UJ	1	J
XYLENE (TOTAL)	10	1.7	10	UJ	10	U	10	UJ		
% SOLIDS:			97.0		97.0		95.0		93.0	

SITE: CTO 127, NCBC, DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS TEST PIT RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-TP5-S1-062493		4-TP5-S2-062493		4-TP6-S1-062593		4-TP6-S2-062593	
LABORATORY ID:			14317.31		14317.32		14345.01		14345.02 RE	
TCL VOLATILES SOILS (ug/Kg)	CRQL	MDL								
CHLOROMETHANE	10	0.7	11	U	10	U	12	UJ	11	U
BROMOMETHANE	10	0.7	11	U	10	U	12	UJ	11	U
VINYL CHLORIDE	10	0.4	11	U	10	U	12	UJ	11	U
CHLOROETHANE	10	0.4	11	U	10	U	12	UJ	11	U
METHYLENE CHLORIDE	10	0.7	20	U	13		42	J	53	J
ACETONE	10	4.2	11	U	17	U	54	U	39	U
CARBON DISULFIDE	10	0.7	11	U	10	U	12	UJ	11	U
1,1-DICHLOROETHENE	10	0.7	11	U	10	U	12	UJ	11	U
1,1-DICHLOROETHANE	10	0.5	11	U	10	U	12	UJ	11	U
1,2-DICHLOROETHENE (TOTAL)	10	1	11	U	10	U	12	UJ	11	U
CHLOROFORM	10	0.6	11	U	10	U	12	U	11	U
1,2-DICHLOROETHANE	10	0.8	11	U	10	U	12	UJ	11	U
2-BUTANONE	10	3.2	11	UJ	10	UJ	12	UJ	11	U
1,1,1-TRICHLOROETHANE	10	0.5	11	U	10	U	12	UJ	11	U
CARBON TETRACHLORIDE	10	0.9	11	U	10	U	12	UJ	11	U
BROMODICHLOROMETHANE	10	0.8	11	U	10	U	12	UJ	11	U
1,2-DICHLOROPROPANE	10	0.7	11	U	10	U	12	UJ	11	U
CIS-1,3-DICHLOROPROPENE	10	0.5	11	U	10	U	12	UJ	11	U
TRICHLOROETHENE	10	2.6	11	U	10	U	12	UJ	11	U
DIBROMOCHLOROMETHANE	10	1.3	11	U	10	U	12	UJ	11	U
1,1,2-TRICHLOROETHANE	10	1.4	11	U	10	U	12	UJ	11	U
BENZENE	10	0.4	11	U	10	U	12	UJ	11	U
TRANS-1,3-DICHLOROPROPENE	10	0.8	11	U	10	U	12	UJ	11	U
BROMOFORM	10	1.8	11	U	10	U	12	UJ	11	U
4-METHYL-2-PENTANONE	10	4.8	11	U	10	U	12	UJ	11	U
2-HEXANONE	10	4.1	11	U	10	U	12	UJ	11	U
TETRACHLOROETHENE	10	0.9	11	U	10	U	12	UJ	11	U
1,1,2,2-TETRACHLOROETHANE	10	2.7	11	U	10	U	12	UJ	2	J
TOLUENE	10	0.7	11	U	10	U	12	UJ	11	U
CHLOROBENZENE	10	1	11	U	10	U	12	UJ	11	U
ETHYLBENZENE	10	0.7	11	U	10	U	12	UJ	11	U
STYRENE	10	1.1	11	U	10	U	12	UJ	11	U
XYLENE (TOTAL)	10	1.7	11	U	10	U	12	UJ	11	U
% SOLIDS:			87.0		96.0		85.0		91.0	

SITE: CTO 127, NCBC DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS TEST PIT RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-TP1-S1-062493		4-TP1-S2-062493		4-TP2-S1-062493		4-TP2-S2-062493		4-TP3-S1-062493		4-TP3-S3-062493	
LABORATORY ID:			14317.01		14317.02		14317.03		14317.04		14317.05		14317.07	
											FIELD DUPLICATE PAIR			
TCL SEMIVOLATILES SOILS (ug/Kg)	CRQL	MDL												
PHENOL	330	36	370	U	340	U	340	U	340	U	340	U	390	U
BIS(2-CHLOROETHYL)ETHER	330	27	370	U	340	U	340	U	340	U	340	U	390	U
2-CHLOROPHENOL	330	37	370	U	340	U	340	U	340	U	340	U	390	U
1,3-DICHLOROBENZENE	330	40	370	U	340	U	340	U	340	U	340	U	390	U
1,4-DICHLOROBENZENE	330	43	370	U	340	U	340	U	340	U	340	U	390	U
1,2-DICHLOROBENZENE	330	47	370	U	340	U	340	U	340	U	340	U	390	U
2-METHYLPHENOL	330	47	370	U	340	U	340	U	340	U	340	U	390	U
BIS(2-CHLOROISOPROPYL)ETHER	330	40	370	U	340	U	340	U	340	U	340	U	390	U
4-METHYLPHENOL	330	47	370	U	340	U	340	U	340	U	340	U	390	U
N-NITROSO-DI-N-PROPYLAMINE	330	47	370	U	340	U	340	U	340	U	340	U	390	U
HEXACHLOROETHANE	330	27	370	U	340	U	340	U	340	U	340	U	390	U
NITROBENZENE	330	53	370	U	340	U	340	U	340	U	340	U	390	U
ISOPHORONE	330	40	370	U	340	U	340	U	340	U	340	U	390	U
2-NITROPHENOL	330	33	370	U	340	U	340	U	340	U	340	U	390	U
2,4-DIMETHYLPHENOL	330	77	370	U	340	U	340	U	340	U	340	U	390	U
2,4-DICHLOROPHENOL	330	40	370	U	340	U	340	U	340	U	340	U	390	U
1,2,4-TRICHLOROBENZENE	330	40	370	U	340	U	340	U	340	U	340	U	390	U
NAPHTHALENE	330	47	370	U	340	U	340	U	340	U	340	U	390	U
4-CHLOROANILINE	330	57	370	U	340	U	340	U	340	U	340	U	390	U
BIS(2-CHLOROETHOXY)METHANE	330	47	370	U	340	U	340	U	340	U	340	U	390	U
HEXACHLOROBUTADIENE	330	47	370	U	340	U	340	U	340	U	340	U	390	U
4-CHLORO-3-METHYLPHENOL	330	57	370	U	340	U	340	U	340	U	340	U	390	U
2-METHYLNAPHTHALENE	330	47	370	U	340	U	340	U	340	U	340	U	390	U
HEXACHLOROCYCLOPENTADIENE	330	110	370	U	340	U	340	U	340	U	340	U	390	U
2,4,6-TRICHLOROPHENOL	330	53	370	U	340	U	340	U	340	U	340	U	390	U
2,4,5-TRICHLOROPHENOL	800	80	890	U	820	U	830	U	820	U	820	U	940	U
2-CHLORONAPHTHALENE	330	73	370	U	340	U	340	U	340	U	340	U	390	U
2-NITROANILINE	800	77	890	U	820	U	830	U	820	U	820	U	940	U
DIMETHYL PHTHALATE	330	83	370	U	340	U	340	U	340	U	340	U	390	U
ACENAPHTHYLENE	330	70	370	U	340	U	340	U	340	U	340	U	390	U
2,6-DINITROTOLUENE	330	60	370	U	340	U	340	U	340	U	340	U	390	U
3-NITROANILINE	800	55	890	U	820	U	830	U	820	U	820	U	940	U
ACENAPHTHENE	330	97	370	U	340	U	340	U	340	U	340	U	390	U

SITE: CTO 127, NCBC DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS TEST PIT RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-TP3-S2-062493		4-TP3-S4-062493		4-TP4-S1-062493		4-TP4-S3-062493		4-TP4-S2-062493		4-TP4-S4-062493	
LABORATORY ID:			14317.06		14317.08		14317.09		14317.11		14317.10		14317.12	
			FIELD DUPLICATE PAIR				FIELD DUPLICATE PAIR				FIELD DUPLICATE PAIR			
TCL SEMIVOLATILES SOILS (ug/Kg)	CRQL	MDL												
PHENOL	330	36	370	U	380	U	340	U	340	U	350	U	350	U
BIS(2-CHLOROETHYL)ETHER	330	27	370	U	380	U	340	U	340	U	350	U	350	U
2-CHLOROPHENOL	330	37	370	U	380	U	340	U	340	U	350	U	350	U
1,3-DICHLOROBENZENE	330	40	370	U	380	U	340	U	340	U	350	U	350	U
1,4-DICHLOROBENZENE	330	43	370	U	380	U	340	U	340	U	350	U	350	U
1,2-DICHLOROBENZENE	330	47	370	U	380	U	340	U	340	U	350	U	350	U
2-METHYLPHENOL	330	47	370	U	380	U	340	U	340	U	350	U	350	U
BIS(2-CHLOROISOPROPYL)ETHER	330	40	370	U	380	U	340	U	340	U	350	U	350	U
4-METHYLPHENOL	330	47	370	U	380	U	340	U	340	U	350	U	350	U
N-NITROSO-DI-N-PROPYLAMINE	330	47	370	U	380	U	340	U	340	U	350	U	350	U
HEXACHLOROETHANE	330	27	370	U	380	U	340	U	340	U	350	U	350	U
NITROBENZENE	330	53	370	U	380	U	340	U	340	U	350	U	350	U
ISOPHORONE	330	40	370	U	380	U	340	U	340	U	350	U	350	U
2-NITROPHENOL	330	33	370	U	380	U	340	U	340	U	350	U	350	U
2,4-DIMETHYLPHENOL	330	77	370	U	380	U	340	U	340	U	350	U	350	U
2,4-DICHLOROPHENOL	330	40	370	U	380	U	340	U	340	U	350	U	350	U
1,2,4-TRICHLOROBENZENE	330	40	370	U	380	U	340	U	340	U	350	U	350	U
NAPHTHALENE	330	47	370	U	380	U	340	U	340	U	350	U	350	U
4-CHLOROANILINE	330	57	370	U	380	U	340	U	340	U	350	U	350	U
BIS(2-CHLOROETHOXY)METHANE	330	47	370	U	380	U	340	U	340	U	350	U	350	U
HEXACHLOROBUTADIENE	330	47	370	U	380	U	340	U	340	U	350	U	350	U
4-CHLORO-3-METHYLPHENOL	330	57	370	U	380	U	340	U	340	U	350	U	350	U
2-METHYLNAPHTHALENE	330	47	370	U	380	U	340	U	340	U	350	U	350	U
HEXACHLOROCYCLOPENTADIENE	330	110	370	U	380	U	340	U	340	U	350	U	350	U
2,4,6-TRICHLOROPHENOL	330	53	370	U	380	U	340	U	340	U	350	U	350	U
2,4,5-TRICHLOROPHENOL	800	80	900	U	920	U	830	U	830	U	840	U	860	U
2-CHLORONAPHTHALENE	330	73	370	U	380	U	340	U	340	U	350	U	350	U
2-NITROANILINE	800	77	900	U	920	U	830	U	830	U	840	U	860	U
DIMETHYL PHTHALATE	330	83	370	U	380	U	340	U	340	U	350	U	350	U
ACENAPHTHYLENE	330	70	370	U	380	U	340	U	340	U	350	U	350	U
2,6-DINITROTOLUENE	330	60	370	U	380	U	340	U	340	U	350	U	350	U
3-NITROANILINE	800	55	900	U	920	U	830	U	830	U	840	U	860	U
ACENAPHTHENE	330	97	370	U	380	U	340	U	340	U	350	U	350	U

SITE: CTO 127, NCBC DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS TEST PIT RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-TP5-S1-062493		4-TP5-S2-062493		4-TP6-S1-062593		4-TP6-S2-062593	
LABORATORY ID:			14317.31		14317.32		14345.01		14345.02	
TCL SEMIVOLATILES SOILS (ug/Kg)	CRQL	MDL								
PHENOL	330	36	380	U	340	U	390	U	360	U
BIS(2-CHLOROETHYL)ETHER	330	27	380	U	340	U	390	U	360	U
2-CHLOROPHENOL	330	37	380	U	340	U	390	U	360	U
1,3-DICHLOROBENZENE	330	40	380	U	340	U	390	U	360	U
1,4-DICHLOROBENZENE	330	43	380	U	340	U	390	U	360	U
1,2-DICHLOROBENZENE	330	47	380	U	340	U	390	U	360	U
2-METHYLPHENOL	330	47	380	U	340	U	390	U	360	U
BIS(2-CHLOROISOPROPYL)ETHER	330	40	380	U	340	U	390	U	360	U
4-METHYLPHENOL	330	47	380	U	340	U	390	U	360	U
N-NITROSO-DI-N-PROPYLAMINE	330	47	380	U	340	U	390	U	360	U
HEXACHLOROETHANE	330	27	380	U	340	U	390	U	360	U
NITROBENZENE	330	53	380	U	340	U	390	U	360	U
ISOPHORONE	330	40	380	U	340	U	390	U	360	U
2-NITROPHENOL	330	33	380	U	340	U	390	U	360	U
2,4-DIMETHYLPHENOL	330	77	380	U	340	U	390	U	360	U
2,4-DICHLOROPHENOL	330	40	380	U	340	U	390	U	360	U
1,2,4-TRICHLOROBENZENE	330	40	380	U	340	U	390	U	360	U
NAPHTHALENE	330	47	380	U	340	U	390	U	360	U
4-CHLOROANILINE	330	57	380	U	340	U	390	U	360	U
BIS(2-CHLOROETHOXY)METHANE	330	47	380	U	340	U	390	U	360	U
HEXACHLOROBUTADIENE	330	47	380	U	340	U	390	U	360	U
4-CHLORO-3-METHYLPHENOL	330	57	380	U	340	U	390	U	360	U
2-METHYLNAPHTHALENE	330	47	380	U	340	U	390	U	360	U
HEXACHLOROCYCLOPENTADIENE	330	110	380	U	340	U	390	U	360	U
2,4,6-TRICHLOROPHENOL	330	53	380	U	340	U	390	U	360	U
2,4,5-TRICHLOROPHENOL	800	80	920	U	840	U	940	U	880	U
2-CHLORONAPHTHALENE	330	73	380	U	340	U	390	U	360	U
2-NITROANILINE	800	77	920	U	840	U	940	U	880	U
DIMETHYL PHTHALATE	330	83	380	U	340	U	390	U	360	U
ACENAPHTHYLENE	330	70	380	U	340	U	390	U	360	U
2,6-DINITROTOLUENE	330	60	380	U	340	U	390	U	360	U
3-NITROANILINE	800	55	920	U	840	U	940	U	880	U
ACENAPHTHENE	330	97	380	U	340	U	390	U	360	U

SITE: CTO 127, NCBC DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS TEST PIT RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-TP1-S1-062493		4-TP1-S2-062493		4-TP2-S1-062493		4-TP2-S2-062493		4-TP3-S1-062493		4-TP3-S3-062493	
LABORATORY ID:			14317.01		14317.02		14317.03		14317.04		14317.05		14317.07	
											FIELD DUPLICATE PAIR			
TCL SEMIVOLATILES SOILS (ug/Kg)	CRQL	MDL												
2,4-DINITROPHENOL	800	43	890	U	820	U	830	U	820	U	820	U	940	U
4-NITROPHENOL	800	120	890	U	820	U	830	U	820	U	820	U	940	U
DIBENZOFURAN	330	73	370	U	340	U	340	U	340	U	340	U	390	U
2,4-DINITROTOLUENE	330	57	370	U	340	U	340	U	340	U	340	U	390	U
DIETHYLPHTHALATE	330	50	370	U	340	U	340	U	340	U	340	U	390	U
4-CHLOROPHENYL-PHENYLETHER	330	40	370	U	340	U	340	U	340	U	340	U	390	U
FLUORENE	330	37	370	U	340	U	340	U	340	U	340	U	390	U
4-NITROANILINE	800	43	890	U	820	U	830	U	820	U	820	U	940	U
4,6-DINITRO-2-METHYLPHENOL	800	160	890	U	820	U	830	U	820	U	820	U	940	U
N-NITROSODIPHENYLAMIN(1)	330	33	370	U	340	U	340	U	340	U	340	U	390	U
4-BROMOPHENYL-PHENYLETHER	330	53	370	U	340	U	340	U	340	U	340	U	390	U
HEXACHLOROBENZENE	330	57	370	U	340	U	340	U	340	U	340	U	390	U
PENTACHLOROPHENOL	800	93	890	U	820	U	830	U	820	U	820	U	940	U
PHENANTHRENE	330	77	370	U	340	U	340	U	340	U	340	U	390	U
ANTHRACENE	330	73	370	U	340	U	340	U	340	U	340	U	390	U
CARBAZOLE	330	47	370	U	340	U	340	U	340	U	340	U	390	U
DI-N-BUTYLPHTHALATE	330	50	370	U	340	U	340	U	340	U	340	U	390	U
FLUORANTHENE	330	80	370	U	340	U	340	U	340	U	340	U	390	U
PYRENE	330	73	370	U	340	U	340	U	340	U	340	U	390	U
BUTYLBENZYLPHTHALATE	330	43	370	U	340	U	340	U	340	U	340	U	390	U
3,3'-DICHLOROBENZIDINE	330	80	370	U	340	U	340	U	340	U	340	U	390	U
BENZO(A)ANTHRACENE	330	47	370	U	340	U	340	U	340	U	340	U	390	U
CHRYSENE	330	30	370	U	340	U	340	U	340	U	340	U	390	U
BIS(2-ETHYLHEXYL)PHTHALATE	330	57	370	U	340	U	340	U	340	U	340	U	390	U
DI-N-OCTYL PHTHALATE	330	47	370	U	340	U	340	U	340	U	340	U	390	U
BENZO(B)FLUORANTHENE	330	120	370	U	340	U	340	U	340	U	340	U	390	U
BENZO(K)FLUORANTHENE	330	150	370	U	340	U	340	U	340	U	340	U	390	U
BENZO(A)PYRENE	330	77	370	U	340	U	340	U	340	U	340	U	390	U
INDENO(1,2,3-CD)PYRENE	330	57	370	U	340	U	340	U	340	U	340	U	390	U
DIBENZ(A,H)ANTHRACENE	330	67	370	U	340	U	340	U	340	U	340	U	390	U
BENZO(G,H,I)PERYLENE	330	97	370	U	340	U	340	U	340	U	340	U	390	U
% SOLIDS:			90.0		98.0		97.0		97.0		97.0		85.0	

SITE: CTO 127, NCBC DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS TEST PIT RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-TP3-S2-062493		4-TP3-S4-062493		4-TP4-S1-062493		4-TP4-S3-062493		4-TP4-S2-062493		4-TP4-S4-062493	
LABORATORY ID:			14317.06		14317.08		14317.09		14317.11		14317.10		14317.12	
			FIELD DUPLICATE PAIR				FIELD DUPLICATE PAIR				FIELD DUPLICATE PAIR			
TCL SEMIVOLATILES SOILS (ug/Kg)	CRQL	MDL												
2,4-DINITROPHENOL	800	43	900	U	920	U	830	U	830	U	840	U	860	U
4-NITROPHENOL	800	120	900	U	920	U	830	U	830	U	840	U	860	U
DIBENZOFURAN	330	73	370	U	380	U	340	U	340	U	350	U	350	U
2,4-DINITROTOLUENE	330	57	370	U	380	U	340	U	340	U	350	U	350	U
DIETHYLPHTHALATE	330	50	370	U	380	U	340	U	340	U	350	U	350	U
4-CHLOROPHENYL-PHENYLETHER	330	40	370	U	380	U	340	U	340	U	350	U	350	U
FLUORENE	330	37	370	U	380	U	340	U	340	U	350	U	350	U
4-NITROANILINE	800	43	900	U	920	U	830	U	830	U	840	U	860	U
4,6-DINITRO-2-METHYLPHENOL	800	160	900	U	920	U	830	U	830	U	840	U	860	U
N-NITROSODIPHENYLAMIN(1)	330	33	370	U	380	U	340	U	340	U	350	U	350	U
4-BROMOPHENYL-PHENYLETHER	330	53	370	U	380	U	340	U	340	U	350	U	350	U
HEXACHLOROBENZENE	330	57	370	U	380	U	340	U	340	U	350	U	350	U
PENTACHLOROPHENOL	800	93	900	U	920	U	830	U	830	U	840	U	860	U
PHENANTHRENE	330	77	370	U	380	U	340	U	340	U	350	U	350	U
ANTHRACENE	330	73	370	U	380	U	340	U	340	U	350	U	350	U
CARBAZOLE	330	47	370	U	380	U	340	U	340	U	350	U	350	U
DI-N-BUTYLPHTHALATE	330	50	370	U	380	U	340	U	340	U	350	U	350	U
FLUORANTHENE	330	80	370	U	380	U	340	U	340	U	350	U	350	U
PYRENE	330	73	370	U	380	U	340	U	340	U	350	U	350	U
BUTYLBENZYLPHTHALATE	330	43	370	U	380	U	340	U	340	U	350	U	350	U
3,3'-DICHLOROBENZIDINE	330	80	370	U	380	U	340	U	340	U	350	U	350	U
BENZO(A)ANTHRACENE	330	47	370	U	380	U	340	U	340	U	350	U	350	U
CHRYSENE	330	30	370	U	380	U	340	U	340	U	350	U	350	U
BIS(2-ETHYLHEXYL)PHTHALATE	330	57	370	U	380	U	340	U	340	U	350	U	350	U
DI-N-OCTYL PHTHALATE	330	47	370	U	380	U	340	U	340	U	350	U	350	U
BENZO(B)FLUORANTHENE	330	120	370	U	380	U	340	U	340	U	350	U	350	U
BENZO(K)FLUORANTHENE	330	150	370	U	380	U	340	U	340	U	350	U	350	U
BENZO(A)PYRENE	330	77	370	U	380	U	340	U	340	U	350	U	350	U
INDENO(1,2,3-CD)PYRENE	330	57	370	U	380	U	340	U	340	U	350	U	350	U
DIBENZ(A,H)ANTHRACENE	330	67	370	U	380	U	340	U	340	U	350	U	350	U
BENZO(G,H,I)PERYLENE	330	97	370	U	380	U	340	U	340	U	350	U	350	U
% SOLIDS:			89.0		87.0		97.0		97.0		95.0		93.0	

SITE: CTO 127, NCBC DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS TEST PIT RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-TP5-S1-062493		4-TP5-S2-062493		4-TP6-S1-062593		4-TP6-S2-062593	
LABORATORY ID:			14317.31		14317.32		14345.01		14345.02	
TCL SEMIVOLATILES SOILS (ug/Kg)	CRQL	MDL								
2,4-DINITROPHENOL	800	43	920	U	840	U	940	U	880	U
4-NITROPHENOL	800	120	920	U	840	U	940	U	880	U
DIBENZOFURAN	330	73	380	U	340	U	390	U	360	U
2,4-DINITROTOLUENE	330	57	380	U	340	U	390	U	360	U
DIETHYLPHTHALATE	330	50	380	U	340	U	390	U	360	U
4-CHLOROPHENYL-PHENYLETHER	330	40	380	U	340	U	390	U	360	U
FLUORENE	330	37	380	U	340	U	390	U	360	U
4-NITROANILINE	800	43	920	U	840	U	940	U	880	U
4,6-DINITRO-2-METHYLPHENOL	800	160	920	U	840	U	940	U	880	U
N-NITROSODIPHENYLAMIN(1)	330	33	380	U	340	U	390	U	360	U
4-BROMOPHENYL-PHENYLETHER	330	53	380	U	340	U	390	U	360	U
HEXACHLOROBENZENE	330	57	380	U	340	U	390	U	360	U
PENTACHLOROPHENOL	800	93	920	U	840	U	940	U	880	U
PHENANTHRENE	330	77	380	U	340	U	390	U	360	U
ANTHRACENE	330	73	380	U	340	U	390	U	360	U
CARBAZOLE	330	47	380	U	340	U	390	U	360	U
DI-N-BUTYLPHTHALATE	330	50	380	U	340	U	390	U	360	U
FLUORANTHENE	330	80	380	U	340	U	390	U	360	U
PYRENE	330	73	380	U	340	U	390	U	360	U
BUTYLBENZYLPHTHALATE	330	43	380	U	340	U	390	U	360	U
3,3'-DICHLOROBENZIDINE	330	80	380	U	340	U	390	U	360	U
BENZO(A)ANTHRACENE	330	47	380	U	340	U	390	U	360	U
CHRYSENE	330	30	380	U	340	U	390	U	360	U
BIS(2-ETHYLHEXYL)PHTHALATE	330	57	380	U	340	U	390	U	360	U
DI-N-OCTYL PHTHALATE	330	47	380	U	340	U	390	U	360	U
BENZO(B)FLUORANTHENE	330	120	380	U	340	U	390	U	360	U
BENZO(K)FLUORANTHENE	330	150	380	U	340	U	390	U	360	U
BENZO(A)PYRENE	330	77	380	U	340	U	390	U	360	U
INDENO(1,2,3-CD)PYRENE	330	57	380	U	340	U	390	U	360	U
DIBENZ(A,H)ANTHRACENE	330	67	380	U	340	U	390	U	360	U
BENZO(G,H,I)PERYLENE	330	97	380	U	340	U	390	U	360	U
% SOLIDS:			87.0		96.0		85.0		91.0	

SITE: CTO 127, NCBC, DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS TEST PIT RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-TP1-S1-062493		4-TP1-S2-062493		4-TP2-S1-062493		4-TP2-S2-062493	
LABORATORY ID:			14317.01		14317.02		14317.03		14317.04	
TCL PESTICIDES/PCB SOILS (ug/Kg)	CRQL	MDL								
ALPHA-BHC	1.7	0.06	1.9	U	1.7	U	1.8	U	1.8	U
BETA-BHC	1.7	0.12	1.9	U	1.7	U	1.8	U	1.8	U
DELTA-BHC	1.7	0.06	1.9	U	1.7	U	1.8	U	1.8	U
GAMMA-BHC (LINDANE)	1.7	0.06	1.9	U	1.7	U	1.8	U	1.8	U
HEPTACHLOR	1.7	0.06	1.9	U	1.7	U	1.8	U	1.8	U
ALDRIN	1.7	0.03	1.9	U	1.7	U	1.8	U	1.8	U
HEPTACHLOR EPOXIDE	1.7	0.03	1.9	U	1.7	U	1.8	U	1.8	U
ENDOSULFAN I	1.7	0.06	1.9	U	1.7	U	1.8	U	1.8	U
DIELDRIN	3.3	0.06	3.7	U	3.4	U	3.4	U	3.4	U
4,4'-DDE	3.3	0.06	3.7	U	3.4	U	3.4	U	3.4	U
ENDRIN	3.3	0.15	3.7	U	3.4	U	3.4	U	3.4	U
ENDOSULFAN II	3.3	0.12	3.7	U	3.4	U	3.4	U	3.4	U
4,4'-DDD	3.3	0.09	3.7	U	3.4	U	3.4	U	3.4	U
ENDOSULFAN SULFATE	3.3	0.12	3.7	U	3.4	U	3.4	U	3.4	U
4,4'-DDT	3.3	0.12	3.7	U	3.4	U	3.4	U	3.4	U
METHOXYCHLOR	17	0.57	19	U	17	U	18	U	18	U
ENDRIN KETONE	3.3	0.09	3.7	U	3.4	U	3.4	U	3.4	U
ENDRIN ALDEHYDE	3.3	0.09	3.7	U	3.4	U	3.4	U	3.4	U
ALPHA-CHLORDANE	1.7	0.06	1.9	U	1.7	U	1.8	U	1.8	U
GAMMA-CHLORDANE	1.7	0.09	1.9	U	1.7	U	1.8	U	1.8	U
TOXAPHENE	170	0.9	190	U	170	U	180	U	180	U
AROCLOR-1016	33	0.9	37	U	34	U	34	U	34	U
AROCLOR-1221	67	0.12	74	U	68	U	69	U	69	U
AROCLOR-1232	33	0.3	37	U	34	U	34	U	34	U
AROCLOR-1242	33	0.3	37	U	34	U	34	U	34	U
AROCLOR-1248	33	1.2	37	U	34	U	34	U	34	U
AROCLOR-1254	33	1.5	37	U	34	U	34	U	34	U
AROCLOR-1260	33	1.2	37	U	34	U	34	U	34	U
% SOLIDS:			90.0		98.0		97.0		97.0	

SITE: CTO 127, NCBC, DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS TEST PIT RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-TP3-S1-062493		4-TP3-S3-062493		4-TP3-S2-062493		4-TP3-S4-062493	
LABORATORY ID:			14317.05		14317.07		14317.06		14317.08	
					FIELD DUPLICATE PAIR				FIELD DUPLICATE PAIR	
TCL PESTICIDES/PCB SOILS (ug/Kg)	CRQL	MDL								
ALPHA-BHC	1.7	0.06	1.8	U	2	UJ	1.9	U	2	UJ
BETA-BHC	1.7	0.12	1.8	U	2	UJ	1.9	U	2	UJ
DELTA-BHC	1.7	0.06	1.8	U	2	UJ	1.9	U	2	UJ
GAMMA-BHC (LINDANE)	1.7	0.06	1.8	U	2	UJ	1.9	U	2	UJ
HEPTACHLOR	1.7	0.06	1.8	U	2	UJ	1.9	U	2	UJ
ALDRIN	1.7	0.03	1.8	U	2	UJ	1.9	U	2	UJ
HEPTACHLOR EPOXIDE	1.7	0.03	1.8	U	2	UJ	1.9	U	2	UJ
ENDOSULFAN I	1.7	0.06	1.8	U	2	UJ	1.9	U	2	UJ
DIELDRIN	3.3	0.06	3.4	U	3.9	UJ	3.7	U	3.8	UJ
4,4'-DDE	3.3	0.06	3.4	U	3.9	UJ	3.7	U	3.8	UJ
ENDRIN	3.3	0.15	3.4	U	3.9	UJ	3.7	U	3.8	UJ
ENDOSULFAN II	3.3	0.12	3.4	U	3.9	UJ	3.7	U	3.8	UJ
4,4'-DDD	3.3	0.09	3.4	U	3.9	UJ	3.7	U	3.8	UJ
ENDOSULFAN SULFATE	3.3	0.12	3.4	U	3.9	UJ	3.7	U	3.8	UJ
4,4'-DDT	3.3	0.12	3.4	U	3.9	UJ	3.7	U	3.8	UJ
METHOXYCHLOR	17	0.57	18	U	20	UJ	19	U	20	UJ
ENDRIN KETONE	3.3	0.09	3.4	U	3.9	UJ	3.7	U	3.8	UJ
ENDRIN ALDEHYDE	3.3	0.09	3.4	U	3.9	UJ	3.7	U	3.8	UJ
ALPHA-CHLORDANE	1.7	0.06	1.8	U	2	UJ	1.9	U	2	UJ
GAMMA-CHLORDANE	1.7	0.09	1.8	U	2	UJ	1.9	U	2	UJ
TOXAPHENE	170	0.9	180	U	200	UJ	190	U	200	UJ
AROCLOR-1016	33	0.9	34	U	39	UJ	37	U	38	UJ
AROCLOR-1221	67	0.12	69	U	79	UJ	75	U	77	UJ
AROCLOR-1232	33	0.3	34	U	39	UJ	37	U	38	UJ
AROCLOR-1242	33	0.3	34	U	39	UJ	37	U	38	UJ
AROCLOR-1248	33	1.2	34	U	39	UJ	37	U	38	UJ
AROCLOR-1254	33	1.5	34	U	39	UJ	37	U	38	UJ
AROCLOR-1260	33	1.2	34	U	39	UJ	37	U	38	UJ
% SOLIDS:			97.0		85.0		89.0		87.0	

SITE: CTO 127, NCBC, DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS TEST PIT RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-TP4-S1-062493		4-TP4-S3-062493		4-TP4-S2-062493		4-TP4-S4-062493	
LABORATORY ID:			14317.09		14317.11		14317.10		14317.12	
			FIELD DUPLICATE PAIR				FIELD DUPLICATE PAIR			
TCL PESTICIDES/PCB SOILS (ug/Kg)	CRQL	MDL								
ALPHA-BHC	1.7	0.06	1.8	UJ	1.8	U	1.8	U	1.8	U
BETA-BHC	1.7	0.12	1.8	UJ	1.8	U	1.8	U	1.8	U
DELTA-BHC	1.7	0.06	1.8	UJ	1.8	U	1.8	U	1.8	U
GAMMA-BHC (LINDANE)	1.7	0.06	1.8	UJ	1.8	U	1.8	U	1.8	U
HEPTACHLOR	1.7	0.06	1.8	UJ	1.8	U	1.8	U	1.8	U
ALDRIN	1.7	0.03	1.8	UJ	1.8	U	1.8	U	1.8	U
HEPTACHLOR EPOXIDE	1.7	0.03	1.8	UJ	1.8	U	1.8	U	1.8	U
ENDOSULFAN I	1.7	0.06	1.8	UJ	1.8	U	1.8	U	1.8	U
DIELDRIN	3.3	0.06	3.4	UJ	3.4	U	3.5	U	3.5	U
4,4'-DDE	3.3	0.06	3.4	UJ	3.4	U	3.5	U	3.5	U
ENDRIN	3.3	0.15	3.4	UJ	3.4	U	3.5	U	3.5	U
ENDOSULFAN II	3.3	0.12	3.4	UJ	3.4	U	3.5	U	3.5	U
4,4'-DDD	3.3	0.09	3.4	UJ	3.4	U	3.5	U	3.5	U
ENDOSULFAN SULFATE	3.3	0.12	3.4	UJ	3.4	U	3.5	U	3.5	U
4,4'-DDT	3.3	0.12	3.4	UJ	3.4	U	3.5	U	3.5	U
METHOXYCHLOR	17	0.57	18	UJ	18	U	18	U	18	U
ENDRIN KETONE	3.3	0.09	3.4	UJ	3.4	U	3.5	U	3.5	U
ENDRIN ALDEHYDE	3.3	0.09	3.4	UJ	3.4	U	3.5	U	3.5	U
ALPHA-CHLORDANE	1.7	0.06	1.8	UJ	1.8	U	1.8	U	1.8	U
GAMMA-CHLORDANE	1.7	0.09	1.8	UJ	1.8	U	1.8	U	1.8	U
TOXAPHENE	170	0.9	180	UJ	180	U	180	U	180	U
AROCLOR-1016	33	0.9	34	UJ	34	U	35	U	35	U
AROCLOR-1221	67	0.12	69	UJ	69	U	71	U	72	U
AROCLOR-1232	33	0.3	34	UJ	34	U	35	U	35	U
AROCLOR-1242	33	0.3	34	UJ	34	U	35	U	35	U
AROCLOR-1248	33	1.2	34	UJ	34	U	35	U	35	U
AROCLOR-1254	33	1.5	34	UJ	34	U	35	U	35	U
AROCLOR-1260	33	1.2	34	UJ	34	U	35	U	35	U
% SOLIDS:			97.0		97.0		95.0		93.0	

SITE: CTO 127, NCBC, DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS TEST PIT RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-TP5-S1-062493		4-TP5-S2-062493		4-TP6-S1-062593		4-TP6-S2-062593	
LABORATORY ID:			14317.31		14317.32		14345.01		14345.02	
TCL PESTICIDES/PCB SOILS (ug/Kg)	CRQL	MDL								
ALPHA-BHC	1.7	0.06	2	U	1.8	U	2	UJ	1.9	UJ
BETA-BHC	1.7	0.12	2	U	1.8	U	2	UJ	1.9	UJ
DELTA-BHC	1.7	0.06	2	U	1.8	U	2	UJ	1.9	UJ
GAMMA-BHC (LINDANE)	1.7	0.06	2	U	1.8	U	2	UJ	1.9	UJ
HEPTACHLOR	1.7	0.06	2	U	1.8	U	2	UJ	1.9	UJ
ALDRIN	1.7	0.03	2	U	1.8	U	2	UJ	1.9	UJ
HEPTACHLOR EPOXIDE	1.7	0.03	2	U	1.8	U	2	UJ	1.9	UJ
ENDOSULFAN I	1.7	0.06	2	U	1.8	U	2	UJ	1.9	UJ
DIELDRIN	3.3	0.06	3.8	U	3.4	U	3.9	UJ	3.6	UJ
4,4'-DDE	3.3	0.06	3.8	U	3.4	U	3.9	UJ	3.6	UJ
ENDRIN	3.3	0.15	3.8	U	3.4	U	3.9	UJ	3.6	UJ
ENDOSULFAN II	3.3	0.12	3.8	U	3.4	U	3.9	UJ	3.6	UJ
4,4'-DDD	3.3	0.09	3.8	U	3.4	U	3.9	UJ	3.6	UJ
ENDOSULFAN SULFATE	3.3	0.12	3.8	U	3.4	U	3.9	UJ	3.6	UJ
4,4'-DDT	3.3	0.12	3.8	U	3.4	U	3.9	UJ	3.6	UJ
METHOXYCHLOR	17	0.57	20	U	18	U	20	UJ	19	UJ
ENDRIN KETONE	3.3	0.09	3.8	U	3.4	U	3.9	UJ	3.6	UJ
ENDRIN ALDEHYDE	3.3	0.09	3.8	U	3.4	U	3.9	UJ	3.6	UJ
ALPHA-CHLORDANE	1.7	0.06	2	U	1.8	U	2	UJ	1.9	UJ
GAMMA-CHLORDANE	1.7	0.09	2	U	1.8	U	2	UJ	1.9	UJ
TOXAPHENE	170	0.9	200	U	180	U	200	UJ	190	UJ
AROCLOR-1016	33	0.9	38	U	34	U	39	UJ	36	UJ
AROCLOR-1221	67	0.12	77	U	70	U	79	UJ	74	UJ
AROCLOR-1232	33	0.3	38	U	34	U	39	UJ	36	UJ
AROCLOR-1242	33	0.3	38	U	34	U	39	UJ	36	UJ
AROCLOR-1248	33	1.2	38	U	34	U	39	UJ	36	UJ
AROCLOR-1254	33	1.5	38	U	34	U	39	UJ	36	UJ
AROCLOR-1260	33	1.2	38	U	34	U	39	UJ	36	UJ
% SOLIDS:			87.0		96.0		85.0		91.0	

SITE: CTO 127, NCBC DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS TEST PIT RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-TP1-S1-062493		4-TP1-S2-062493		4-TP2-S1-062493		4-TP2-S2-062493	
LABORATORY ID:			14317.01		14317.02		14317.03		14317.04	
TAL METAL SOILS (mg/Kg)	CRDL	IDL								
ALUMINUM	40	6.8	6020		2840		2410		2410	
ANTIMONY	12	3.2	5.8	U	4.7	UJ	4.7	UJ	6.1	U
ARSENIC	2	0.4	1.9		0.86		0.99		1.1	
BARIUM	40	1.8	11.4		5.9		4.2		4.3	
BERYLLIUM	1	0.2	0.34		0.20	U	0.24		0.26	
CADMIUM	1	0.6	0.66	U	0.61	U	0.62	U	0.68	U
CALCIUM	1000	46	324		429		1940		1170	
CHROMIUM	2	1.2	6.8		3.9		4		2.7	
COBALT	10	1.2	5.3		1.7		2.9		2.8	
COPPER	5	0.4	10.2		3.6		3.0		4.4	
IRON	20	1.6	9850		5620		6420		5830	
LEAD	0.6	0.4	6	J	3.5	J	4.5	J	3.6	J
MAGNESIUM	1000	38.6	1530		873		810		812	
MANGANESE	1.8	0.4	140		65.9		76.3		77.2	
MERCURY	0.1	0.1	0.11		0.10	U	0.10	U	0.11	U
NICKEL	8	3	4.1		1.4	U	1.4	U	1.9	
POTASSIUM	1000	148.6	521		318		321		405	
SELENIUM	1	0.2	0.44	U	0.41	U	0.41	U	0.45	U
SILVER	2	0.4	1.5	UJ	1.4	UJ	1.4	UJ	1.6	UJ
SODIUM	1000	50.4	119	U	112	U	137	U	161	U
THALLIUM	2	0.6	0.22	U	0.20	U	0.21	U	0.23	U
VANADIUM	10	1.2	7.8		4.2		4.2		4.1	
ZINC	4	0.4	22.4		12.4		15.3		17.4	
% SOLIDS:			91.4		97.9		96.9		88.2	

SITE: CTO 127, NCBC DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS TEST PIT RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-TP3-S1-062493		4-TP3-S3-062493		4-TP3-S2-062493		4-TP3-S4-062493	
LABORATORY ID:			14317.05		14317.07		14317.06		14317.08	
			FIELD DUPLICATE PAIR				FIELD DUPLICATE PAIR			
TAL METAL SOILS (mg/Kg)	CRDL	IDL								
ALUMINUM	40	6.8	6150		3710		10900		11500	
ANTIMONY	12	3.2	4.9	UJ	5.8	U	9.6	U	5.7	UJ
ARSENIC	2	0.4	1.4		1		3.7		5.2	
BARIUM	40	1.8	15.6		7.3		33.1		32.6	
BERYLLIUM	1	0.2	0.36		0.25		0.46		0.55	
CADMIUM	1	0.6	0.64	U	0.62	U	0.72	U	0.75	U
CALCIUM	1000	46	1070		770		1350		924	
CHROMIUM	2	1.2	7.3		5.5		11.3		12.8	
COBALT	10	1.2	3.5		3.7		7.8		6.4	
COPPER	5	0.4	4.2		3.2		8.9		13.0	
IRON	20	1.6	9270		8570		15800		17800	
LEAD	0.6	0.4	5.5	J	3.9	J	8.2	J	12.8	J
MAGNESIUM	1000	38.6	1810		1470		3180		3610	
MANGANESE	1.8	0.4	109		94.2		190		170	
MERCURY	0.1	0.1	0.11	U	0.10	U	0.15		0.12	U
NICKEL	8	3	3.9		3.8		9.1		7.0	
POTASSIUM	1000	148.6	432		443		1240		1360	
SELENIUM	1	0.2	0.42	U	0.41	U	0.48	U	0.5	U
SILVER	2	0.4	1.5	UJ	1.5	UJ	1.7	UJ	1.7	UJ
SODIUM	1000	50.4	131	U	130	U	170	U	172	U
THALLIUM	2	0.6	0.21	U	0.21	U	0.24	U	0.25	U
VANADIUM	10	1.2	8.3		6.9		16.5		16.8	
ZINC	4	0.4	21.5		16.9		31.5		31.1	
% SOLIDS:			94.2		96.4		83.2		80.1	

SITE: CTO 127, NCBC DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS TEST PIT RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-TP4-S1-062493		4-TP4-S3-062493		4-TP4-S2-062493		4-TP4-S4-062493	
LABORATORY ID:			14317.09		14317.11		14317.10		14317.12	
			FIELD DUPLICATE PAIR				FIELD DUPLICATE PAIR			
TAL METAL SOILS (mg/Kg)	CRDL	IDL								
ALUMINUM	40	6.8	2770		2330		2860		2660	
ANTIMONY	12	3.2	5.1	UJ	4.7	UJ	4.9	UJ	4.8	UJ
ARSENIC	2	0.4	0.84		0.78		0.95		1.2	
BARIUM	40	1.8	5.3		4		5.9		5.7	
BERYLLIUM	1	0.2	0.25		0.21	U	0.21	U	0.21	U
CADMIUM	1	0.6	0.66	U	0.62	U	0.64	U	0.62	U
CALCIUM	1000	46	830		666		1370		4700	
CHROMIUM	2	1.2	4.7		3.8		4		3.6	
COBALT	10	1.2	4.0		2.6		2.5		2.3	
COPPER	5	0.4	4.5		3.0		2.1		1.9	
IRON	20	1.6	7220		5720		5160		4810	
LEAD	0.6	0.4	3.1	J	2.7	J	2.4	J	2	J
MAGNESIUM	1000	38.6	914		786		1080		868	
MANGANESE	1.8	0.4	84		66.6		74.4		64.1	
MERCURY	0.1	0.1	0.11	U	0.10	U	0.11	U	0.10	U
NICKEL	8	3	1.6		1.4	U	1.5	U	1.5	U
POTASSIUM	1000	148.6	328		261		417		384	
SELENIUM	1	0.2	0.44	U	0.41	U	0.42	U	0.41	U
SILVER	2	0.4	1.5	UJ	1.4	UJ	1.5	UJ	1.5	UJ
SODIUM	1000	50.4	142	U	133	U	138	U	166	U
THALLIUM	2	0.6	0.22	U	0.21	U	0.21	U	0.21	U
VANADIUM	10	1.2	5.3		3.9		5.4		4.1	
ZINC	4	0.4	15.9		13.3		11.8		11.1	
% SOLIDS:			90.7		97.0		94.3		96.5	

APPENDIX C

SURFICIAL SOIL SAMPLE ANALYTICAL RESULTS

DATA QUALIFIER DEFINITIONS

J	-	Quantitation is approximate due to limitations identified during data validation.
U	-	Result is non-detected at the indicated detection limit/quantitation limit.
UJ	-	Result is non-detected and the indicated detection limit is estimated.
R or UR	-	Rejected.

SITE: CTO #127, NCBC DAVISVILLE, RHODE ISLAND
SDG NO: 14409
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-SS1-S1-63093	4-SS2-S1-63093	4-SS3-S1-63093
LABORATORY ID:			14409.12	14409.13	14409.14
TAL LEAD SOLIDS (mg/Kg)					
	CRDL	IDL			
LEAD	0.6	0.4	31.5	12.1	0.74
% SOLIDS:			96.6	97.1	97.1

SITE: CTO #127, NCBC DAVISVILLE, RHODE ISLAND
SDG NO: 14409
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-SS1-S1-63093	4-SS2-S1-63093	4-SS3-S1-63093
LABORATORY ID:			14409.15	14409.16	14409.17
TCLP LEAD SOLIDS (mg/L)					
	CRDL	IDL			
LEAD	N/A	N/A	0.047	0.030	0.021

SITE: CTO 127, NCBC DAVISVILLE, RI
CALF PASTURE POINT MUNITIONS BUNKERS SURFACE SOIL RESULTS - ROUND 2
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-SS1A-S1-021494		4-SS2A-S1-021494		4-SS3A-S1-021494	
LABORATORY ID:			17590.10		17590.11		17590.12	
% SOLIDS:			75		84		83	
TAL METAL SOILS (MG/KG)	CRQL	MDL						
LEAD	0.3	0.1	34.5	J	38.7		9.7	U

SITE: CTO 127, NCBC DAVISVILLE, RI
CALF PASTURE POINT MUNITIONS BUNKERS SURFACE SOIL RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-SS1A-S1-021494	4-SS2A-S1-021494	4-SS3A-S1-021494	
LABORATORY ID:			17590.22	17590.23	17590.24	
TCLP METALS (UG/L)	CRQL	MDL				
LEAD	14	NA	19.6	40.6	14	U

APPENDIX D

WIPE SAMPLE
ANALYTICAL RESULTS

DATA QUALIFIER DEFINITIONS

J	-	Quantitation is approximate due to limitations identified during data validation.
U	-	Result is non-detected at the indicated detection limit/quantitation limit.
UJ	-	Result is non-detected and the indicated detection limit is estimated.
R or UR	-	Rejected.

SITE: CTO #127, NCBC DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS WIPE SAMPLE RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-WS1-S1-63093		4-WS2-S1-63093		4-WS3-S1-63093		4-WS4-S1-63093	
LABORATORY ID:			14409.01		14409.02		14409.03		14409.04	
TCL SEMIVOLATILE WIPES (ug/wipe)										
	CRQL	MDL								
PHENOL	10	1.2	10	U	10	U	10	U	10	U
BIS(2-CHLOROETHYL)ETHER	10	0.8	10	U	10	U	10	U	10	U
2-CHLOROPHENOL	10	0.8	10	U	10	U	10	U	10	U
1,3-DICHLOROBENZENE	10	0.6	10	U	10	U	10	U	10	U
1,4-DICHLOROBENZENE	10	0.7	10	U	10	U	10	U	10	U
1,2-DICHLOROBENZENE	10	0.8	10	U	10	U	10	U	10	U
2-METHYLPHENOL	10	0.6	10	U	10	U	10	U	10	U
BIS(2-CHLOROISOPROPYL)ETHER	10	0.9	10	U	10	U	10	U	10	U
4-METHYLPHENOL	10	0.6	10	U	10	U	10	U	10	U
N-NITROSO-DI-N-PROPYLAMINE	10	0.7	10	U	10	U	10	U	10	U
HEXACHLOROETHANE	10	0.8	10	U	10	U	10	U	10	U
NITROBENZENE	10	0.6	10	U	10	U	10	U	10	U
ISOPHORONE	10	0.5	10	U	10	U	10	U	10	U
2-NITROPHENOL	10	0.7	10	U	10	U	10	U	10	UJ
2,4-DIMETHYLPHENOL	10	0.7	10	U	10	U	10	U	10	U
2,4-DICHLOROPHENOL	10	0.5	10	U	10	U	10	U	10	U
1,2,4-TRICHLOROBENZENE	10	0.8	10	U	10	U	10	U	10	U
NAPHTHALENE	10	0.7	10	U	10	U	1	J	10	U
4-CHLOROANILINE	10	1	10	U	10	U	10	U	10	U
BIS(2-CHLOROETHOXY)METHANE	10	0.4	10	U	10	U	10	U	10	U
HEXACHLOROBUTADIENE	10	0.6	10	U	10	U	10	U	10	U
4-CHLORO-3-METHYLPHENOL	10	1	10	U	10	U	10	U	10	U
2-METHYLNAPHTHALENE	10	0.6	10	U	10	U	10	U	10	U
HEXACHLOROCYCLOPENTADIENE	10	NA	10	U	10	U	10	U	10	U
2,4,6-TRICHLOROPHENOL	10	1.5	10	U	10	U	10	U	10	U
2,4,5-TRICHLOROPHENOL	25	0.8	25	U	25	U	25	U	25	U
2-CHLORONAPHTHALENE	10	1	10	U	10	U	10	U	10	U
2-NITROANILINE	25	1	25	U	25	U	25	U	25	U
DIMETHYL PHTHALATE	10	0.5	10	U	10	U	10	U	10	U
ACENAPHTHYLENE	10	1.2	10	U	10	U	10	U	10	U
2,6-DINITROTOLUENE	10	1.3	10	U	10	U	10	U	10	U
3-NITROANILINE	25	2.4	25	U	25	U	25	U	25	U
ACENAPHTHENE	10	1.5	10	U	10	U	10	U	10	U

SITE: CTO #127, NCBC DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS WIPE SAMPLE RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-WS5-S1-63093		4-WS6-S1-63093		4-WS7-S1-63093		4-WS8-S1-63093	
LABORATORY ID:			14409.05		14409.06		14409.07		14409.08	
TCL SEMIVOLATILE WIPES (ug/wipe)										
	CRQL	MDL								
PHENOL	10	1.2	10	U	10	U	10	U	10	U
BIS(2-CHLOROETHYL)ETHER	10	0.8	10	U	10	U	10	U	10	U
2-CHLOROPHENOL	10	0.8	10	U	10	U	10	U	10	U
1,3-DICHLOROBENZENE	10	0.6	10	U	10	U	10	U	10	U
1,4-DICHLOROBENZENE	10	0.7	10	U	10	U	10	U	10	U
1,2-DICHLOROBENZENE	10	0.8	10	U	10	U	10	U	10	U
2-METHYLPHENOL	10	0.6	10	U	10	U	10	U	10	U
BIS(2-CHLOROISOPROPYL)ETHER	10	0.9	10	U	10	U	10	U	10	U
4-METHYLPHENOL	10	0.6	10	U	10	U	10	U	10	U
N-NITROSO-DI-N-PROPYLAMINE	10	0.7	10	U	10	U	10	U	10	U
HEXACHLOROETHANE	10	0.8	10	U	10	U	10	U	10	U
NITROBENZENE	10	0.6	10	U	10	U	10	U	10	U
ISOPHORONE	10	0.5	10	U	10	U	10	U	10	U
2-NITROPHENOL	10	0.7	10	UJ	10	UJ	10	UJ	10	UJ
2,4-DIMETHYLPHENOL	10	0.7	10	U	10	U	10	U	10	U
2,4-DICHLOROPHENOL	10	0.5	10	U	10	U	10	U	10	U
1,2,4-TRICHLOROBENZENE	10	0.8	10	U	10	U	10	U	10	U
NAPHTHALENE	10	0.7	10	U	10	U	10	U	10	U
4-CHLOROANILINE	10	1	10	U	10	U	10	U	10	U
BIS(2-CHLOROETHOXY)METHANE	10	0.4	10	U	10	U	10	U	10	U
HEXACHLOROBUTADIENE	10	0.6	10	U	10	U	10	U	10	U
4-CHLORO-3-METHYLPHENOL	10	1	10	U	10	U	10	U	10	U
2-METHYLNAPHTHALENE	10	0.6	10	U	10	U	10	U	10	U
HEXACHLOROCYCLOPENTADIENE	10	NA	10	U	10	U	10	U	10	U
2,4,6-TRICHLOROPHENOL	10	1.5	10	U	10	U	10	U	10	U
2,4,5-TRICHLOROPHENOL	25	0.8	25	U	25	U	25	U	25	U
2-CHLORONAPHTHALENE	10	1	10	U	10	U	10	U	10	U
2-NITROANILINE	25	1	25	U	25	U	25	U	25	U
DIMETHYL PHTHALATE	10	0.5	10	U	10	U	10	U	10	U
ACENAPHTHYLENE	10	1.2	10	U	10	U	10	U	10	U
2,6-DINITROTOLUENE	10	1.3	10	U	10	U	10	U	10	U
3-NITROANILINE	25	2.4	25	U	25	U	25	U	25	U
ACENAPHTHENE	10	1.5	10	U	10	U	10	U	10	U

SITE: CTO #127, NCBC DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS WIPE SAMPLE RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-WS9-S1-63093		4-WS10-S1-63093		4-WS11-S1-63093		4-WS12-S1-63093	
LABORATORY ID:			14409.09		14409.10		14409.11		14409.25	
TCL SEMIVOLATILE WIPES (ug/wipe)										
	CRQL	MDL								
PHENOL	10	1.2	10	U	10	U	10	U	10	U
BIS(2-CHLOROETHYL)ETHER	10	0.8	10	U	10	U	10	U	10	U
2-CHLOROPHENOL	10	0.8	10	U	10	U	10	U	10	U
1,3-DICHLOROBENZENE	10	0.6	10	U	10	U	10	U	10	U
1,4-DICHLOROBENZENE	10	0.7	10	U	10	U	10	U	10	U
1,2-DICHLOROBENZENE	10	0.8	10	U	10	U	10	U	10	U
2-METHYLPHENOL	10	0.6	10	U	10	U	10	U	10	U
BIS(2-CHLOROISOPROPYL)ETHER	10	0.9	10	U	10	U	10	U	10	U
4-METHYLPHENOL	10	0.6	10	U	10	U	10	U	10	U
N-NITROSO-DI-N-PROPYLAMINE	10	0.7	10	U	10	U	10	U	10	U
HEXACHLOROETHANE	10	0.8	10	U	10	U	10	U	10	U
NITROBENZENE	10	0.6	10	U	10	U	10	U	10	U
ISOPHORONE	10	0.5	10	U	10	U	10	U	10	U
2-NITROPHENOL	10	0.7	10	UJ	10	UJ	10	UJ	10	UJ
2,4-DIMETHYLPHENOL	10	0.7	10	U	10	U	10	U	10	U
2,4-DICHLOROPHENOL	10	0.5	10	U	10	U	10	U	10	U
1,2,4-TRICHLOROBENZENE	10	0.8	10	U	10	U	10	U	10	U
NAPHTHALENE	10	0.7	0.9	J	0.5	J	4	J	0.9	J
4-CHLOROANILINE	10	1	10	U	10	U	10	U	10	U
BIS(2-CHLOROETHOXY)METHANE	10	0.4	10	U	10	U	10	U	10	U
HEXACHLOROBUTADIENE	10	0.6	10	U	10	U	10	U	10	U
4-CHLORO-3-METHYLPHENOL	10	1	10	U	10	U	10	U	10	U
2-METHYLNAPHTHALENE	10	0.6	10	U	10	U	1	J	10	U
HEXACHLOROCYCLOPENTADIENE	10	NA	10	U	10	U	10	U	10	U
2,4,6-TRICHLOROPHENOL	10	1.5	10	U	10	U	10	U	10	U
2,4,5-TRICHLOROPHENOL	25	0.8	25	U	25	U	25	U	25	U
2-CHLORONAPHTHALENE	10	1	10	U	10	U	10	U	10	U
2-NITROANILINE	25	1	25	U	25	U	25	U	25	U
DIMETHYL PHTHALATE	10	0.5	10	U	10	U	10	U	10	U
ACENAPHTHYLENE	10	1.2	10	U	10	U	10	U	10	U
2,6-DINITROTOLUENE	10	1.3	10	U	10	U	10	U	10	U
3-NITROANILINE	25	2.4	25	U	25	U	25	U	25	U
ACENAPHTHENE	10	1.5	10	U	10	U	10	U	10	U

SITE: CTO #127, NCBC DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS WIPE SAMPLE RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-WS1-S1-63093		4-WS2-S1-63093		4-WS3-S1-63093		4-WS4-S1-63093	
LABORATORY ID:			14409.01		14409.02		14409.03		14409.04	
TCL SEMIVOLATILE WIPES (ug/wipe)										
2,4-DINITROPHENOL	25	1.1	25	U	25	U	25	U	25	U
4-NITROPHENOL	25	2.4	25	U	25	U	25	U	25	U
DIBENZOFURAN	10	1.3	10	U	10	U	10	U	10	U
2,4-DINITROTOLUENE	10	1.6	10	U	10	U	10	U	10	U
DIETHYLPHTHALATE	10	1	10	U	10	U	10	U	10	U
4-CHLOROPHENYL-PHENYLETHER	10	1.1	10	U	10	U	10	U	10	U
FLUORENE	10	1.2	10	U	10	U	10	U	10	U
4-NITROANILINE	25	1.4	25	U	25	U	25	U	25	U
4,6-DINITRO-2-METHYLPHENOL	25	2.1	25	U	25	U	25	U	25	U
N-NITROSODIPHENYLAMIN(1)	10	1.3	10	U	10	U	10	U	10	U
4-BROMOPHENYL-PHENYLETHER	10	1.8	10	U	10	U	10	U	10	U
HEXACHLOROBENZENE	10	1.8	10	U	10	U	10	U	10	U
PENTACHLOROPHENOL	25	1.6	25	U	25	U	25	U	25	U
PHENANTHRENE	10	3.1	10	U	10	U	0.8	J	10	U
ANTHRACENE	10	2.1	10	U	10	U	10	U	10	U
CARBAZOLE	10	2.6	10	U	10	U	10	U	10	U
DI-N-BUTYLPHTHALATE	10	2.5	10	U	10	U	10	U	10	U
FLUORANTHENE	10	2.1	10	U	10	U	10	U	10	U
PYRENE	10	1.2	10	U	10	U	10	U	10	U
BUTYLBENZYLPHTHALATE	10	1.5	10	U	10	U	10	U	10	U
3,3'-DICHLOROBENZIDINE	10	0.7	10	U	10	U	10	U	10	U
BENZO(A)ANTHRACENE	10	1.4	10	U	10	U	10	U	10	U
CHRYSENE	10	1	10	U	10	U	10	U	10	U
BIS(2-ETHYLHEXYL)PHTHALATE	10	1.9	10	U	10	U	10	U	10	U
DI-N-OCTYL PHTHALATE	10	1.2	10	U	10	U	10	U	10	U
BENZO(B)FLUORANTHENE	10	2.7	10	U	10	U	10	U	10	U
BENZO(K)FLUORANTHENE	10	2.6	10	U	10	U	10	U	10	U
BENZO(A)PYRENE	10	1	10	U	10	U	10	U	10	U
INDENO(1,2,3-CD)PYRENE	10	2	10	U	10	U	10	U	10	U
DIBENZ(A,H)ANTHRACENE	10	2.3	10	U	10	U	10	U	10	U
BENZO(G,H,I)PERYLENE	10	2.1	10	U	10	U	10	U	10	U

SITE: CTO #127, NCBC DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS WIPE SAMPLE RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-WS5-S1-63093		4-WS6-S1-63093		4-WS7-S1-63093		4-WS8-S1-63093	
LABORATORY ID:			14409.05		14409.06		14409.07		14409.08	
TCL SEMIVOLATILE WIPES (ug/wipe)										
2,4-DINITROPHENOL	25	1.1	25	U	25	U	25	U	25	U
4-NITROPHENOL	25	2.4	25	U	25	U	25	U	25	U
DIBENZOFURAN	10	1.3	10	U	10	U	10	U	10	U
2,4-DINITROTOLUENE	10	1.6	10	U	10	U	10	U	10	U
DIETHYLPHTHALATE	10	1	10	U	10	U	10	U	10	U
4-CHLOROPHENYL-PHENYLETHER	10	1.1	10	U	10	U	10	U	10	U
FLUORENE	10	1.2	10	U	10	U	10	U	10	U
4-NITROANILINE	25	1.4	25	U	25	U	25	U	25	U
4,6-DINITRO-2-METHYLPHENOL	25	2.1	25	U	25	U	25	U	25	U
N-NITROSODIPHENYLAMIN(1)	10	1.3	10	U	10	U	10	U	10	U
4-BROMOPHENYL-PHENYLETHER	10	1.8	10	U	10	U	10	U	10	U
HEXACHLOROBENZENE	10	1.8	10	U	10	U	10	U	10	U
PENTACHLOROPHENOL	25	1.6	25	U	25	U	25	U	25	U
PHENANTHRENE	10	3.1	10	U	10	U	10	U	10	U
ANTHRACENE	10	2.1	10	U	10	U	10	U	10	U
CARBAZOLE	10	2.6	10	U	10	U	10	U	10	U
DI-N-BUTYLPHTHALATE	10	2.5	0.6	J	0.8	J	10	U	10	U
FLUORANTHENE	10	2.1	10	U	10	U	10	U	0.6	J
PYRENE	10	1.2	10	U	10	U	10	U	10	U
BUTYLBENZYLPHTHALATE	10	1.5	10	U	10	U	10	U	10	U
3,3'-DICHLOROBENZIDINE	10	0.7	10	U	10	U	10	U	10	U
BENZO(A)ANTHRACENE	10	1.4	10	U	10	U	10	U	10	U
CHRYSENE	10	1	10	U	10	U	10	U	10	U
BIS(2-ETHYLHEXYL)PHTHALATE	10	1.9	10	U	10	U	10	U	10	U
DI-N-OCTYL PHTHALATE	10	1.2	10	U	10	U	10	U	10	U
BENZO(B)FLUORANTHENE	10	2.7	10	U	10	U	10	U	10	U
BENZO(K)FLUORANTHENE	10	2.6	10	U	10	U	10	U	10	U
BENZO(A)PYRENE	10	1	10	U	10	U	10	U	10	U
INDENO(1,2,3-CD)PYRENE	10	2	10	U	10	U	10	U	10	U
DIBENZ(A,H)ANTHRACENE	10	2.3	10	U	10	U	10	U	10	U
BENZO(G,H,I)PERYLENE	10	2.1	10	U	10	U	10	U	10	U

SITE: CTO #127, NCBC DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS WIPE SAMPLE RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-WS9-S1-63093		4-WS10-S1-63093		4-WS11-S1-63093		4-WS12-S1-63093	
LABORATORY ID:			14409.09		14409.10		14409.11		14409.25	
TCL SEMIVOLATILE WIPES (ug/wipe)										
2,4-DINITROPHENOL	25	1.1	25	U	25	U	25	U	25	U
4-NITROPHENOL	25	2.4	25	U	25	U	25	U	25	U
DIBENZOFURAN	10	1.3	10	U	10	U	10	U	10	U
2,4-DINITROTOLUENE	10	1.6	10	U	10	U	10	U	10	U
DIETHYLPHTHALATE	10	1	10	U	10	U	10	U	10	U
4-CHLOROPHENYL-PHENYLETHER	10	1.1	10	U	10	U	10	U	10	U
FLUORENE	10	1.2	10	U	10	U	10	U	10	U
4-NITROANILINE	25	1.4	25	U	25	U	25	U	25	U
4,6-DINITRO-2-METHYLPHENOL	25	2.1	25	U	25	U	25	U	25	U
N-NITROSODIPHENYLAMIN(1)	10	1.3	10	U	5	J	10	U	10	U
4-BROMOPHENYL-PHENYLETHER	10	1.8	10	U	10	U	10	U	10	U
HEXACHLOROBENZENE	10	1.8	10	U	10	U	10	U	10	U
PENTACHLOROPHENOL	25	1.6	25	U	25	U	25	U	25	U
PHENANTHRENE	10	3.1	10	U	10	U	10	U	10	U
ANTHRACENE	10	2.1	10	U	10	U	10	U	10	U
CARBAZOLE	10	2.6	10	U	10	U	10	U	10	U
DI-N-BUTYLPHTHALATE	10	2.5	10	U	1	J	10	U	0.6	J
FLUORANTHENE	10	2.1	10	U	10	U	10	U	10	U
PYRENE	10	1.2	10	U	10	U	10	U	10	U
BUTYLBENZYLPHTHALATE	10	1.5	10	U	10	U	10	U	10	U
3,3'-DICHLOROBENZIDINE	10	0.7	10	U	10	U	10	U	10	U
BENZO(A)ANTHRACENE	10	1.4	10	U	10	U	10	U	10	U
CHRYSENE	10	1	10	U	10	U	10	U	10	U
BIS(2-ETHYLHEXYL)PHTHALATE	10	1.9	10	U	10	U	10	U	10	U
DI-N-OCTYL PHTHALATE	10	1.2	10	U	10	U	10	U	10	U
BENZO(B)FLUORANTHENE	10	2.7	10	U	10	U	10	U	10	U
BENZO(K)FLUORANTHENE	10	2.6	10	U	10	U	10	U	10	U
BENZO(A)PYRENE	10	1	10	U	10	U	10	U	10	U
INDENO(1,2,3-CD)PYRENE	10	2	10	U	10	U	10	U	10	U
DIBENZ(A,H)ANTHRACENE	10	2.3	10	U	10	U	10	U	10	U
BENZO(G,H,I)PERYLENE	10	2.1	10	U	10	U	10	U	10	U

SITE: CTO #127, NCBC DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS WIPE SAMPLE RESULTS
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-WS1-S1-63093		4-WS2-S1-63093		4-WS3-S1-63093		4-WS4-S1-63093	
LABORATORY ID:			14409.01		14409.02		14409.03		14409.04	
TCL PESTICIDES WIPES (UG/WIPE)	CRQL	MDL/IDL								
ALPHA-BHC	0.05	0.002	0.05	UJ	0.05	U	0.05	U	0.05	U
BETA-BHC	0.05	0.004	0.05	UJ	0.05	U	0.05	U	0.05	U
DELTA-BHC	0.05	0.002	0.05	UJ	0.05	U	0.05	U	0.05	U
GAMMA-BHC (LINDANE)	0.05	0.002	0.05	UJ	0.05	U	0.05	U	0.05	U
HEPTACHLOR	0.05	0.002	0.05	UJ	0.05	U	0.05	U	0.05	U
ALDRIN	0.05	0.001	0.05	UJ	0.05	U	0.05	U	0.05	U
HEPTACHLOR EPOXIDE	0.05	0.001	0.05	UJ	0.05	U	0.05	U	0.05	U
ENDOSULFAN I	0.05	0.002	0.05	UJ	0.05	U	0.05	U	0.05	U
DIELDRIN	0.1	0.002	0.1	UJ	0.1	U	0.1	U	0.1	U
4,4'-DDE	0.1	0.002	0.1	UJ	0.1	U	0.1	U	0.1	U
ENDRIN	0.1	0.005	0.1	UJ	0.1	U	0.1	U	0.1	U
ENDOSULFAN II	0.1	0.004	0.1	UJ	0.1	U	0.1	U	0.1	U
4,4'-DDD	0.1	0.003	0.1	UJ	0.1	U	0.1	U	0.1	U
ENDOSULFAN SULFATE	0.1	0.004	0.1	UJ	0.1	U	0.1	U	0.1	U
4,4'-DDT	0.1	0.004	0.1	UJ	0.1	U	0.1	U	0.1	U
METHOXYCHLOR	0.5	0.019	0.5	UJ	0.5	U	0.5	U	0.5	U
ENDRIN KETONE	0.1	0.003	0.1	UJ	0.1	U	0.1	U	0.1	U
ENDRIN ALDEHYDE	0.1	0.003	0.1	UJ	0.1	U	0.1	U	0.1	U
ALPHA-CHLORDANE	0.05	0.002	0.05	UJ	0.05	U	0.05	U	0.05	U
GAMMA-CHLORDANE	0.05	0.003	0.05	UJ	0.05	U	0.05	U	0.05	U
TOXAPHENE	5	0.03	5	UJ	5	U	5	U	5	U
AROCLOR-1016	1	0.03	1	UJ	1	U	1	U	1	U
AROCLOR-1221	2	0.04	2	UJ	2	U	2	U	2	U
AROCLOR-1232	1	0.01	1	UJ	1	U	1	U	1	U
AROCLOR-1242	1	0.01	1	UJ	1	U	1	U	1	U
AROCLOR-1248	1	0.04	1	UJ	1	U	1	U	1	U
AROCLOR-1254	1	0.05	1	UJ	1	U	1	U	1	U
AROCLOR-1260	1	0.04	1	UJ	1	U	1	U	1	U

SITE: CTO #127, NCBC DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS WIPE SAMPLE RESUL
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-WS5-S1-63093		4-WS6-S1-63093		4-WS7-S1-63093		4-WS8-S1-63093	
LABORATORY ID:			14409.05		14409.06		14409.07		14409.08	
TCL PESTICIDES WIPES (UG/WIPE)	CRQL	MDL/IDL								
ALPHA-BHC	0.05	0.002	0.05	UJ	0.05	UJ	0.05	U	0.05	UJ
BETA-BHC	0.05	0.004	0.05	UJ	0.05	UJ	0.05	U	0.05	UJ
DELTA-BHC	0.05	0.002	0.05	UJ	0.05	UJ	0.05	U	0.05	UJ
GAMMA-BHC (LINDANE)	0.05	0.002	0.05	UJ	0.05	UJ	0.05	U	0.05	UJ
HEPTACHLOR	0.05	0.002	0.05	UJ	0.05	UJ	0.05	U	0.05	UJ
ALDRIN	0.05	0.001	0.05	UJ	0.05	UJ	0.05	U	0.05	UJ
HEPTACHLOR EPOXIDE	0.05	0.001	0.05	UJ	0.05	UJ	0.05	U	0.05	UJ
ENDOSULFAN I	0.05	0.002	0.05	UJ	0.05	UJ	0.05	U	0.05	UJ
DIELDRIN	0.1	0.002	0.1	UJ	0.1	UJ	0.1	U	0.1	UJ
4,4'-DDE	0.1	0.002	0.1	UJ	0.1	UJ	0.1	U	0.1	UJ
ENDRIN	0.1	0.005	0.1	UJ	0.1	UJ	0.1	U	0.1	UJ
ENDOSULFAN II	0.1	0.004	0.1	UJ	0.1	UJ	0.1	U	0.1	UJ
4,4'-DDD	0.1	0.003	0.1	UJ	0.1	UJ	0.1	U	0.1	UJ
ENDOSULFAN SULFATE	0.1	0.004	0.1	UJ	0.1	UJ	0.1	U	0.1	UJ
4,4'-DDT	0.1	0.004	0.1	UJ	0.1	UJ	0.1	U	0.1	UJ
METHOXYCHLOR	0.5	0.019	0.5	UJ	0.5	UJ	0.5	U	0.5	UJ
ENDRIN KETONE	0.1	0.003	0.1	UJ	0.1	UJ	0.1	U	0.1	UJ
ENDRIN ALDEHYDE	0.1	0.003	0.1	UJ	0.1	UJ	0.1	U	0.1	J
ALPHA-CHLORDANE	0.05	0.002	0.12	J	0.088	J	0.05	U	0.05	UJ
GAMMA-CHLORDANE	0.05	0.003	0.11	J	0.07	J	0.05	U	0.05	UJ
TOXAPHENE	5	0.03	5	UJ	5	UJ	5	U	5	UJ
AROCLOR-1016	1	0.03	1	UJ	1	UJ	1	U	1	UJ
AROCLOR-1221	2	0.04	2	UJ	2	UJ	2	U	2	UJ
AROCLOR-1232	1	0.01	1	UJ	1	UJ	1	U	1	UJ
AROCLOR-1242	1	0.01	1	UJ	1	UJ	1	U	1	UJ
AROCLOR-1248	1	0.04	1	UJ	1	UJ	1	U	1	UJ
AROCLOR-1254	1	0.05	1	UJ	1	UJ	1	U	1	UJ
AROCLOR-1260	1	0.04	1	UJ	1	UJ	1	U	1	UJ

SITE: CTO #127, NCBC DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS WIPE SAMPLES
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-WS6-S1-63093		4-WS7-S1-63093		4-WS8-S1-63093		4-WS9-S1-63093		4-WS10-S1-63093	
LABORATORY ID:			14409.06		14409.07		14409.08		14409.09		14409.10	
TAL METAL WIPES (ug/wipe)												
	CRDL	IDL										
ALUMINUM	40	6.8	5430		1710	U	759	U	687	U	10500	
ANTIMONY	12	3.2	9.5	UJ	1.9	UJ	1.9	UJ	1.9	UJ	1.9	UJ
ARSENIC	2	0.4	6.30		1.30	U	0.29	U	0.53	U	4.60	
BARIUM	40	1.8	17.7	U	18.7	U	0.6	U	18.4	U	71.8	J
BERYLLIUM	1	0.2	0.50	U	0.10	U	0.10	U	0.10	U	0.66	
CADMIUM	1	0.6	2.5		0.42	U	0.2	U	0.42	U	5.3	
CALCIUM	1000	46	1610	U	553	U	132	U	2510	U	8080	U
CHROMIUM	2	1.2	51.5		6.10	U	1.3	U	10.7	U	62.6	
COBALT	10	1.2	10.5		1.9		0.50	UJ	0.50	UJ	6.0	
COPPER	5	0.4	346		74.7		6.9	U	14.3	U	133	
IRON	20	1.6	227000		28400		5250	U	4630	U	24000	
LEAD	0.6	0.4	33.9	U	38.4	U	0.55	U	16	U	380	
MAGNESIUM	1000	38.6	609	U	272	U	19.7	U	236	U	2290	
MANGANESE	1.8	0.4	851	J	121		19.8		30.3		359	
MERCURY	0.1	0.1	0.63		0.28		0.05		0.02	U	0.16	
NICKEL	8	3	117		16.7		4.5		2.1	U	12.2	
POTASSIUM	1000	148.6	3430		292	U	79.6	U	601	U	1440	U
SELENIUM	1	0.2	0.2	U	0.2	U	0.2	U	0.2	U	0.2	UJ
SILVER	2	0.4	2.4		0.39	U	0.3	U	0.3	U	0.4	U
SODIUM	1000	50.4	629	U	306	U	271	U	545	U	416	U
THALLIUM	2	0.6	2	UJ	0.2	UJ	0.2	U	0.2	U	2	U
VANADIUM	10	1.2	13.7		3.1	U	0.6	U	2	U	19.5	
ZINC	4	0.4	64.3	U	39.6	U	9.6	U	148	U	3060	

SITE: CTO #127, NCBC DAVISVILLE, RHODE ISLAND
CALF PASTURE POINT MUNITIONS BUNKERS WIPE SAMPLES
LABORATORY: SOUTHWEST LABORATORY OF OKLAHOMA

CLIENT ID:			4-WS11-S1-63093		4-WS12-S1-63093	
LABORATORY ID:			14409.11		14409.25	
TAL METAL WIPES (ug/wipe)						
	CRDL	IDL				
ALUMINUM	40	6.8	25	U	179	U
ANTIMONY	12	3.2	1.9	UJ	1.9	UJ
ARSENIC	2	0.4	0.10	U	0.10	U
BARIUM	40	1.8	0.6	U	1.1	U
BERYLLIUM	1	0.2	0.10	U	0.10	U
CADMIUM	1	0.6	0.20	U	0.20	U
CALCIUM	1000	46	92.3	U	119	U
CHROMIUM	2	1.2	0.46	U	8.2	U
COBALT	10	1.2	0.50	UJ	0.50	UJ
COPPER	5	0.4	0.97	U	3.1	U
IRON	20	1.6	30.6	U	528	U
LEAD	0.6	0.4	0.33	U	3.6	U
MAGNESIUM	1000	38.6	35.8	U	37.3	U
MANGANESE	1.8	0.4	0.74		2.8	U
MERCURY	0.1	0.1	0.02	U	0.02	U
NICKEL	8	3	2.1	U	2.1	U
POTASSIUM	1000	148.6	79.6	U	106	U
SELENIUM	1	0.2	0.2	U	0.2	U
SILVER	2	0.4	0.3	U	0.3	U
SODIUM	1000	50.4	265	U	319	U
THALLIUM	2	0.6	0.2	U	0.2	U
VANADIUM	10	1.2	0.6	U	0.6	U
ZINC	4	0.4	17.7	U	15.3	U

APPENDIX E

SCREENING CRITERIA CALCULATION SPREADSHEET
AND
SOURCE DOCUMENTATION

SCHEENING CRITERIA VALUES SPREADSHEET

Analyte/Compound	RfDo (mg/kg/day)	RfDi (mg/kg/day)	SFo (kd-day/mg	SFi (kd-day/mg	Koc (L/kg)	Henry's Const (atm-m3/mol)	Vi (cm3/mol)	MW (g/mol)	Di (cm2/sec)	Dai (cm2/sec)	Kas (g/cm3)	Alpha (cm2/sec)	VF (m3/kg)
1,1-Dichloroethane	1.00E-01	1.43E-01			3.00E+01	4.26E-03	7.99E+01	98.96	9.17E-02	2.59E-02	2.91E-01	1.08E-03	3.89E+03
1,1-Dichloroethene	9.00E-03		6.00E-01	1.75E-01	6.50E+01	1.90E-01	7.60E+01	96.94	9.38E-02	2.65E-02	5.99E+00	1.25E-02	6.29E+02
1,1,1-Trichloroethane	9.00E-02	2.86E-01			1.52E+02	3.00E-02	9.74E+01	133.41	8.19E-02	2.32E-02	4.05E-01	1.32E-03	3.46E+03
1,1,1,2-Tetrachloroethane	3.00E-02		2.60E-02	2.59E-02	1.18E+02	3.80E-04	1.15E+02	167.85	7.50E-02	2.12E-02	6.60E-03	2.09E-05	2.92E+04
1,1,2-Trichloroethane	4.00E-03		5.70E-02	5.60E-02	5.60E+01	7.42E-04	9.74E+01	133.41	8.19E-02	2.32E-02	2.72E-02	9.38E-05	1.37E+04
1,1,2,2-Tetrachloroethane			2.00E-01	2.03E-01	1.18E+02	3.80E-04	1.15E+02	167.85	7.50E-02	2.12E-02	6.60E-03	2.09E-05	2.92E+04
1,2-Dichlorobenzene	9.00E-02	5.71E-02			1.70E+03	1.93E-03	1.26E+02	147.01	7.29E-02	2.06E-02	2.33E-03	7.17E-06	4.99E+04
1,2-Dichloroethane		2.86E-03	9.10E-02	9.10E-02	1.40E+01	9.14E-04	7.99E+01	98.98	9.17E-02	2.59E-02	1.34E-01	5.09E-04	5.81E+03
1,2-Dichloroethene	2.00E-02				5.90E+01	6.70E-02	7.60E+01	96.94	9.38E-02	2.65E-02	2.33E+00	6.85E-03	1.20E+03
1,2-Dichloropropane		1.14E-03	6.80E-02		5.10E+01	2.31E-03	1.00E+02	112.99	8.22E-02	2.32E-02	9.29E-02	3.18E-04	7.38E+03
1,2,4-Trichlorobenzene	1.00E-02	2.57E-03			9.20E+03	2.30E-03	1.43E+02	181.45	6.78E-02	1.92E-02	5.13E-04	1.47E-06	1.10E+05
1,3-Dichloropropene	3.00E-04	5.71E-03	1.80E-01	1.30E-01	4.80E+01	1.30E-03	9.64E+01	110.98	8.38E-02	2.37E-02	5.55E-02	1.95E-04	9.49E+03
1,4-Dichlorobenzene		2.29E-01	2.40E-02		1.70E+03	3.10E-03	1.26E+02	147.01	7.29E-02	2.06E-02	3.74E-03	1.15E-05	3.93E+04
2-Butanone	5.00E-02	3.00E-01			1.70E+01	2.08E-05	1.64E+02	72.1	7.02E-02	1.98E-02	2.51E-03	7.44E-06	4.90E+04
2-Chlorophenol	5.00E-03				7.30E+01	1.03E-05		128.56	0.00E+00	0.00E+00	2.89E-04	0.00E+00	0.00E+00
2-Hexanone					7.50E+01	7.53E-06	1.28E+02	100.2	7.50E-02	2.12E-02	2.06E-04	6.53E-07	1.65E+05
2-Methylnaphthalene	2.00E-02					4.60E-04		142.2	0.00E+00	0.00E+00	ERR	ERR	0.00E+00
2-Methylphenol	5.00E-02				2.45E+01	3.92E-06		108.1	0.00E+00	0.00E+00	3.28E-04	0.00E+00	0.00E+00
2,3,7,8-TCDD			1.50E+05	1.50E+05	3.30E+06	2.10E-03	2.55E+02	3.22E+02	5.06E-02	1.43E-02	1.30E-06	2.79E-09	2.53E+06
2,4-Dichlorophenol	3.00E-03								0.00E+00	0.00E+00	ERR	ERR	0.00E+00
2,4-Dimethylphenol	2.00E-02				9.60E+01	1.70E-05		122.2	0.00E+00	0.00E+00	3.63E-04	0.00E+00	0.00E+00
2,4-Dinitrophenol	2.00E-03								0.00E+00	0.00E+00	ERR	ERR	0.00E+00
2,4,5-Trichlorophenol	1.00E-01								0.00E+00	0.00E+00	ERR	ERR	0.00E+00
2,4,6-Trichlorophenol			1.10E-02	1.10E-02					0.00E+00	0.00E+00	ERR	ERR	0.00E+00
3,3'-Dichlorobenzidine			4.50E-01						0.00E+00	0.00E+00	ERR	ERR	0.00E+00
4-Chloro-3-methylphenol	2.00E+00				6.04E+02	2.50E-06		142.6	0.00E+00	0.00E+00	6.49E-06	0.00E+00	0.00E+00
4-Chloroaniline	4.00E-03				5.20E+01	1.07E-05		127.6	0.00E+00	0.00E+00	4.22E-04	0.00E+00	0.00E+00
4-Methyl-2-pentanone	5.00E-02	2.00E-02			1.13E+02	4.16E-05	1.28E+02	100.2	7.50E-02	2.12E-02	7.55E-04	2.39E-06	8.64E+04
4-Methylphenol	5.00E-03				2.43E+01	1.29E-06		108.1	0.00E+00	0.00E+00	1.09E-04	0.00E+00	0.00E+00
4,4'-DDD			2.40E-01		7.70E+05	2.20E-06		320	0.00E+00	0.00E+00	5.86E-11	0.00E+00	0.00E+00
4,4'-DDE			3.40E-01		4.40E+06	6.80E-05		318	0.00E+00	0.00E+00	3.17E-08	0.00E+00	0.00E+00
4,4'-DDT	5.00E-04		3.40E-01	3.40E-01	3.90E+06	1.58E-05		354.5	0.00E+00	0.00E+00	8.31E-09	0.00E+00	0.00E+00
Acenaphthene	6.00E-02				4.60E+03	9.10E-05		154.2	0.00E+00	0.00E+00	4.06E-05	0.00E+00	0.00E+00
Acetone	1.00E-01				3.50E-01	3.43E-05	6.69E+01	58.08	1.06E-01	3.00E-02	2.01E-01	8.75E-04	4.39E+03
Aldrin	3.00E-05		1.70E+01	1.70E+01	9.60E+04	1.60E-05		365	0.00E+00	0.00E+00	3.42E-07	0.00E+00	0.00E+00
Alpha-BHC			6.30E+00	6.30E+00	3.80E+03	6.00E-06		291	0.00E+00	0.00E+00	3.24E-06	0.00E+00	0.00E+00
Aniline		2.86E-04	5.70E-03		4.40E+01	9.00E-06		93.12	0.00E+00	0.00E+00	4.19E-04	0.00E+00	0.00E+00
Anthracene	3.00E-01				1.40E+04	6.60E-05		178.2	0.00E+00	0.00E+00	1.26E-05	0.00E+00	0.00E+00
Antimony	4.00E-04							121.75	0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Aroclor			7.70E+00		5.30E+05	2.60E-03	2.65E+02	328.4	4.97E-02	1.40E-02	1.01E-05	2.11E-08	9.19E+05
Arsenic	3.00E-04		1.75E+00	1.51E+01				74.92	0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Barium	7.00E-02	1.43E-04						137.34	0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Benzene		1.43E-04	2.90E-02	2.90E-02	6.50E+01	5.50E-03	9.10E+01	78.12	8.95E-02	2.53E-02	1.73E-01	6.40E-04	5.15E+03
Benzoic acid	4.00E+00				1.50E+02	7.00E-08		122.13	0.00E+00	0.00E+00	9.57E-07	0.00E+00	0.00E+00
Benzo(a)anthracene			7.30E+00	6.10E+00	2.00E+05	1.00E-06		228.28	0.00E+00	0.00E+00	1.03E-08	0.00E+00	0.00E+00
Benzo(a)pyrene			7.30E+00	6.10E+00	5.50E+06	4.90E-07		252	0.00E+00	0.00E+00	1.83E-10	0.00E+00	0.00E+00
Benzo(b)fluoranthene			7.30E+00	6.10E+00	5.50E+05	1.22E-05		252.3	0.00E+00	0.00E+00	4.55E-08	0.00E+00	0.00E+00
Benzo(g,h,i)perylene					1.60E+06	1.44E-07		276	0.00E+00	0.00E+00	1.85E-10	0.00E+00	0.00E+00
Benzo(k)fluoranthene			7.30E+00	6.10E+00	5.50E+05	3.87E-05		252.3	0.00E+00	0.00E+00	1.44E-07	0.00E+00	0.00E+00
Beryllium	5.00E-03		4.30E+00	8.40E+00				9.01	0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Beta-BHC			1.80E+00	1.80E+00	3.80E+03	4.50E-07		291	0.00E+00	0.00E+00	2.43E-07	0.00E+00	0.00E+00
Bis(2-chloroethyl)ether			1.10E+00	1.16E+00	1.39E+01	1.30E-05		143	0.00E+00	0.00E+00	1.92E-03	0.00E+00	0.00E+00
Bis(2-chloroisopropyl)ether	4.00E-02		7.00E-02	3.50E-02	6.10E+01	1.10E-04		171.1	0.00E+00	0.00E+00	3.70E-03	0.00E+00	0.00E+00
Bis(2-ethylhexyl)phthalate	2.00E-02		1.40E-02		2.00E+09	3.00E-07	4.93E+02	390.62	3.66E-02	1.03E-02	3.08E-13	4.76E-16	6.12E+09
Bromodichloromethane	2.00E-02		6.20E-02		6.10E+01	2.41E-03	8.29E+01	163.83	8.62E-02	2.44E-02	8.10E-02	2.92E-04	7.73E+03
Bromomethane	1.40E-03	1.00E-03			5.90E+00	1.97E-01	4.63E+01	94.94	1.14E-01	3.23E-02	6.84E+01	2.94E-02	6.93E+01

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SCREENING CRITERIA VALUES SPREADSHEET

Analyte/Compound	RfDo (mg/kg/day)	RfDi (mg/kg/day)	SFo (kd-day/mg	SFi (kd-day/mg	Koc (L/kg)	Henry's Const (atm-m3/mol)	Vi (cm3/mol)	MW (g/mol)	Di (cm2/sec)	Dai (cm2/sec)	Kas (g/cm3)	Alpha (cm2/sec)	VF (m3/kg)
Butylbenzylphthalate	2.00E-01			6.30E+00	1.70E+05	8.30E-06		312	0.00E+00	0.00E+00	1.00E-07	0.00E+00	0.00E+00
Cadmium	5.00E-04							112.4	0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Caprolactam	5.00E-01								0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Carbon disulfide	1.00E-01	2.86E-03			1.42E+02	1.13E-02		76.14	0.00E+00	0.00E+00	1.63E-01	0.00E+00	0.00E+00
Carbon tetrachloride	7.00E-04	5.71E-04	1.30E-01	5.25E-02	4.39E+02	2.30E-02	9.45E+01	153.82	8.20E-02	2.32E-02	1.07E-01	3.67E-04	6.87E+03
Chlordane	6.00E-05		1.30E+00	1.29E+00	1.40E+05	9.40E-05		409.8	0.00E+00	0.00E+00	1.38E-06	0.00E+00	0.00E+00
Chlorobenzene	2.00E-02	5.71E-03			3.30E+02	3.58E-03	1.08E+02	112.56	7.97E-02	2.25E-02	2.22E-02	7.47E-05	1.54E+04
Chloroethane	2.00E-02	2.86E+00			1.49E+01	1.48E-01	6.24E+01	65.42	1.07E-01	3.02E-02	2.04E+01	2.28E-02	2.19E+02
Chloroform	1.00E-02		6.10E-03	8.05E-02	4.40E+01	2.88E-03	7.70E+01	119.38	9.13E-02	2.58E-02	1.34E-01	5.08E-04	5.81E+03
Chloromethane			1.30E-02	6.30E-03	4.30E+00	4.00E-02	4.19E+01	50.49	1.30E-01	3.68E-02	1.91E+01	2.72E-02	2.10E+02
Chromium (III)	1.00E+00	5.71E-07						52	0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Chromium (VI)	5.00E-03			4.20E+01				52	0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Chrysene			7.30E+00	6.10E+00	2.00E+05	1.05E-06		228.3	0.00E+00	0.00E+00	1.08E-08	0.00E+00	0.00E+00
Cobalt	8.00E-03							58.93	0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Copper	4.00E-02							63.54	0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Cyanide	2.00E-02								0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Dibenzo(a,h)anthracene			7.30E+00	6.10E+00	3.30E+06	7.30E-08		278.4	0.00E+00	0.00E+00	4.53E-11	0.00E+00	0.00E+00
Dibromochloromethane	2.00E-02		8.40E-02		8.40E+01	9.90E-04	8.50E+01	208.29	8.39E-02	2.37E-02	2.42E-02	8.55E-05	1.44E+04
Dieldrin	5.00E-05		1.60E+01	1.60E+01	1.70E+03	4.57E-10		381	0.00E+00	0.00E+00	5.51E-10	0.00E+00	0.00E+00
Diethylphthalate	8.00E-01				1.42E+02	1.20E-06		222.2	0.00E+00	0.00E+00	1.73E-05	0.00E+00	0.00E+00
Dimethylphthalate	1.00E+01				1.74E+01	2.15E-06		194.2	0.00E+00	0.00E+00	2.53E-04	0.00E+00	0.00E+00
Di-n-butylphthalate	1.00E-01				1.70E+05	2.80E-07	3.09E+02	278.3	4.66E-02	1.32E-02	3.38E-09	6.65E-12	5.18E+07
Di-n-octylphthalate	2.00E-02				3.60E+09	1.70E-05		391	0.00E+00	0.00E+00	9.68E-12	0.00E+00	0.00E+00
Endosulfan	6.00E-03				9.60E-03	1.91E-05		406.9	0.00E+00	0.00E+00	4.08E+00	0.00E+00	0.00E+00
Endrin	3.00E-04				1.70E+03	4.00E-07		381	0.00E+00	0.00E+00	4.82E-07	0.00E+00	0.00E+00
Ethylbenzene	1.00E-01	2.86E-01			1.10E+03	6.60E-03	1.32E+02	106.16	7.37E-02	2.08E-02	1.23E-02	3.83E-05	2.16E+04
Fluoranthene	4.00E-02				3.80E+04	6.50E-06		202.3	0.00E+00	0.00E+00	3.51E-07	0.00E+00	0.00E+00
Fluorene	4.00E-02				7.30E+03	6.40E-05		116.2	0.00E+00	0.00E+00	1.80E-05	0.00E+00	0.00E+00
Gamma-BHC	3.00E-04		1.30E+00		3.80E+03	7.80E-06		291	0.00E+00	0.00E+00	4.21E-06	0.00E+00	0.00E+00
Heptachlor	5.00E-04		4.50E+00	4.55E+00	1.20E+04	4.00E-03		373.5	0.00E+00	0.00E+00	6.83E-04	0.00E+00	0.00E+00
Heptachlor epoxide	1.30E-05		9.10E+00	9.10E+00	2.20E+02	3.90E-04		389.2	0.00E+00	0.00E+00	3.63E-03	0.00E+00	0.00E+00
Hexachlorobenzene	8.00E-04		1.60E+00	1.61E+00	1.20E+06	6.80E-04	1.96E+02	284.79	5.75E-02	1.62E-02	1.16E-06	2.82E-09	2.51E+06
Hexachlorobutadiene	2.00E-04		7.80E-02	7.70E-02	2.90E+04	2.56E-02	1.83E+02	260.76	5.95E-02	1.68E-02	1.81E-03	4.56E-06	6.26E+04
Hexachloroethane	1.00E-03		1.40E-02	1.40E-02	2.00E+04	2.49E-03	1.50E+02	236.74	6.54E-02	1.85E-02	2.55E-04	7.06E-07	1.59E+05
Indeno(1,2,3-cd)pyrene			7.30E+00	6.10E+00	1.60E+06	6.95E-08		276.3	0.00E+00	0.00E+00	8.90E-11	0.00E+00	0.00E+00
Isophorone	2.00E-01		9.50E-04		8.70E+01	5.75E-06		138.2	0.00E+00	0.00E+00	1.35E-04	0.00E+00	0.00E+00
Lead	1.00E-07							207.19	0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Manganese	5.00E-03	1.43E-05						54.94	0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Mercury	3.00E-04	8.57E-05						200.59	0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Methoxychlor	5.00E-03				8.00E+04	1.58E-05		345.66	0.00E+00	0.00E+00	4.05E-07	0.00E+00	0.00E+00
Methylene chloride	6.00E-02	8.57E-01	7.50E-03	1.64E-03	8.80E+00	2.03E-03	5.95E+01	84.94	1.05E-01	2.97E-02	4.73E-01	1.96E-03	2.82E+03
Naphthalene	4.00E-03				9.40E+02	4.60E-04	1.40E+02	128.2	7.04E-02	1.99E-02	1.00E-03	2.99E-06	7.73E+04
Nickel	2.00E-02			8.40E-01				58.71	0.00E+00	0.00E+00	ERR	ERR	0.00E+00
N-nitroso-di-n-propylamin			7.00E+00						0.00E+00	0.00E+00	ERR	ERR	0.00E+00
N-nitrosodiphenylamine			4.90E-03		6.48E+02	6.60E-04		198.2	0.00E+00	0.00E+00	2.09E-03	0.00E+00	0.00E+00
Pentachlorophenol	3.00E-02		1.20E-01		5.30E+04	2.80E-06		266.35	0.00E+00	0.00E+00	1.08E-07	0.00E+00	0.00E+00
Phenol	6.00E-01				1.42E+01	4.54E-07		94.11	0.00E+00	0.00E+00	6.55E-05	0.00E+00	0.00E+00
Pyrene	3.00E-02				3.80E+04	5.10E-06		202.3	0.00E+00	0.00E+00	2.75E-07	0.00E+00	0.00E+00
Selenium	5.00E-03							78.96	0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Silver	5.00E-03							107.87	0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Styrene	2.00E-01	2.86E-01	3.00E-02	2.00E-03	5.68E+02	2.28E-03	1.28E+02	104.14	7.48E-02	2.12E-02	8.23E-03	2.60E-05	2.62E+04
Tetrachloroethene	1.00E-02		5.20E-02	2.03E-03	3.64E+02	1.53E-02	1.11E+02	165.83	7.62E-02	2.15E-02	8.62E-02	2.74E-04	7.97E+03
Thallium	7.00E-05							204.37	0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Tin	6.00E-01							118.69	0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Toluene	2.00E-01	1.14E-01			3.00E+02	6.66E-03	1.11E+02	92.13	8.06E-02	2.28E-02	4.55E-02	1.54E-04	1.07E+04
Toxaphene			1.10E+00	1.12E+00	9.64E+02	2.10E-01		414	0.00E+00	0.00E+00	4.47E-01	0.00E+00	0.00E+00

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SCREENING CRITERIA VALUES SPREADSHEET

Analyte/Compound	RfDo (mg/kg/day)	RfDi (mg/kg/day)	SFo (kd-day/mg	SFi (kd-day/mg	Koc (L/kg)	Henry's Const. (atm-m3/mol)	Vi (cm3/mol)	MW (g/mol)	Di (cm2/sec)	Dai (cm2/sec)	Kas (g/cm3)	Alpha (cm2/sec)	VF (m3/kg)
Trichloroethene	6.00E-03		1.10E-02	6.00E-03	1.26E+02	9.10E-03	9.38E+01	131.39	8.34E-02	2.36E-02	1.48E-01	5.11E-04	5.78E+03
Vanadium	7.00E-03							50.94	0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Vinyl acetate	1.00E+00	5.71E-02							0.00E+00	0.00E+00	ERR	ERR	0.00E+00
Vinyl chloride			1.90E+00	3.00E-01	8.20E+00	8.14E-02	5.84E+01	62.5	1.11E-01	3.12E-02	2.04E+01	2.35E-02	2.15E+02
Xylenes	2.00E+00	8.57E-02			6.70E+02	6.82E-03	1.32E+02	106.16	7.37E-02	2.08E-02	1.61E-02	5.00E-05	1.89E+04
Zinc	3.00E-01							65.37	0.00E+00	0.00E+00	ERR	ERR	0.00E+00

SCREENING CRITERIA VALUES SPREADSHEET

Analyte/Compound	URF (ug/m3)-1	RfC (mg/m3)	Kd (l/kg)	Air Inh SSLc (mg/kg)	Air Inh SSLnc (mg/kg)	Air Inh SSLmin (mg/kg)	Air Inh SSLmin w/unit conv.	units	Soil Exp Ing SSLc (mg/kg)	Soil Exp. Ing SSLnc (mg/kg)	Soil Exp. Ing SSLmin (mg/kg)	Soil Exp. Ing SSLmin w/unit conv.	units
1,1-Dichloroethane	NA	5.01E-01		NA	4.50E+02	450.000	450,000	ug/kg	need data	7800.000	7800.000	7,800,000	ug/kg
1,1-Dichloroethene	5.00E-05	NA		1.70E-01	NA	0.170	170	ug/kg	1.100	703.926	1.100	1,100	ug/kg
1,1,1-Trichloroethane	NA	1.00E+00		NA	4.20E+02	420.000	420,000	ug/kg	need data	7000.000	7000.000	7,000,000	ug/kg
1,1,1,2-Tetrachloroethane	7.40E-06	NA		9.60E+00	NA	9.595	9,595	ug/kg	2.463	2346.420	2.463	2,463	ug/kg
1,1,2-Trichloroethane	1.60E-05	NA		2.09E+00	NA	2.090	2,090	ug/kg	1.123	312.856	1.123	1,123	ug/kg
1,1,2,2-Tetrachloroethane	5.80E-05	NA		1.22E+00	NA	1.224	1,224	ug/kg	0.320	need data	0.320	320	ug/kg
1,2-Dichlorobenzene	NA	2.00E-01		NA	1.04E+04	10391.526	10,391,526	ug/kg	need data	7039.260	7039.260	7,039,260	ug/kg
1,2-Dichloroethane	2.60E-05	1.00E-02		5.44E-01	6.06E+01	0.544	544	ug/kg	0.704	need data	0.704	704	ug/kg
1,2-Dichloroethene	NA	NA		NA	NA	need data	need data	ug/kg	need data	1564.280	1564.280	1,564,280	ug/kg
1,2-Dichloropropane	NA	3.99E-03		NA	3.07E+01	30.725	30,725	ug/kg	0.942	need data	0.942	942	ug/kg
1,2,4-Trichlorobenzene	NA	9.00E-03		9.30E+01	1.03E+03	93.000	93,000	ug/kg	780.000	782.140	780.000	780,000	ug/kg
1,3-Dichloropropene	3.71E-05	2.00E-02		6.21E-01	1.98E+02	0.621	621	ug/kg	0.356	23.464	0.356	356	ug/kg
1,4-Dichlorobenzene	NA	8.02E-01		8.00E+01	3.29E+04	80.000	80,000	ug/kg	27.000	need data	27.000	27,000	ug/kg
2-Butanone	NA	1.05E+00		NA	5.36E+04	53600.462	53,600,462	ug/kg	need data	3910.700	3910.700	3,910,700	ug/kg
2-Chlorophenol	NA	NA		NA	NA	need data	need data	ug/kg	need data	391.070	391.070	391,070	ug/kg
2-Hexanone	NA	NA		NA	NA	need data	need data	ug/kg	need data	need data	need data	need data	ug/kg
2-Methylnaphthalene	NA	NA		NA	NA	need data	need data	ug/kg	need data	1564.280	1564.280	1,564,280	ug/kg
2-Methylphenol	NA	NA		NA	NA	need data	need data	ug/kg	need data	3910.700	3910.700	3,910,700	ug/kg
2,3,7,8-TCDD	4.29E+01	NA		1.43E-04	NA	1.43E-04	1.43E-01	ug/kg	4.27E-07	need data	4.27E-07	4.27E-04	ug/kg
2,4-Dichlorophenol	NA	NA		NA	NA	need data	need data	ug/kg	need data	234.642	234.642	234,642	ug/kg
2,4-Dimethylphenol	NA	NA		NA	NA	need data	need data	ug/kg	need data	1564.280	1564.280	1,564,280	ug/kg
2,4-Dinitrophenol	NA	NA		NA	NA	need data	need data	ug/kg	need data	156.428	156.428	156,428	ug/kg
2,4,5-Trichlorophenol	NA	NA		NA	NA	need data	need data	ug/kg	need data	7821.400	7821.400	7,821,400	ug/kg
2,4,6-Trichlorophenol	3.14E-06	NA		1.10E+00	NA	1.097	1,097	ug/kg	5.821	need data	5.821	5,821	ug/kg
3,3'-Dichlorobenzidine	NA	NA		NA	NA	need data	need data	ug/kg	0.142	need data	0.142	142	ug/kg
4-Chloro-3-methylphenol	NA	NA		NA	NA	need data	need data	ug/kg	need data	156428.000	156428.000	156,428,000	ug/kg
4-Chloroaniline	NA	NA		NA	NA	need data	need data	ug/kg	need data	312.856	312.856	312,856	ug/kg
4-Methyl-2-pentanone	NA	7.00E-02		NA	6.30E+03	6304.388	6,304,388	ug/kg	need data	3910.700	3910.700	3,910,700	ug/kg
4-Methylphenol	NA	NA		NA	NA	need data	need data	ug/kg	need data	391.070	391.070	391,070	ug/kg
4,4'-DDD	NA	NA		NA	NA	need data	need data	ug/kg	0.267	need data	0.267	267	ug/kg
4,4'-DDE	NA	NA		NA	NA	need data	need data	ug/kg	0.188	need data	0.188	188	ug/kg
4,4'-DDT	9.71E-05	NA		3.90E+00	NA	3.900	3,900	ug/kg	1.900	39.107	1.900	1,900	ug/kg
Acenaphthene	NA	NA		NA	NA	need data	need data	ug/kg	need data	4692.840	4692.840	4,692,840	ug/kg
Acetone	NA	NA		NA	NA	need data	need data	ug/kg	need data	7821.400	7821.400	7,821,400	ug/kg
Aldrin	4.86E-03	NA		9.08E-01	NA	0.908	908	ug/kg	0.004	2.346	0.004	4	ug/kg
Alpha-BHC	1.80E-03	NA		1.00E+00	NA	1.000	1,000	ug/kg	0.100	need data	0.100	100	ug/kg
Aniline	NA	1.00E-03		NA	4.71E+05	470798.900	4.71E+08	ug/kg	11.234	need data	11.234	11,234	ug/kg
Anthracene	NA	NA		NA	NA	need data	need data	ug/kg	need data	23464.200	23464.200	23,464,200	ug/kg
Antimony	NA	NA	No Kd	NA	NA	need data	need data	mg/kg	need data	31.286	31.286	31	mg/kg
Aroclor	NA	NA		NA	NA	need data	need data	ug/kg	1.000	need data	1.000	1,000	ug/kg
Arsenic	4.31E-03	NA	3.32E+00	2.60E+03	NA	2600.000	2,600.000	mg/kg	0.370	23.464	0.370	0.370	mg/kg
Barium	NA	5.01E-04	2.71E+01	NA	2.35E+05	235399.450	235,399.450	mg/kg	need data	5,474.980	5,474.980	5,474.980	mg/kg
Benzene	8.29E-06	5.01E-04		2.50E+00	2.69E+00	2.500	2,500	ug/kg	22.000	need data	22.000	22,000	ug/kg
Benzoic acid	NA	NA		NA	NA	need data	need data	ug/kg	need data	312856.000	312856.000	312,856,000	ug/kg
Benzo(a)anthracene	1.74E-03	NA		1.02E+00	NA	1.021	1,021	ug/kg	0.009	need data	0.009	9	ug/kg
Benzo(a)pyrene	1.74E-03	NA		1.33E+01	NA	13.300	13,300	ug/kg	0.110	need data	0.110	110	ug/kg
Benzo(b)fluoranthene	1.74E-03	NA		1.02E+00	NA	1.021	1,021	ug/kg	0.009	need data	0.009	9	ug/kg
Benzo(g,h,i)perylene	NA	NA		NA	NA	need data	need data	ug/kg	need data	need data	need data	need data	ug/kg
Benzo(k)fluoranthene	1.74E-03	NA		1.02E+00	NA	1.021	1,021	ug/kg	0.009	need data	0.009	9	ug/kg
Beryllium	2.40E-03	NA	No Kd	9.95E-01	NA	0.995	0.995	mg/kg	0.015	391.070	0.015	0.015	mg/kg
Beta-BHC	5.14E-04	NA		1.07E+00	NA	1.074	1,074	ug/kg	0.036	need data	0.036	36	ug/kg
Bis(2-chloroethyl)ether	3.31E-04	NA		1.08E+00	NA	1.082	1,082	ug/kg	0.058	need data	0.058	58	ug/kg
Bis(2-chloroisopropyl)ether	1.00E-05	NA		1.10E+00	NA	1.097	1,097	ug/kg	0.915	3128.560	0.915	915	ug/kg
Bis(2-ethylhexyl)phthalate	NA	NA		NA	NA	need data	need data	ug/kg	4.574	1564.280	4.574	4,574	ug/kg
Bromodichloromethane	NA	NA		NA	NA	need data	need data	ug/kg	1.033	1564.280	1.033	1,033	ug/kg
Bromomethane	NA	3.50E-03		NA	2.53E-01	0.253	253	ug/kg	need data	109.500	109.500	109,500	ug/kg

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SCREENING CRITERIA VALUES SPREADSHEET

Analyte/Compound	URF (ug/m3)-1	RfC (mg/m3)	Kd (l/kg)	Air Inh. SSLc (mg/kg)	Air Inh. SSLnc (mg/kg)	Air Inh. SSLmin (mg/kg)	Air Inh. SSLmin w/unit conv.	units	Soil Exp Ing. SSLc (mg/kg)	Soil Exp. Ing. SSLnc (mg/kg)	Soil Exp. Ing. SSLmin (mg/kg)	Soil Exp. Ing. SSLmin w/unit conv.	units
Butylbenzylphthalate	NA	NA		NA	NA	need data	need data	ug/kg	need data	15642.800	15642.800	15,642,800	ug/kg
Cadmium	1.80E-03	NA	6.69E+00	6.20E+03	NA	6200.000	6,200.000	mg/kg	need data	39.000	39.000	39.000	mg/kg
Caprolactam	NA	NA		NA	NA	need data	need data	ug/kg	need data	39107.000	39107.000	39,107,000	ug/kg
Carbon disulfide	NA	1.00E-02		NA	4.71E+06	4707989.000	4.71E+09	ug/kg	need data	7821.400	7821.400	7,821,400	ug/kg
Carbon tetrachloride	1.50E-05	2.00E-03		1.50E+00	1.43E+01	1.500	1,500	ug/kg	4.900	54.750	4.900	4,900	ug/kg
Chlordane	3.69E-04	NA		6.00E-01	NA	0.600	600	ug/kg	0.490	4.693	0.490	490	ug/kg
Chlorobenzene	NA	2.00E-02		NA	1.70E+02	170.000	170,000	ug/kg	need data	1600.000	1600.000	1,600,000	ug/kg
Chloroethane	NA	1.00E+01		NA	2.28E+03	2284.389	2,284,389	ug/kg	need data	1564.280	1564.280	1,564,280	ug/kg
Chloroform	2.30E-05	NA		1.10E+00	NA	1.100	1,100	ug/kg	100.000	782.140	100.000	100,000	ug/kg
Chloromethane	1.80E-06	NA		2.84E-01	NA	0.284	284	ug/kg	4.926	need data	4.926	4,926	ug/kg
Chromium (III)	NA	2.00E-06	2.21E+03	NA	9.40E+02	939.952	939.952	mg/kg	need data	78,214.000	78,214.000	78,214.000	mg/kg
Chromium (VI)	1.20E-02	NA	3.66E+01	9.15E+01	NA	91.453	91.453	mg/kg	need data	390.000	390.000	390.000	mg/kg
Chrysene	1.74E-03	NA		8.00E-01	NA	0.800	800	ug/kg	110.000	need data	110.000	110,000	ug/kg
Cobalt	NA	NA	5.46E+01	NA	NA	need data	need data	mg/kg	need data	625.712	625.712	625.712	mg/kg
Copper	NA	NA	2.22E+01	NA	NA	need data	need data	mg/kg	need data	3,128.560	3,128.560	3,128.560	mg/kg
Cyanide	NA	NA	No Kd	NA	NA	need data	need data	mg/kg	need data	1,564.280	1,564.280	1,564.280	mg/kg
Dibenzo(a,h)anthracene	1.74E-03	NA		6.30E+02	NA	629.675	629,675	ug/kg	0.009	need data	0.009	9	ug/kg
Dibromochloromethane	NA	NA		NA	NA	need data	need data	ug/kg	0.762	1564.280	0.762	762	ug/kg
Dieldrin	4.57E-03	NA		5.10E+00	NA	5.100	5,100	ug/kg	0.040	3.911	0.040	40	ug/kg
Diethylphthalate	NA	NA		NA	NA	need data	need data	ug/kg	need data	62571.200	62571.200	62,571,200	ug/kg
Dimethylphthalate	NA	NA		NA	NA	need data	need data	ug/kg	need data	782140.000	782140.000	7.82E+08	ug/kg
Di-n-butylphthalate	NA	NA		NA	NA	need data	need data	ug/kg	need data	7821.400	7821.400	7,821,400	ug/kg
Di-n-octylphthalate	NA	NA		NA	NA	need data	need data	ug/kg	need data	1564.280	1564.280	1,564,280	ug/kg
Endosulfan	NA	NA		NA	NA	need data	need data	ug/kg	need data	469.284	469.284	469,284	ug/kg
Endrin	NA	NA		NA	NA	need data	need data	ug/kg	need data	23.464	23.464	23,464	ug/kg
Ethylbenzene	NA	1.00E+00		NA	5.80E+01	58.000	58,000	ug/kg	need data	7800.000	7800.000	7,800,000	ug/kg
Fluoranthene	NA	NA		NA	NA	need data	need data	ug/kg	need data	3128.560	3128.560	3,128,560	ug/kg
Fluorene	NA	NA		NA	NA	need data	need data	ug/kg	need data	3128.560	3128.560	3,128,560	ug/kg
Gamma-BHC	NA	NA		NA	NA	need data	need data	ug/kg	0.049	23.464	0.049	49	ug/kg
Heptachlor	1.30E-03	NA		8.44E+02	NA	844.179	844,179	ug/kg	0.014	39.107	0.014	14	ug/kg
Heptachlor epoxide	2.60E-03	NA		4.22E+02	NA	422.090	422,090	ug/kg	0.007	1.017	0.007	7	ug/kg
Hexachlorobenzene	4.60E-04	NA		1.33E+01	NA	13.290	13,290	ug/kg	0.040	62.571	0.040	40	ug/kg
Hexachlorobutadiene	2.20E-05	NA		6.92E+00	NA	6.922	6,922	ug/kg	0.821	15.643	0.821	821	ug/kg
Hexachloroethane	4.00E-06	NA		9.67E+01	NA	96.743	96,743	ug/kg	4.574	78.214	4.574	4,574	ug/kg
Indeno(1,2,3-cd)pyrene	1.74E-03	NA		6.30E+02	NA	629.675	629,675	ug/kg	0.009	need data	0.009	9	ug/kg
Isophorone	NA	NA		NA	NA	need data	need data	ug/kg	67.405	15642.800	67.405	67,405	ug/kg
Lead	NA	NA	9.95E+01	NA	NA	need data	150.000	mg/kg	need data	0.008	0.008	150.000	mg/kg
Manganese	NA	5.01E-05	1.48E+02	NA	2.35E+04	23539.945	23,539.945	mg/kg	need data	391.070	391.070	391.070	mg/kg
Mercury	NA	3.00E-04	No Kd	NA	4.10E+01	41.000	41.000	mg/kg	need data	23.000	23.000	23.000	mg/kg
Methoxychlor	NA	NA		NA	NA	need data	need data	ug/kg	need data	391.070	391.070	391,070	ug/kg
Methylene chloride	4.69E-07	3.00E+00		4.40E+01	8.81E+03	44.000	44,000	ug/kg	85.000	4692.840	85.000	85,000	ug/kg
Naphthalene	NA	NA		NA	5.20E+01	52.000	52,000	ug/kg	need data	3100.000	3100.000	3,100,000	ug/kg
Nickel	2.40E-04	NA	No Kd	4.70E+04	NA	47000.000	47,000.000	mg/kg	need data	1,600.000	1,600.000	1,600.000	mg/kg
N-nitroso-di-n-propylamin	NA	NA		NA	NA	need data	need data	ug/kg	0.009	need data	0.009	9	ug/kg
N-nitrosodiphenylamine	NA	NA		NA	NA	need data	need data	ug/kg	13.068	need data	13.068	13,068	ug/kg
Pentachlorophenol	NA	NA		NA	NA	need data	need data	ug/kg	5.300	2346.420	5.300	5,300	ug/kg
Phenol	NA	NA		NA	NA	need data	need data	ug/kg	need data	46928.400	46928.400	46,928,400	ug/kg
Pyrene	NA	NA		NA	NA	need data	need data	ug/kg	need data	2346.420	2346.420	2,346,420	ug/kg
Selenium	NA	NA	2.72E+00	NA	NA	need data	need data	mg/kg	need data	391.070	391.070	391.070	mg/kg
Silver	NA	NA	1.10E+02	NA	NA	need data	need data	mg/kg	need data	391.070	391.070	391.070	mg/kg
Styrene	5.71E-07	1.00E+00		1.11E+02	2.73E+04	111.404	111,404	ug/kg	2.135	15642.800	2.135	2,135	ug/kg
Tetrachloroethene	5.80E-07	NA		4.10E+01	NA	41.000	41,000	ug/kg	12.000	782.140	12.000	12,000	ug/kg
Thallium	NA	NA	5.99E+04	NA	NA	need data	need data	mg/kg	need data	5.475	5.475	5.475	mg/kg
Tin	NA	NA	No Kd	NA	NA	need data	need data	mg/kg	need data	46,928.400	46,928.400	46,928.400	mg/kg
Toluene	NA	3.99E-01		1.50E+02	4.45E+03	150.000	150,000	ug/kg	16000.000		16000.000	16,000,000	ug/kg
Toxaphene	3.20E-04	NA		3.43E+03	NA	3429.479	3,429,479	ug/kg	0.058	need data	0.058	58	ug/kg

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SCREENING CRITERIA VALUES SPREADSHEET

Analyte/Compound	URF (ug/m3)-1	RfC (mg/m3)	Kd (l/kg)	Air Inh. SSLc (mg/kg)	Air Inh. SSLnc (mg/kg)	Air Inh. SSLmin (mg/kg)	Air Inh. SSLmin w/unit conv.	units	Soil Exp. Ing. SSLc (mg/kg)	Soil Exp. Ing. SSLnc (mg/kg)	Soil Exp. Ing. SSLmin (mg/kg)	Soil Exp. Ing. SSLmin w/unit conv.	units
Trichloroethene	1.71E-06	NA		1.30E+01	NA	13.000	13.000	ug/kg	58.000	469.284	58.000	58.000	ug/kg
Vanadium	NA	NA	No Kd	NA	NA	need data	need data	mg/kg	need data	547.498	547.498	547.498	mg/kg
Vinyl acetate	NA	2.00E-01		NA	9.40E+07	93995165.000	9.40E+10	ug/kg	need data	78214.000	78214.000	78,214,000	ug/kg
Vinyl chloride	8.57E-05	NA		2.00E-02	NA	0.020	20	ug/kg	0.340	need data	0.340	340	ug/kg
Xylenes	NA	3.00E-01		NA	9.70E+01	97.000	97,000	ug/kg	need data	160000.000	160000.000	160,000,000	ug/kg
Zinc	NA	NA	1.64E+01	NA	NA	need data	need data	mg/kg	need data	23,464.200	23,464.200	23,464.200	mg/kg

SCREENING CRITERIA VALUES SPREADSHEET

Analyte/Compound	Groundwater Ing./Inh. SSL min (mg/l)	Groundwater Ing./Inh. SSL min w/unit conv.	units	Wipe Ing. NJCSc (ug/100 cm2)	Wipe Ing. NJCSnc (ug/100 cm2)	Wipe Ing. NJCSmin (ug/100 cm2)	Groundwater Ing./Inh. MCLG/MCL/Cw (mg/l)	Groundwater Ing./Inh. MCLG/MCL/Cw (ug/l)
1,1-Dichloroethane	6.200	6,200	ug/kg	need data	3.630	3.630	3.5000	3,500.0000
1,1-Dichloroethene	0.020	20	ug/kg	0.033	0.327	0.033	0.0070	7.0000
1,1,1-Trichloroethane	0.700	700	ug/kg	need data	3.267	3.267	0.2000	200.0000
1,1,1,2-Tetrachloroethane	1.003	1,003	ug/kg	0.109	1.089	0.109	0.0013	1.3462
1,1,2-Trichloroethane	1.003	1,003	ug/kg	0.015	0.145	0.015	0.0030	3.0000
1,1,2,2-Tetrachloroethane	1.000	1,000	ug/kg	192.500	need data	192.500	1.75E-05	0.0175
1,2-Dichlorobenzene	21.400	21,400	ug/kg	need data	3.267	3.267	0.6000	600.0000
1,2-Dichloroethane	1.001	1,001	ug/kg	42.308	need data	42.308	0.0050	5.0000
1,2-Dichloroethene	1.083	1,083	ug/kg	need data	0.726	0.726	0.0700	70.0000
1,2-Dichloropropane	1.005	1,005	ug/kg	56.618	need data	56.618	0.0050	5.0000
1,2,4-Trichlorobenzene	2.300	2,300	ug/kg	need data	0.363	0.363	0.0700	70.0000
1,3-Dichloropropene	1.000	1,000	ug/kg	21.389	0.011	0.011	0.0002	0.1944
1,4-Dichlorobenzene	0.800	800	ug/kg	1604.167	need data	1604.167	0.0750	75.0000
2-Butanone	1.595	1,595	ug/kg	need data	1.815	1.815	1.7500	1,750.0000
2-Chlorophenol	1.256	1,256	ug/kg	need data	0.182	0.182	0.1750	175.0000
2-Hexanone	need data	need data	ug/kg	need data	need data	need data	need data	need data
2-Methylnaphthalene	need data	need data	ug/kg	need data	0.726	0.726	0.7000	700.0000
2-Methylphenol	1.858	1,858	ug/kg	need data	1.815	1.815	1.7500	1,750.0000
2,3,7,8-TCDD	1.00E+00	1.00E+03	ug/kg	0.000	need data	2.57E-05	3.00E-08	0.0000
2,4-Dichlorophenol	need data	need data	ug/kg	need data	0.109	0.109	0.1050	105.0000
2,4-Dimethylphenol	2.344	2,344	ug/kg	need data	0.726	0.726	0.7000	700.0000
2,4-Dinitrophenol	need data	need data	ug/kg	need data	0.073	0.073	0.0700	70.0000
2,4,5-Trichlorophenol	need data	need data	ug/kg	need data	3.630	3.630	3.5000	3,500.0000
2,4,6-Trichlorophenol	need data	need data	ug/kg	350.000	need data	350.000	0.0003	0.3182
3,3'-Dichlorobenzidine	need data	need data	ug/kg	8.556	need data	8.556	7.78E-06	0.0078
4-Chloro-3-methylphenol	846.600	846,600	ug/kg	need data	72.600	72.600	70.0000	70,000.0000
4-Chloroaniline	1.146	1,146	ug/kg	need data	0.145	0.145	0.1400	140.0000
4-Methyl-2-pentanone	4.955	4,955	ug/kg	need data	1.815	1.815	1.7500	1,750.0000
4-Methylphenol	1.085	1,085	ug/kg	need data	0.182	0.182	0.1750	175.0000
4,4'-DDD	1.225	1,225	ug/kg	16.042	need data	16.042	1.46E-05	0.0146
4,4'-DDE	1.906	1,906	ug/kg	11.324	need data	11.324	1.03E-05	0.0103
4,4'-DDT	2.300	2,300	ug/kg	11.324	0.018	0.018	0.0001	0.1029
Acenaphthene	194.200	194,200	ug/kg	need data	2.178	2.178	2.1000	2,100.0000
Acetone	1.025	1,025	ug/kg	need data	3.630	3.630	3.5000	3,500.0000
Aldrin	1.004	1,004	ug/kg	0.226	0.001	0.001	2.06E-06	0.0021
Alpha-BHC	0.001	1	ug/kg	0.611	need data	0.611	5.56E-07	0.0006
Aniline	1.001	1,001	ug/kg	675.439	need data	675.439	0.0006	0.6140
Anthracene	2941.000	2,941,000	ug/kg	need data	10.890	10.890	10.5000	10,500.0000
Antimony	need data	need data	mg/kg	need data	300.000	300.000	0.0060	6.0000
Aroclor	8.200	8,200	ug/kg	2.700	need data	2.700	0.0005	0.5000
Arsenic	14.000	14,000	mg/kg	2.200	0.011	2.200	0.0500	50.0000
Barium	543.253	543,253	mg/kg	need data	2.541	2.541	2.0000	2,000.0000
Benzene	0.010	10	ug/kg	132.759	need data	132.759	0.0050	5.0000
Benzoic acid	421.000	421,000	ug/kg	need data	145.200	145.200	140.0000	140,000.0000
Benzo(a)anthracene	1.400	1,400	ug/kg	0.527	need data	0.527	0.0001	0.1000
Benzo(a)pyrene	7.100	7,100	ug/kg	0.527	need data	0.527	0.0002	0.2000
Benzo(b)fluoranthene	3.200	3,200	ug/kg	0.527	need data	0.527	0.0002	0.2000
Benzo(g,h,i)perylene	need data	need data	ug/kg	need data	need data	need data	need data	need data
Benzo(k)fluoranthene	3.200	3,200	ug/kg	0.527	need data	0.527	0.0002	0.2000
Beryllium	need data	need data	mg/kg	0.895	0.182	0.182	0.0040	4.0000
Beta-BHC	1.000	1,000	ug/kg	21.389	need data	21.389	1.94E-06	0.0019
Bis(2-chloroethyl)ether	1.000	1,000	ug/kg	3.500	need data	3.500	3.18E-06	0.0032
Bis(2-chloroisopropyl)ether	1.001	1,001	ug/kg	55.000	1.452	1.452	0.0005	0.5000
Bis(2-ethylhexyl)phthalate	100001.000	1.00E+08	ug/kg	275.000	0.726	0.726	0.0025	2.5000
Bromodichloromethane	1.122	1,122	ug/kg	62.097	0.726	0.726	0.1000	100.0000
Bromomethane	1.006	1,006	ug/kg	need data	0.051	0.051	0.0490	49.0000

SCREENING CRITERIA VALUES SPREADSHEET

Analyte/Compound	Groundwater Ing./Inh. SSLmin (mg/l)	Groundwater Ing./Inh. SSLmin w/unit conv.	units	Wipe Ing. NJCSc (ug/100 cm2)	Wipe Ing. NJCSnc (ug/100 cm2)	Wipe Ing. NJCSmin (ug/100 cm2)	Groundwater Ing./Inh. MCLG/MCL/Cw (mg/l)	Groundwater Ing./Inh. MCLG/MCL/Cw (ug/l)
Butylbenzylphthalate	341.000	341,000	ug/kg	need data	7.260	7.260	0.1000	100.0000
Cadmium	8.100	8.100	mg/kg	need data	280.000	280.000	0.0050	5.0000
Caprolactam	need data	need data	ug/kg	need data	18.150	18.150	17.5000	17,500.0000
Carbon disulfide	10.940	10,940	ug/kg	need data	3.630	3.630	3.5000	3,500.0000
Carbon tetrachloride	0.030	30	ug/kg	29.615	0.025	0.025	0.0050	5.0000
Chlordane	2.000	2,000	ug/kg	2.962	0.002	0.002	0.0020	2.0000
Chlorobenzene	0.500	500	ug/kg	need data	0.726	0.726	0.1000	100.0000
Chloroethane	1.209	1,209	ug/kg	need data	0.726	0.726	0.7000	700.0000
Chloroform	0.200	200	ug/kg	631.148	0.363	0.363	0.1000	100.0000
Chloromethane	1.000	1,000	ug/kg	2961.538	need data	2961.538	0.0003	0.2692
Chromium (III)	2,209.348	2,209.348	mg/kg	need data	36.300	36.300	0.1000	100.0000
Chromium (VI)	19.000	19.000	mg/kg	need data	0.182	0.182	0.1000	100.0000
Chrysene	0.400	400	ug/kg	0.527	need data	0.527	0.0002	0.2000
Cobalt	153.875	153.875	mg/kg	need data	0.290	0.290	0.2800	280.0000
Copper	289.573	289.573	mg/kg	need data	1.452	1.452	1.3000	1,300.0000
Cyanide	need data	need data	mg/kg	need data	0.726	0.726	0.2000	200.0000
Dibenzo(a,h)anthracene	20.800	20,800	ug/kg	0.527	need data	0.527	0.0003	0.3000
Dibromochloromethane	1.168	1,168	ug/kg	0.073	0.726	0.073	0.1000	100.0000
Dieldrin	0.001	1	ug/kg	0.241	0.002	0.002	2.19E-06	0.0022
Diethylphthalate	80.520	80,520	ug/kg	need data	29.040	29.040	28.0000	28,000.0000
Dimethylphthalate	122.800	122,800	ug/kg	need data	363.000	363.000	350.0000	350,000.0000
Di-n-butylphthalate	11901.000	11,901,000	ug/kg	need data	3.630	3.630	3.5000	3,500.0000
Di-n-octylphthalate	50400001.000	5.04E+10	ug/kg	need data	0.726	0.726	0.7000	700.0000
Endosulfan	1.000	1,000	ug/kg	need data	0.218	0.218	0.2100	210.0000
Endrin	1.068	1,068	ug/kg	need data	0.011	0.011	0.0020	2.0000
Ethylbenzene	3.300	3,300	ug/kg	need data	3.630	3.630	0.7000	700.0000
Fluoranthene	1065.000	1,065,000	ug/kg	need data	1.452	1.452	1.4000	1,400.0000
Fluorene	205.400	205,400	ug/kg	need data	1.452	1.452	1.4000	1,400.0000
Gamma-BHC	1.002	1,002	ug/kg	2.962	0.011	0.011	2.69E-05	0.0269
Heptachlor	1.096	1,096	ug/kg	0.856	0.018	0.018	0.0004	0.4000
Heptachlor epoxide	1.001	1,001	ug/kg	0.423	0.000	0.000	0.0002	0.2000
Hexachlorobenzene	25.000	25,000	ug/kg	2.406	0.029	0.029	0.0010	1.0000
Hexachlorobutadiene	1.580	1,580	ug/kg	0.001	0.007	0.001	0.0010	1.0000
Hexachloroethane	2.000	2,000	ug/kg	275.000	0.036	0.036	0.0025	2.5000
Indeno(1,2,3-cd)pyrene	13.800	13,800	ug/kg	0.527	need data	0.527	0.0004	0.4000
Isophorone	1.064	1,064	ug/kg	0.726	7.260	0.726	0.0368	36.8421
Lead	15.923	15.923	mg/kg	need data	21.500	21.500	0.0150	15.0000
Manganese	260.723	260.723	mg/kg	need data	0.182	0.182	0.1750	175.0000
Mercury	3.000	3.000	mg/kg	need data	240.000	240.000	0.0020	2.0000
Methoxychlor	65.000	65,000	ug/kg	need data	0.182	0.182	0.0400	40.0000
Methylene chloride	0.007	7	ug/kg	513.333	2.178	2.178	0.0050	5.0000
Naphthalene	25.000	25,000	ug/kg	need data	0.145	0.145	0.1400	140.0000
Nickel	82.000	82.000	mg/kg	need data	0.726	0.726	0.1000	100.0000
N-nitroso-di-n-propylamin	need data	need data	ug/kg	0.550	need data	0.550	5.00E-07	0.0005
N-nitrosodiphenylamine	1.009	1,009	ug/kg	785.714	need data	785.714	0.0007	0.7143
Pentachlorophenol	0.009	9	ug/kg	32.083	1.089	1.089	0.0010	1.0000
Phenol	6.964	6,964	ug/kg	need data	21.780	21.780	21.0000	21,000.0000
Pyrene	799.000	799,000	ug/kg	need data	1.089	1.089	1.0500	1,050.0000
Selenium	2.359	2.359	mg/kg	need data	0.182	0.182	0.0500	50.0000
Silver	193.408	193.408	mg/kg	need data	0.182	0.182	0.1750	175.0000
Styrene	2.136	2,136	ug/kg	128.333	7.260	7.260	0.1000	100.0000
Tetrachloroethene	0.030	30	ug/kg	74.038	0.363	0.363	0.0050	5.0000
Thallium	300.371	300.371	mg/kg	need data	0.003	0.003	0.0005	0.5000
Tin	need data	need data	mg/kg	need data	21.780	21.780	21.0000	21,000.0000
Toluene	3.600	3,600	ug/kg	need data	7.260	7.260	1.0000	1,000.0000
Toxaphene	1.058	1,058	ug/kg	3.500	need data	3.500	0.0030	3.0000

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NOTES

Cw	-	Concentration in water corresponding to 10-6 risk for carcinogens or hazard quotient of 1 for noncarcinogens.
Kd	-	Distribution coefficient
Koc	-	Organic Carbon Partitioning Coefficient
MCL	-	Maximum Contaminant Level
MCLG	-	Maximum Contaminant Level Goal
MW	-	Molecular Weight
NJCS	-	New Jersey Cleanup Standard
RfDi	-	Inhalation Reference Dose
RfDo	-	Oral Reference Dose
SFi	-	Inhalation Slope Factor
SFo	-	Oral Slope Factor
SSL	-	Soil Screening Level
URF	-	Unit Risk Factor
VF	-	Soil-to-Air Volatilization Factor

1. Shaded values in the Screening Criteria Values Spreadsheet are values presented in EPA or state guidance documents specified below. Values which are not shaded were determined using equations presented in the EPA Draft Soil Screening Level Guidance dated September 1993.

2. The primary source for the SSLs is the EPA Draft Soil Screening Level Guidance dated September 1993.

3. The primary source for the slope factors and reference doses used to calculate the SSLs presented in the Screening Criteria Values Spreadsheet is the U.S. EPA Region III Risk-Based Concentration Table, dated January 7, 1994.

4. In accordance with U.S. EPA Region 1 guidance (1989), oral and inhalation slope factors for benzo(a)pyrene were applied to benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

5. MCLs and MCLGs were obtained from the EPA publication,"Drinking Water Regulations and Advisories," dated December 1993.

6. New Jersey Cleanup Standards are published in "Cleanup Standards for Contaminated Sites." Proposed New Rules: NJAC 7:26D. 1992.

7. Groundwater pathway and air pathway SSLs for naphthalene serve as surrogates for 2-methyl naphthalene.

8. SSLs for fluoranthene serve as surrogates for phenanthrene.

9. SSLs for endosulfan serve as surrogates for endosulfan I, endosulfan II, and endosulfan sulfate.

10. SSLs for endrin serve as surrogates for endrin aldehyde.

11. The groundwater SSL for barium was calculated using the distribution coefficient (K_d) for strontium (Dragun, 1988).

SCREENING CRITERIA VALUES SPREADSHEET

Analyte/Compound	Groundwater Ing./Inh. SSLmin (mg/l)	Groundwater Ing./Inh. SSLmin w/unit conv.	units	Wipe Ing. NJCSc (ug/100 cm2)	Wipe Ing. NJCSnc (ug/100 cm2)	Wipe Ing. NJCSmin (ug/100 cm2)	Groundwater Ing./Inh. MCLG/MCL/Cw (mg/l)	Groundwater Ing./Inh. MCLG/MCL/Cw (ug/l)
Trichloroethene	0.010	10	ug/kg	350.000	0.218	0.218	0.0050	5.0000
Vanadium	need data	need data	mg/kg	need data	0.254	0.254	0.2450	245.0000
Vinyl acetate	need data	need data	ug/kg	need data	36.300	36.300	35.0000	35,000.0000
Vinyl chloride	0.002	2	ug/kg	2.026	need data	2.026	0.0020	2.0000
Xylenes	57.000	57,000	ug/kg	need data	72.600	72.600	10.0000	10,000.0000
Zinc	1,727.688	1,727.688	mg/kg	need data	10.890	10.890	10.5000	10,500.0000

12. Rhode Island Department of Health "lead-free" standards (1992) were used as screening values for lead in soil and wipe samples.

13. Spreadsheet cells containing formulas which cannot be solved due to insufficient data display the message "need data."

14. SSLs were rounded using U.S. EPA Contract Laboratory Program rounding rules prior to insertion into the report tables.

United States Environmental Protection Agency

Office of Solid Waste and Emergency Response

September 1993

EPA

Draft Soil Screening Level Guidance

RECEIVED

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HALLIBURTON NUS ENVIRONMENTAL CORPORATION

Office of Emergency and Remedial Response
Hazardous Site Control Division

Quick Reference Fact She

NOTICE. This document is draft and should only be used in the context of demonstration pilots being overseen by the U.S. EPA. The memo used to support the approach discussed herein will undergo rigorous technical review and public comment before this document is finalized alo with SSLs for approximately 60 additional chemicals in the summer of 1994

BACKGROUND

On June 19, 1991, the U.S. Environmental Protection Agency's (EPA's) Administrator charged the Office of Solid Waste and Emergency Response (OSWER) with conducting a 30-day study to outline options for accelerating the rate of cleanups at National Priority List (NPL) sites. The study found that the current investigation/remedy selection process takes over 3 years to complete because each site is treated as a unique problem, requiring the preparation of site-specific risk assessments, cleanup levels, and technical solutions. The study proposed that standardizing the remedial planning and remedy selection process would significantly reduce the time it takes to start cleanups and would improve consistency across the Regions. One of the specific proposals was for OSWER to "examine the means to develop standards or guidelines for contaminated soils."

On June 23, 1993, EPA announced the development of Soil Trigger Levels as one of the Administrative Improvements to the Superfund program. This fact sheet presents Soil Screening Levels (SSLs) (formerly known as trigger levels) for 30 chemicals and represents OSWER's first step toward standardizing the evaluation and cleanup of contaminated soils under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA).

An SSL is a chemical concentration in soil that represents a level of contamination above which there is sufficient concern to warrant further site-specific study. Concentrations in soil above this screening level would *not* automatically designate a site as "dirty," nor trigger a response action. However, they suggest that a further evaluation of the potential risks that may be posed by site contaminants is appropriate. Generally, if contaminant concentrations in soil fall below the screening level and the site meets specific residential use conditions, no further study or action is warranted for that area under CERCLA (Superfund). However, some States have developed screening numbers that are more stringent than those presented in this fact sheet, and therefore further study may be warranted under State programs.

PURPOSE OF SSLs

The primary purpose of the SSLs is to accelerate decisi making concerning contaminated soils. Initial applications focus remedial investigations by eliminating from further st site areas that do not warrant further study under CERC In fostering prompt identification of the contaminants exposure areas of concern, the SSLs may also help simplif accelerate the baseline risk assessment and may serve Preliminary Remediation Goals (PRGs) under specc conditions. EPA will explore other potential applications proceeds to refine and expand this guidance. Such applicati may include removal response actions, site assessment/ listing, voluntary cleanups, and Resource Conservation Recovery Act (RCRA) Corrective Actions.

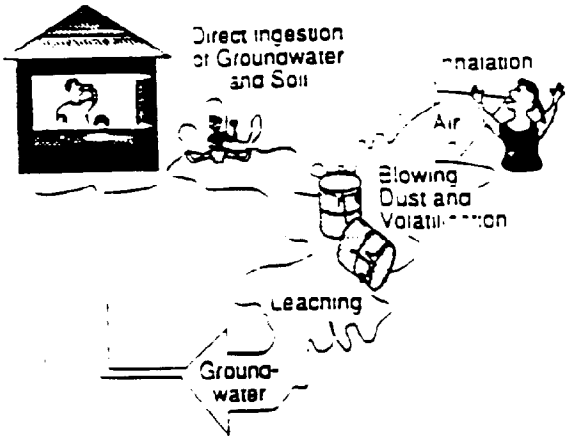
ATTRIBUTES OF SSLs

The 30 SSLs presented in this document have been develo using residential land use human exposure assumptions considering three pathways of exposure to the contamin (see Figure 1):

- ingestion of soil
- inhalation of volatiles and fugitive dusts
- migration of contaminants through soil to an underl potable aquifer.

These pathways have proven to be the most common route human exposure to contaminants in the residential settin hazardous waste sites evaluated by EPA. Also, substa efforts have been made to model these particular pathway

Other routes/pathways may contribute significantly to the posed by exposure to specific contaminants (e.g., der exposure or exposure via food chain contamination). OSV will continue to seek consensus on the appropriate meth required to quantify additional routes/pathways generic. The results of these efforts may be included in the guidance.



Not Addressed:

- Ecological effects
- Dermal absorption
- Indoor exposure to volatiles from soil and water
- Consumption of fish, beef, or dairy products
- Land uses other than residential

Figure 1. Pathways addressed by soil screening.

An overview of key SSL attributes includes:

- SSLs calculated for the ingestion and inhalation pathways are based on standard equations modified from the *Human Health Evaluation Manual (Part B)* (U.S. EPA, 1991).
- SSLs for migration to groundwater pathways are based on a partitioning equation coupled with a dilution and attenuation factor (DAF).
- Conservative default values were used to calculate levels protective of "high end" individual exposures.
- SSLs are generally based on a 10^{-6} risk for carcinogens, or a hazard quotient of 1 for noncarcinogens; SSLs for protection of groundwater are based on nonzero maximum contaminant level goals (MCLGs), or maximum contaminant levels (MCLs), if available, or these same risk-based targets otherwise.
- SSLs are calculated for individual exposure pathways.

The SSLs correspond to a 10^{-6} risk level for carcinogens and a hazard quotient of 1 for noncarcinogens and the potential for additive effects has not been "built in" to the SSLs through apportionment. For carcinogens, EPA believes that setting a 10^{-6} risk level for individual chemicals and pathways will generally lead to cumulative risks within the risk range (10^{-4} to 10^{-6}) for the combinations of chemicals typically found at Superfund sites.

For noncarcinogens, there is no widely accepted "risk range." Thus, for developing national numbers, options are either (1) to set the risk level for individual contaminants at the reference dose (RfD) or reference concentration (RfC, i.e., a hazard quotient of 1), or (2) to set chemical-specific concentrations by apportioning risk based on some arbitrarily chosen fraction of the acceptable risk level (e.g., one-fifth or one-tenth the RfD/RfC). The Agency believes, and the Science Advisory Board agrees (U.S. EPA, 1993b), that noncancer risks should be added only for those chemicals with the same toxic endpoint or mechanism of action. Because the combination of contaminants will vary from site to site, the potential for additive effects and the need to apportion risk must be a site-specific determination.

Practically speaking, however, the five SSLs listed in Table 1 that are based on noncarcinogenic effects (RfDs) all have different endpoints of toxicity (i.e., the critical effects on which the RfDs are based are different). Thus risks for cumulative exposure would not be additive. Furthermore, for the noncarcinogenic volatiles (e.g., ethylbenzene and toluene), the SSLs based on the ingestion pathway are very high, higher than what is physically possible. In these cases, it is necessary to establish a reasonable "ceiling limit" for the amount of chemical that may be in the soil matrix at sites likely to use this guidance. For the purposes of this guidance, this "ceiling limit" is based on the soil saturation limit (C_{sat}), not toxicity, and serves as the SSL for that chemical. For these reasons, straight apportionment of SSLs in this fact sheet would be inappropriate.

For the groundwater pathway only, SSLs are part of a four-tiered approach to evaluating soil contaminants that may leach to groundwater. The tiers reflect increasing levels of site specificity and cost but generally decreasing levels of conservatism. The first tier SSLs rely heavily on concentration levels derived from mathematical models and generic assumptions. If contaminant levels at a site do not exceed the first tier SSLs and other site exposure pathways are accounted for in the assumptions used to derive the SSLs, then the area or site is no longer of concern under CERCLA remedial authority. If contaminant levels at a site equal or exceed the first tier SSLs, or other pathways of concern are present, full site investigation may be initiated or one may consider higher tier screening analyses. The other three tiers are distinguished by their approach to evaluating the soil-to-groundwater pathway. Tier 2 uses site-specific values in a partitioning equation. Tier 3 uses a leach test, and Tier 4 involves full-scale site-specific modeling.

LIMITATIONS OF SSLs

SSLs do not trigger the need for response actions or define "unacceptable" levels of contaminants in soil. In addition, the levels are not necessarily protective of all known human exposure pathways, reasonable land uses, or ecological threats.

SSLs were not developed as nationwide cleanup levels or standards. They are risk-based levels that have not yet been modified based on the Superfund remedy selection criteria that are designed to tailor final cleanup levels to site-specific conditions (NCP Section 300.430 (3)(2)(i)(A)).

Table 1. Superfund Proposed Soil Screening Levels[a]

Chemical	Pathway-specific values for surface soils (mg/kg)		Surface soil SSLs (mg/kg)[b]	Groundwater pathway levels (mg/kg)		
	Ingestion	Inhalation		Unadjusted	With 10 DAF[c]	With 100 DAF[c]
α-BHC	0.1 [d]	1.0 [d]	0.1 [d]	0.0001 [e]	0.001 [d]	0.01 [d]
Benzene	22 [d]	2.5 [d]	2.5 [d]	0.001 [e]	0.01 [d]	0.1
Benzo(a)pyrene	0.11 [d]	13.3 [d]	0.11 [d]	0.71 [d]	7.1	71
Carbon tetrachloride	4.9 [d]	1.5 [d]	1.5 [d]	0.003 [e]	0.03	0.3
Chlordane	0.49 [d]	0.6 [d]	0.49 [d]	0.2 [d]	2	20
Chlorobenzene	1,600 [f]	170 [g]	170 [g]	0.05	0.5	5
Chloroform	100 [d]	1.1 [d]	1.1 [d]	0.02	0.2	2
Chrysene	110 [d]	0.8 [g]	0.8 [g]	0.04	0.4	4
DDT	1.9 [d]	3.9 [d]	1.9 [d]	0.23	2.3	23
1,4-Dichlorobenzene	27 [d]	80 [g]	27 [d]	0.08 [e]	0.8	8
1,1-Dichloroethane	7,800 [f]	450 [g]	450 [g]	0.62	6.2	62
1,1-Dichloroethene	1.1 [d]	0.17 [d]	0.17 [d]	0.002 [e]	0.02	0.2
Dieldrin	0.04 [d]	5.1 [d]	0.04 [d]	0.0001 [e]	0.001 [e]	0.01
Ethylbenzene	7,800 [f]	58 [g]	58 [g]	0.33	3.3	33
Methylene chloride	85 [d]	44 [d]	44 [d]	0.001 [e]	0.007 [e]	0.07
Naphthalene	3,100 [f]	52 [g]	52 [g]	2.5	25	250
PCB-1260	1[i]	—[h]	—[h]	0.82	8.2	82
Pentachlorophenol	5.3 [d]	—[h]	—[h]	0.001 [e,j]	0.009 [e,j]	0.09 [j]
Tetrachloroethene	12 [d]	41 [d]	12 [d]	0.003 [e]	0.03	0.3
Toluene	16,000 [f]	150 [d]	150 [g]	0.36	3.6	36
1,2,4-Trichlorobenzene	780 [f]	93 [d]	93 [g]	0.23 [e]	2.3	23
1,1,1-Trichloroethane	7,000 [f]	420 [g]	420 [g]	0.07	0.7	7
Trichloroethene	58 [d]	13 [d]	13 [d]	0.001 [e]	0.01 [e]	0.1
Vinyl chloride	0.34 [d]	0.02 [d]	0.02 [d]	0.0002 [e]	0.002 [e]	0.02
Xylenes (mixed)	160,000 [f]	97 [g]	97 [g]	5.7	57	570
Arsenic	0.37 [d]	2,600 [d]	0.37 [d]	1.4 [j]	14 [j]	140 [j]
Cadmium	39 [f]	6,200 [d]	39 [f]	0.81 [j]	8.1 [j]	81 [j]
Chromium (VI)	390 [f]	930 [d]	390 [f]	1.9 [j]	19 [j]	190 [j]
Mercury	23 [f]	41 [f]	23 [f]	0.3 [j]	3 [j]	30 [j]
Nickel	1,600 [f]	47,000 [d]	1,600 [f]	8.2 [j]	82 [j]	820 [j]

[a] Screening Levels based on human health criteria only.
[b] Surface soil SSLs represent the lower of ingestion and inhalation values.
[c] DAF = Dilution and attenuation factor.
[d] Calculated values correspond to a cancer risk level of 1 in 1,000,000.
[e] Level is at or below Contract Laboratory Program required quantitation limit for Regular Analytical Services (RAS).
[f] Calculated values correspond to a noncancer hazard quotient of 1.
[g] Soil saturation concentration (C_{sat}).
[h] No toxicity criteria available for that route of exposure.
[i] A preliminary remediation goal of 1 ppm has been set for PCBs based on *Guidance on Remedial Actions for Superfund Sites with PCB Contamination* (U.S. EPA, 1990) and on Agency-wide efforts to manage PCB contamination.
[j] SSLs for pH of 6.8.

However, SSLs can serve as PRGs in the following cases:

- Where site conditions mimic the model assumptions underlying the SSLs (i.e., all pathways of concern at a given site match those accounted for in the SSLs), or
- Where the site manager or owner decides not to incur costs of additional site-specific study to arrive at less conservative but still protective levels.

The primary condition for use of the SSLs is that exposur pathways of concern and site conditions must match thos taken into account by the levels. Thus, at all sites it will b necessary to develop a simple conceptual site model to identi likely source areas, exposure pathways, and potential recepto to assist in determining the extent to which the SSLs can serv as PRGs. In addition to developing a conceptual site mode

the following questions should always be considered by the decisionmaker before applying the SSLs:

- Are there potential ecological concerns?
- Is there potential for land use other than residential?
- Are there other likely human exposure pathways that were not considered in development of the SSLs (e.g., local fish consumption; raising of beef, dairy, or other livestock)?
- Are there unusual site conditions (e.g., unusually large area of contamination, unusually high fugitive dust levels)?

If any of these four conditions exist, then SSLs cannot be used to screen out sites or portions of sites from further evaluation. In addition, SSLs should not be viewed independently of either natural or anthropogenic background concentrations. Where natural background levels are higher than SSLs, generally the SSLs will be of little value since it is inappropriate to conduct further study or action to address contaminants below background. Similarly, when anthropogenic background levels exceed the SSLs, EPA does not encourage additional study or action without first attempting to coordinate such action with the authority responsible for managing the more broadly contaminated area. In either case, the collection of site-specific data is highly recommended.

HOW TO USE SSLs

Table 1 contains SSLs for 30 chemicals. The first column to the right of the chemical name presents values based on soil ingestion. The second column presents the lower of two values derived to protect for either inhalation of volatiles or soil particulates. The third column simply presents the lowest number of the first two columns and may be used as the SSL for surface soils under most residential circumstances. For sites where groundwater is a pathway of concern, SSL values for the migration to the groundwater pathway apply. Three different SSLs address migration of contaminants to groundwater; the selection of an appropriate SSL for this pathway depends on site-specific conditions as discussed below. The first column of groundwater values reflects the levels calculated by the partitioning equation with no correction factor added for dilution and attenuation in the subsurface (unadjusted). The next two columns reflect the levels adjusted by factors of 10 and 100, respectively (10 and 100 DAF), to account for such dilution and attenuation.

As mentioned above, the first step in applying the SSL guidance is to develop a simple conceptual model of the site based on available site sampling data, historical records, aerial photographs, and site hydrogeologic information. This model will establish a hypothesis about the possible contaminant sources, their fate and transport, potential exposure pathways, and human or environmental receptors. If the conceptual model indicates that potential exposure pathways and receptors are fully accounted for in the SSL methodology, the SSLs may be directly applied to the site. However, if the model indicates that the site is either very large or complex or that there are exposure pathways NOT accounted for in the SSL methodology, SSLs will not be suitable to fully evaluate the site. They can be used, however, in the site evaluation since SSLs have been derived on a pathway-specific basis, and, thus it will only be necessary to evaluate those exposure pathways that are not already considered in the SSL methodology.

The second step involves collecting a representative sample se for each exposure area. (See Measuring Soil Levels for mor detailed guidance on sample numbers and locations.) A exposure area is defined as that geographic area in which a individual may be exposed to contamination regularly. It mar involve the entire site, portions of a site, or a simple residentic lot. To maximize efficiency, data collection should b coordinated with other early sampling efforts that may b undertaken to gain a better understanding of basic sit hydrogeology, ecological threats, or the potential fo application of various treatment technologies. For exampl the decision may be made early on to collect data for site specific modeling purposes at a particular site; in this case, th site manager should work to limit total trips to the site an minimize the number of samples collected and their location

The third step is to compare site-specific data with the SSL in Table 1. At this point, it is reasonable to revisit the origin conceptual site model with the actual site data in hand reconfirm their accuracy. Generally, this comparison wi result in one of three outcomes:

1. Site-measured values indicate that an area falls well belo any SSL in the table. These areas of the site can b eliminated from further evaluation.
2. Site-measured data indicate that one or more SSLs ha clearly been exceeded by a wide margin. In this case, th SSLs have helped to identify contaminants and exposu pathways of concern on which to focus further analysis data gathering efforts.
3. A site-measured value exceeds one pathway-specific va but not the others. In this case it is reasonable to foc additional site-specific data collection efforts only on da that will help determine whether there is truly a risk fro that pathway at the site. When an exceedence is margina significant, a closer look at site-specific conditions a exposures may result in the area being eliminated fro further study. If this is the case for the groundwa pathway, a manager may choose to collect data specified the next higher tier(s).

For an NPL site at which SSLs are exceeded, a quick analy can determine whether the cumulative risks posed by the s exceed the 10^{-4} risk level for carcinogens (or hazard index (H of 1 for noncarcinogens), which generally is the trigger remedial action under Superfund. Where the basis response action exists, and exposure pathways of concern addressed by the SSLs, the SSLs become PRGs as defined the *Human Health Evaluation Manual, Part B* (U.S. E 1991).

In accordance with the National Contingency Plan (NCP), the decisionmaker will need to consider a variety of factors in determining whether any modification of the SSLs (PRGs) is appropriate in setting final cleanup levels (NCP Section 300.430(e)(2)(i)(A)). Ultimately, final cleanup levels are set through the evaluation of the NCP's nine criteria, including cost, long-term effectiveness, and implementability. If groundwater is the driving pathway, even at this final stage, the option exists to consider other SSL uses in identifying final cleanup levels.

TECHNICAL BACKGROUND

The models and assumptions used to develop the SSLs construct scenarios representative of a "reasonable maximum exposure" (RME) in the residential setting. U.S. EPA (1989b) outlined the Superfund program's approach to calculating an RME. Since that time, the EPA (U.S. EPA, 1991) has coined a new term that corresponds to the definition of RME: "high-end individual exposure." The Superfund program's method to estimate the high-end (outlined in U.S. EPA, 1989b) is to combine an arithmetic average value for site concentration with high-end values for intake and duration. The estimate of high-end exposure is then compared to chemical-specific Agency toxicity criteria found in the Integrated Risk Information System (IRIS) and Health Effects Assessment Summary Tables (HEAST). The method used to set SSLs combines high-end default values for the intake and duration parameters with Agency toxicity criteria to back-calculate to a screening level in soil. Therefore, attainment of SSLs should be measured based on an arithmetic average.

Although the generic assumptions are not considered overly conservative, EPA recognizes that site-specific conditions may differ significantly from the generic assumptions used in the models. Therefore, for the groundwater pathway the subsequent uses of the SSLs allow for the substitution of some of the generic fate and transport assumptions with site-specific data to derive alternative "screening levels" that are more site-specific. Bear in mind, however, that one purpose of the SSLs is to define a level in soil below which no further study or action would be required. Therefore, alternative levels using site-specific data, although less conservative, must still be protective of "high-end" individual exposures.

The following sections present the equations and generic assumptions used to calculate the Screening Levels for each pathway evaluated.

Direct Ingestion

Agency toxicity criteria for noncarcinogens establish a level of "daily" exposure that is not expected to cause deleterious effects over a lifetime of exposure (i.e., 70 years). Depending on the contaminant, however, exceeding the RfD (i.e., the "acceptable" daily level) for a short period of time may be cause for concern. For example, if there is reason to believe that exposure to soil may be higher at a particular stage of an individual's lifetime, one would want to protect for that shorter period of high exposure. Because a number of studies have shown that inadvertent ingestion of soil is common among children age 6 and younger (Calabrese et al., 1989; Davis et al., 1990; Van Wijnen et al., 1990), OERR set SSLs at concentrations that are protective of this increased exposure during childhood by ensuring that the chronic Reference Dose (or RfC) is not exceeded during this shorter (6-year) time period (Equation 1). If there is reason to believe that exposures at a site may be significant over a short period of time (e.g., extensive soil excavation work in a dry region), depending on the contaminant, the site manager should consider the potential for acute health effects as well.

Equation 1: Screening Level Equation for Ingestion of Noncarcinogenic Contaminants in Residential Soil

$$\text{Screening Level (mg/kg)} = \frac{THQ \times BW \times AT \times 365\ d/yr}{1/RfD_o \times 10^{-6}\ kg/mg \times EF \times ED \times IR}$$

Parameter/Definition (units)	Default
THQ/target hazard quotient (unitless)	1
RfD_o/oral reference dose (mg/kg-d)	Chemical-specific
BW/body weight (kg)	15
AT/averaging time (yr)	6[a]
EF/exposure frequency (d/yr)	350
ED/exposure duration (yr)	6
IR/soil ingestion rate (mg/d)[2]	200

[a] For noncarcinogens, Averaging Time is equal to Exposure Duration.

For carcinogens, both the magnitude and duration of exposure are important. Duration is critical because the toxicity criteria are based on "lifetime average daily dose." Therefore, the total dose received, whether it be over 5 years or 50 years, is averaged over a lifetime of 70 years. To be protective of exposures to carcinogens in the residential setting, OERR focuses on exposures to individuals who may live in the same residence for a "high-end" period of time (i.e., 30 years). As mentioned previously, exposure to soil is higher during childhood and decreases with age. Thus, Equation 2 uses time-weighted average soil ingestion rate for children and adults. The derivation of this time-weighted average is presented in U.S. EPA (1991).

Inhalation of Volatiles and Fugitive Dusts

Agency toxicity criteria indicate that risks from exposure to some chemicals via inhalation far outweigh the risks via ingestion; therefore, the SSLs have been designed to address this pathway. The models and assumptions used to calculate SSLs for inhalation of volatiles and fugitive dusts are updates of the equations presented in U.S. EPA's HHEM Part A guidance (U.S. EPA, 1991) and are presented in Equations

Equation 2: Screening Level Equation for Ingestion of Carcinogenic Contaminants in Residential Soil

$$\text{Screening Level (mg/kg)} = \frac{TR \times AT \times 365\ d/yr}{SF_o \times 10^{-6}\ kg/mg \times EF \times IF_{soil\,adj}}$$

Parameter/Definition (units)	Default
TR/target cancer risk (unitless)	10^{-6}
SF_o/oral slope factor $(mg/kg\text{-}d)^{-1}$	Chemical-specific
AT/averaging time (yr)	70
EF/exposure frequency (d/yr)	350
$IF_{soil\,adj}$/age-adjusted soil ingestion factor (mg-yr/kg-d)	114

Equation 3: Screening Level Equation for Inhalation of Carcinogenic Contaminants in Residential Soil

$$\text{Screening Level (mg/kg)} = \frac{TR \times AT \times 365\ d/yr}{URF \times 1000\ \mu g/mg \times EF \times ED \times \left(\frac{1}{VF} + \frac{1}{PEF}\right)}$$

Parameter/Definition (units)	Default
TR/target cancer risk (unitless)	10^{-6}
URF/inhalation unit risk factor $(\mu g/m^3)^{-1}$	Chemical-specific
AT/averaging time (yr)	70
EF/exposure frequency (d)	350
ED/exposure duration (yr)	30
VF/soil-to-air volatilization factor (m^3/kg)	Chemical-specific
PEF/particulate emission factor (m^3/kg)	4.51×10^9

through 7. The volatilization factor (VF), soil saturation limit (C_{sat}), and dispersion model have all been revised.

Another change from the Part B methodology is the separation of the ingestion and inhalation pathways. Agency toxicity criteria for oral exposures are presented as internal doses in units of mg/kg-d; whereas, the inhalation criteria are presented as concentrations in air ($\mu g/m^3$ or mg/m^3) that require conversion to an estimate of internal dose to be comparable to the oral route. EPA's Office of Research and Development (ORD) now believes that the conversion from concentration in air to internal dose is not always appropriate and suggests evaluating these exposure routes separately.

As explained in Part B, the basic principle of the volatilization model is applicable only if the soil concentration is at or below soil saturation. Thus, for those compounds for which the SSL exceeds the soil saturation limit (C_{sat}), the SSL is set at C_{sat}.

Equation 4: Screening Level Equation for Inhalation of Noncarcinogenic Contaminants in Residential Soil

$$\text{Screening Level (mg/kg)} = \frac{THQ \times AT \times 365\ d/yr}{EF \times ED \times \left(\frac{1}{RfC} \times \left(\frac{1}{VF} + \frac{1}{PEF}\right)\right)}$$

Parameter/Definition (units)	Default
THQ/target hazard quotient (unitless)	1
AT/averaging time (yr)	30
EF/exposure frequency (d)	350
ED/exposure duration (yr)	30
RfC/inhalation reference concentration (mg/m^3)	Chemical-specific
VF/soil-to-air volatilization factor (m^3/kg)	Chemical-specific
PEF/particulate emission factor (m^3/kg)	4.7×10^9

Equation 5: Derivation of the Volatilization Factor

$$VF\ (m^3/kg) = (Q/C) \times \frac{(3.14 \times \alpha \times T)^{1/2}}{(2 \times D_{eff} \times P_a \times K_{sa})} \times 10^{-4}\ m^2/cm^2$$

where:

$$\alpha = \frac{D_{eff} \times P_a}{P_a + (\rho_s)(1 - P_a)/K_{sa}}$$

Parameter/Definition (units)	Default
VF/volatilization factor (m^3/kg)	–
(Q/C)/inverse of the mean conc. at the center of a 0.5-acre square source $(g/m^2\text{-}s$ per $kg/m^3)$	101.8
D_{eff}/effective diffusivity (cm^2/s)	$D_i(P_a^{2.33}/P_t^2)$
P_a/air filled soil porosity (unitless)	$P_t - \theta\beta$
P_t/total soil porosity (unitless)	$1-(\beta/\rho_s)$
θ/soil moisture content $(cm^3\text{-water/g-soil})$	10% or 0.1
β/soil bulk density (g/cm^3)	1.5
ρ_s/true soil density or particle density (g/cm^3)	2.65
K_{sa}/soil-air partition coefficient $(g\text{-soil}/cm^3\text{-air})$	$(H/K_d) \times 41$ (41 is conversion factor
T/exposure interval (s)	7.9×10^8 s
D_i/diffusivity in air (cm^2/s)	Chemical-specific
H/Henry's law constant $(atm\text{-}m^3/mol)$	Chemical-specific
K_d/soil-water partition coefficient (cm^3/g)	$K_{oc} \times OC$
K_{oc}/organic carbon partition coefficient (cm^3/g)	Chemical-specific
OC/organic carbon content of soil (fraction)	2% or 0.02

Equation 6: Derivation of the Soil Saturation Limit

$$C_{sat} = \frac{K_d \times C_w \times \beta) + (C_w \times P_w) + (C_w \times H' \times P_a)}{\beta}$$

Parameter/Definition (units)	Default
C_{sat}/soil saturation concentration (mg/kg)	--
K_d/soil-water partition coefficient (L/kg)	K_{oc} x OC
K_{oc}/organic carbon partition coefficient (L/kg)	Chemical-specific
OC/organic carbon content of soil (fraction)	2% or 0.02
C_w/upper-limit of free moisture in soil (mg/L-water)	S x θ_m
θ_m/soil moisture content (kg-water/kg-soil)	10% or 0.1
S/solubility in water (mg/L-water)	Chemical-specific
β/soil bulk density (kg/L)	1.5
P_w/water-filled soil porosity (unitless)	P_t - P_a
H'/Henry's law constant (unitless)	H x 41, where 41 is a conversion factor
H/Henry's law constant (atm-m³/mol)	Chemical-specific
P_a/air-filled soil porosity (unitless)	P_t - θβ
θ/soil moisture content (L-water/kg soil)	10% or 0.1
P_t/total soil porosity (unitless)	1 - (β/ρ_s)
ρ_s/true soil density or particle density (kg/L)	2.65

Equation 7: Derivation of the Particulate Emission Factor

$$PEF(m^3/kg) = (Q/C) \times \frac{3600 s/h}{0.036 \times (1-G) \times (U_m/U_t)^3 \times F(x)}$$

Parameter/Definition (units)	Default
PEF/particulate emission factor (m^3/kg)	4.7×10^9
(Q/C)/inverse of the mean conc. at the center of a 0.5-acre, square source (g/m²-s per kg/m³)	101.8
0.036/respirable fraction (g/m²-h)	0.036
G/fraction of vegetative cover (unitless)	0
U_m/mean annual wind speed (m/s)	4.5
U_t/equivalent threshold value of wind speed at 10 m (m/s)	12.8
F(x)/function dependent on U_m/U_t derived using Cowherd (1985) (unitless)	0.0497

The particulate emission factor (PEF) derived by using the default values in Equation 7 is approximately 0.2 ug/m³. This represents an annual average emission rate estimate that is not appropriate for estimating acute effects. Over the next few months, OSWER will be investigating the impact of acute exposure estimates on the SSLs.

Migration to Groundwater

The methodology for addressing potential contamination of groundwater from contaminants in soil reflects the complex nature of contaminant fate and transport in the subsurface. SSLs for migration to groundwater are based on a tiered approach (see Figure 2). Tier 1 SSLs (presented in Table 1) are based on the commonly used linear form of the Freundlich partitioning equation that describes the ability of contaminants to sorb to organic carbon in soil (Dragun, 1988). Equation 8 incorporates the linear Freundlich equation, along with an adjustment to relate sorbed concentration in soil to the analytically measured total soil concentration.

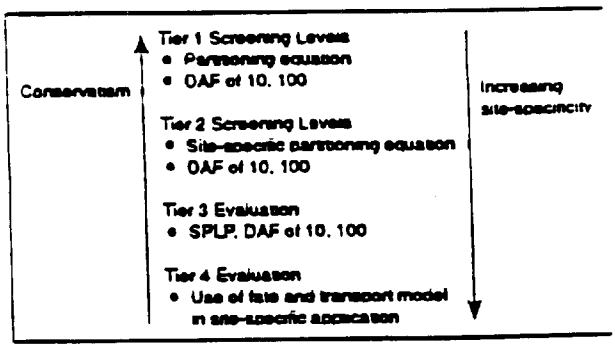


Figure 2. Tiered approach groundwater pathway.

Equation 8: Soil Screening Level Partitioning Equation for Migration to Groundwater

$$\text{Screening Level in Soil (mg/kg)} = C_w[(K_{oc} \times f_{oc}) + (\theta \times S/BD)]$$

Parameter/Definition (units)	Default
C_w/acceptable groundwater limit (mg/L)	MCL
K_{oc}/organic carbon partitioning coefficient (L/kg)	Chemical-specific
f_{oc}/fraction of organic carbon in soil (unitless)	0.002
θ/soil porosity (L_{pore}/L_{soil})	0.5
S/fraction water content (L_{water}/L_{pore})	0.3
BD/soil bulk density (kg/L_{soil})	1.5

In this equation, nonzero groundwater MCLGs were used : the acceptable groundwater limits for each contaminant. F· the 30 SSLs presented in this guidance, generally the nonzer

MCLGs were the same as the MCLs. If nonzero MCLGs were not available, MCLs were used, and, if MCLs were not available, risk-specific concentrations were derived using Agency toxicity criteria, a target cancer risk of 10^{-6}, and/or a noncancer Hazard Quotient of 1. Default values obtained from U.S. EPA's ORD Laboratory in Athens, Georgia, are used for soil porosity, fraction water content, and bulk density (U.S. EPA, 1985). The soil organic carbon content value of 0.002 used for calculating the SSLs was selected from information on the distribution of this parameter in U.S. soils (Carsel et al., 1988). The value used for the organic carbon partitioning coefficient (K_{oc}) is the geometric mean of measured values reported in the literature (from a comprehensive literature search (Truesdale, 1992)). For inorganic constituents, the EPA MINTEQ2 chemical speciation model was used to calculate K_d values, which were then used in Equation 8 in place of the K_{oc} x f_{oc} parameters. K_d values for metals are significantly affected by a variety of soil conditions, the most significant of which is pH. For this reason, metal K_d values for three pH conditions were used to develop the SSLs: 4.9, 6.8, and 8.0. Table 1 contains SSLs for inorganics corresponding to a pH of 6.8. Table 2 contains inorganic SSLs corresponding to pH values of 4.9 and 8.0. If pH conditions at a site are not known, the SSL corresponding to a pH of 6.8 should be used. Table 2 also includes SSLs for pentachlorophenol (PCP), whose partitioning behavior is also highly pH dependent.

The partitioning equation relates contaminant concentrations in soil adsorbed to soil organic carbon to soil leachate contaminant concentrations in the unsaturated zone. Contaminant migration through the unsaturated zone to the water table generally reduces the soil leachate concentration by attenuation processes such as adsorption and degradation. Groundwater transport in the saturated zone further reduces concentrations through attenuation and dilution. Generally, to account for those mechanisms in the subsurface environment, a correction factor should be applied to the partitioning equation value. Use of the EPA's Composite Model for leachate migration with Transformation Products (EPACMTP) (U.S. EPA, 1993a) has identified a DAF of 10 as an appropriate correction factor to be applied to the partitioning value in most cases. However, there are specific circumstances under which use of a DAF is not recommended, such as in areas of very shallow groundwater or karst topography. Likewise, there are other circumstances in which a higher DAF may be appropriate. Further discussion of these situations as well as details on the EPACMTP model are included on the next page of this fact sheet.

The assumptions factored into the Tier 1 levels are conservative, rendering the SSLs fairly stringent. If site concentrations do not exceed the SSLs multiplied by the appropriate DAF, then the pathway is excluded from further investigation. However, if site concentrations do exceed the Tier 1 SSLs, they may be used as PRGs (when appropriate), or a Tier 2, 3, or 4 investigation may be conducted. Each tier requires more site-specific information but may lead to a less stringent "screening" concentration.

The Tier 2 levels represent a minimal increase in site-specificity and perhaps less conservative Screening Levels. The partitioning equation used in the Tier 1 calculation (Equation 8) remains as the base for the Tier 2 levels along with the same DAF (either 1, 10, or 100). However, site-measured values of organic carbon, soil porosity, fraction water content, and soil bulk density are substituted into the equation to calculate Screening Levels more tailored to site characteristics. If site concentrations do not exceed the Tier 2 SSLs, then the pathway is excluded from further investigation or concern. The rationale behind this decision is that, because Tier 2 incorporates site-specific information, the levels are more representative of actual site conditions than Tier 1. If site concentrations exceed the Tier 2 SSLs, the user has the option of conducting a Tier 3 or 4 investigation, realizing the increase in site-specificity and cost associated with collecting additional site data.

The Tier 3 investigation involves conducting a specific leach test, the Synthetic Precipitation Leaching Procedure (SPLP) (U.S. EPA, 1992c). If the leach test results divided by the

Table 2. Proposed Groundwater Pathway SSLs for Inorganics and Pentachlorophenol, as a Function of pH[a]

		Proposed groundwater pathway SSLs (mg/kg)					
		Unadjusted		With 10 DAF[b]		With 100 DAF[b]	
Chemical	pH	4.9	8.0	4.9	8.0	4.9	8.0
Arsenic		1.2	1.6	12.5	15.7	125	157
Cadmium		0.006	10.0	0.08	100	0.81	1,001
Chromium (VI)		3.1	1.4	31.4	13.6	314	138
Mercury		0.0002	0.42	0.002	4.2	0.02	42.2
Nickel		0.32	15.7	3.2	157	31.7	1,573
Pentachlorophenol		0.017	0.0009[c]	0.17	0.009[c]	1.7	0.09

[a]Screening Levels based on human health criteria only.
[b]DAF = Dilution:attenuation factor.
[c]Level at or below Contract Laboratory Program required quantitation limit for Regular Analytical Services (RAS).

DAF of 10 exceed the acceptable groundwater limit (e.g., nonzero MCLG, MCL, 10^{-6} risk-based values), then further investigation would be warranted. The SPLP may not be applicable to all contaminated soils (e.g., oily types of waste do not yield suitable results). Therefore the user is advised to use discretion when applying the SPLP. Additional guidance on the use and limitations of the SPLP will be provided in the final guidance.

Tier 4 represents the highest level of site-specificity in evaluating the migration to groundwater pathway. In this investigation, site-specific data are collected and used in a fate and transport model to confirm the threat to groundwater and further determine site-specific cleanup goals as would typically be done for the remedial investigation/feasibility study (RI/FS). A DAF is not used in this tier because the model would account for fate and transport mechanisms in the subsurface. The advantage of this approach is that it accounts for site hydrogeologic, climatologic, and contaminant source characteristics and may result in fully protective but less stringent remediation goals. However, the additional cost of collecting the data required to apply the model should be factored into the decision to conduct a Tier 4 investigation. An evaluation of 10 fate and transport models for potential use in the Tier 4 evaluation will be included in the technical background document for this fact sheet scheduled to be issued by OERR by January of 1994.

The tiered framework for migration to groundwater represents a sliding scale of increasing site-specificity and decreasing conservatism. The assumptions factored into the Tier 1 SSLs are conservative and therefore result in fairly stringent levels that may not be appropriate in all situations. However, the framework allows the user the flexibility to move away from this conservative level by incorporating increasing levels of site empirical data. In this way, site managers or owners of small, relatively uncomplicated sites may benefit from the Tier 1 levels by bypassing the additional costs associated with collecting additional data to conduct further investigations. However, it is likely to be in the interest of site managers or owners of large and complex sites to conduct a more site-specific investigation to develop remediation goals that are more tailored to site-specific conditions.

DETERMINING THE DILUTION/ ATTENUATION FACTOR

For wastes disposed of on land, the leaching of contaminants into the subsurface and subsequent migration into and through groundwater typically constitute a very significant pathway for human and environmental exposure. As contaminants move through the soil and groundwater, they are subjected to a number of physical, chemical, and biological processes that affect the eventual contaminant concentration level at receptor points. These processes include, but are not limited to, attenuation due to sorption of contaminants onto soil and aquifer grains, chemical transformation (e.g., hydrolysis, redox reactions, precipitation), biological degradation, and dilution due to mixing of the leachate from the disposal unit with ambient groundwater. The contaminant concentration, arrivin at a receptor point is therefore generally lower than the origina contaminant concentration in the leachate leaving the site.

The reduction in concentration can be expressed succinctly e the DAF, defined as the ratio of original leachate concentratio to the receptor point concentration. The lowest possible valu of DAF is therefore 1, corresponding to the situation wher there is no dilution or attenuation of a contaminant at all: i.e the concentration at the receptor point is the same as that : the leachate as it leaves the waste site. High DAF values c the other hand correspond to a high degree of dilution ar attenuation of the contaminant from the leachate to the recept point.

The Agency has developed subsurface fate and transpo models to assess the impact on groundwater quality due migration of contaminants from wastes on land. Specificall these models predict the DAF for a potential site of a domest drinking water receptor well, which may withdraw water fro the saturated zone under, or downgradient of, a contaminate area. The model used to develop DAFs for this guidance the EPACMTP, which consists of three main modules:

1. An unsaturated zone flow and contaminant fate ar transport module
2. A saturated zone groundwater flow and contaminant fa and transport module
3. A Monte Carlo driver module, which generates mod parameters from nationwide probability distributions.

The unsaturated and saturated zone modules simulate t migration of contaminants from the base of a land disposal un to a downgradient receptor well. The Agency has extensive verified both the unsaturated and saturated zone modul against other available analytical and numerical models ensure accuracy and efficiency. Both the unsaturated zone ar the saturated zone modules of the EPACMTP, used for t calculation of DAFs for the SSLs, have been reviewed by t EPA Science Advisory Board and found to be suitable f generic applications such as the derivation of nationwi DAFs.

Modeling Procedure

For nationwide Monte Carlo model applications, the input the model is in the form of probability distributions of each the model input parameters. The output from the moc consists of the probability distribution of DAF valu representing the likelihood that any specific DAF value exceeded.

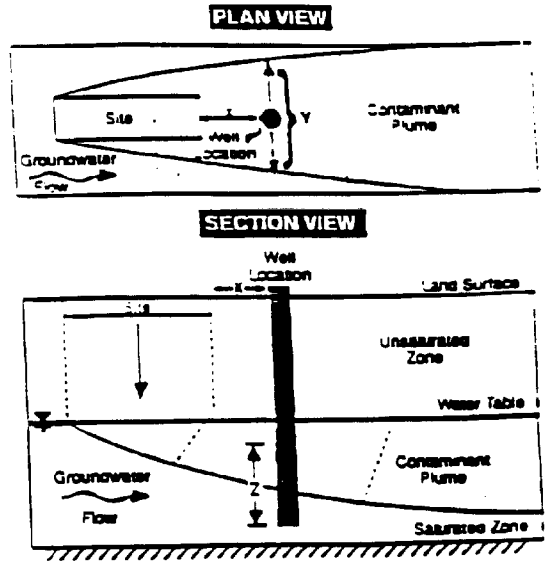
For each model input parameter, a probability distribution provided, describing the nationwide likelihood that parameter has a certain value. The parameters are divided i four main groups:

1. Source-specific parameters, e.g., area of the waste unit, infiltration rate
2. Chemical-specific parameters, e.g., hydrolysis constants, organic carbon partition coefficient
3. Unsaturated zone-specific parameters, e.g., depth to water table, soil hydraulic conductivity
4. Saturated zone-specific parameters, e.g., saturated zone thickness, ambient groundwater flow rate, location of nearest receptor well.

During the Monte Carlo simulation, values for each model parameter are randomly drawn from their respective probability distributions. In the calculation of the DAFs for the SSLs, site data from over 1,300 sites were used to define parameter ranges and distributions. Each combination of randomly drawn parameter values represents one out of a practically infinite universe of possible waste sites. The fate and transport modules are executed for the specific set of model parameters, yielding a corresponding DAF value. This procedure is repeated, typically on the order of several thousand times, to ensure that the entire universe of possible parameter combinations (waste sites) is adequately sampled. At the conclusion of the analysis, a cumulative frequency distribution of DAF values is constructed and plotted.

The Agency performed a number of sensitivity analyses consisting of fixing one parameter at a time to determine the parameter(s) that have the greatest impact on DAFs. The results of the sensitivity analyses indicate that the climate (net precipitation), soil types, and size of the contaminated area have the greatest effect on the DAFs. The Agency feels that the size of the contaminated area lends itself most readily to practical application of the SSLs.

To calculate the DAF for the SSLs, the drinking water well was located 25 feet downgradient of the edge of the contaminated area, and the location of the intake point (receptor well screen) was assumed to vary within the boundaries of 15 and 300 feet within the aquifer (these values are based on empirical data reflecting a national sample distribution of depth of residential drinking water wells). The sensitivity analyses indicated that the placement of the well 25 feet downgradient of the contaminated area is more conservative than allowing the well to be located directly beneath the contaminated area. The location of the intake point allows for mixing within the aquifer. OSWER believes that this is a reasonable assumption because there will always be some dilution attributed to the pumping of water for residential use from an aquifer. The placement of the well was assumed to vary uniformly within the boundary of the plume. Figure 3 shows a schematic of the compliance point location. From these analyses, the largest allowable areas corresponding to DAFs of 10 and 100 at the 90th percentile protection level are approximately 10 and 1 acre, respectively. Therefore, for sites of up to 10 acres, a DAF of 10 should be applied to the unadjusted SSLs, while for sites at or below 1 acre, a DAF of 100 should be applied to the unadjusted SSLs. If a 95th percentile protectiveness level is used, a DAF of 10 is



Parameters:

- X (distance from source to well) = 25 ft
- Y (transverse well location) = Monte Carlo within width of plume
- Z (well intake point below water table) = Monte Carlo, range 15 → 300 ft
- Rainfall = Monte Carlo
- Soil type = Monte Carlo
- Depth to aquifer = Monte Carlo
- Assumes infinite source term

Figure 3. Soil to groundwater pathway—calculating the DAF.

protective for areas under 1/2 acre and a DAF of 10 protective for areas less than 1/10 acre. OSWER considering whether the 90th or 95th percentile protective level should be used in the final guidance. When site located in areas of unusually shallow water table, within of surface, the unadjusted SSLs should be used. In scenario, contamination is located in or directly above saturated zone; therefore, any dilution and attenu processes within the unsaturated zone would be negligib

MEASURING SOIL LEVELS

As described in U.S. EPA (1992b), exposure to contaminants over a long (chronic) period of time is represented by an arithmetic average concentration; then attainment of the SSLs should be based on the arithmetic concentration as well. The issue then becomes the num samples required to adequately estimate the mean and th over which the sample concentrations should be ave Studies by EPA's Exposure Assessment Group in indicate that 20 to 30 samples per exposure area are nee calculate an upper confidence limit (UCL_{95}) on the arit mean that is very close to the true mean (U.S. EPA, 1 i.e., to adequately estimate the true mean without underes ing it. An appropriate exposure/averaging area can

size, depending on site-specific conditions. At some sites, this may be the entire site; at others, this may be only a portion of the site. For the purposes of this guidance, the Agency believes that the size of a typical residential lot (1/4 acre) is an appropriate averaging area for the most conservative case (i.e., residential land use). For large sites that could be divided into many areas equivalent to the size of a residential lot, the number of samples needed to characterize the site becomes quite high. This, coupled with the costs of analytical services for each sample, could make the sampling costs onerous. Therefore, OERR recommends following guidance for measuring soil contaminant levels at NPL sites.

Sample Pattern

A grid pattern such as a triangular or square/rectangular grid is recommended to establish sample locations for each exposure area (U.S. EPA, 1987). Biased sampling must also be used in areas of suspected contamination or stained soils and must be evaluated separately from the samples obtained by systematic sampling.

Number of Samples

As mentioned, it is necessary to balance the need to achieve statistical confidence in determining a meaningful arithmetic mean concentration of contaminants in each exposure area with the cost of obtaining the 20 to 30 samples recommended by ORD. Compositing of discrete samples is an option since EPA is interested in determining the arithmetic mean of the contaminant concentration(s). Twenty discrete samples can be composited down to four or five composite samples, while maintaining confidence that the area average is not grossly underestimated. Compositing may mask contaminant levels that are slightly higher than the SSL, but areas of high contamination will still be detected. Compositing is both a reasonable approach and an efficient use of resources, since Superfund is interested in average exposure over time. However, none of the composite samples should exceed the prescribed SSL for any contaminant. For volatile organic compounds (VOCs), compositing is not appropriate (U.S. EPA, 1989a, 1992a). Therefore, OERR advocates that 10 discrete samples should be taken per exposure area for VOCs, and no sample can exceed the Screening Level(s). Both the discrete VOC samples and the composites must be analyzed by Contract Laboratory Program (CLP) (or equivalent) methods. (NOTE: Seven of the 30 contaminant SSLs for the groundwater migration pathway at a DAF of 10 are below CLP RAS or CLP-equivalent detection limits. For these contaminants, special analytical services should be requested for recalibration of the instruments. For example, to measure low levels of VOCs, the gas chromatograph/mass spectrometer (GC/MS) can be recalibrated to detect at 1, 2, 5, 10, and 25 ppb.

Use of Field Methods

Where available and appropriate, field methods (soil gas surveys, immunoassays, X-ray fluorescence) can be used. Again, for compounds other than VOCs, compositing samples is acceptable as long as it is consistent with the field methodology. If any sample concentration exceeds an SSL, further site study is required. In addition, 10% to 20% of field samples must be sent to a CLP (or equivalent) laboratory for confirmatory analysis (U.S. EPA, 1992a). Please note that field methods must be capable of achieving appropriate detection limits for most groundwater SSLs.

Depth

When measuring soil levels at the surface for the inhalation and ingestion pathways, samples should be taken at a depth of 6 inches. Additional sampling beyond 6 inches may be appropriate, depending on the contaminant's mobility, to account for geographic differences in construction practices where soil disturbances are reasonably expected. For example, in the Northeast, the ground may be excavated to 15 feet before laying the foundation and constructing the basement of a home. Excavated overburden is commonly used as fill material around the property so that contaminants that were at depth are now near the surface. Thus, it is important to be cognizant of construction practices in the area.

For the groundwater pathway, the entire soil column, from the surface to the top of the aquifer, should be sampled. For the evaluation of vertical stratification, samples should not be averaged over depth (i.e., the soil core should not be composited over depth), but rather individual samples should be evaluated at appropriate depth intervals. One soil core per exposure area may be sufficient. However, where dense nonaqueous phase liquids (DNAPLs) are suspected, soil cores may be taken more frequently.

Sampling for Background Contamination

For metals, background sampling is necessary to be certain that OSWER is not defining levels below background as of regulatory concern. If a statistical comparison of background concentration and site samples indicates that background metals concentrations are significantly above the SSLs, use of the SSLs will be of limited value, as discussed earlier.

Additional Sampling Needed for Groundwater Tier 2

To use groundwater Tier 2, site-specific soil characteristics must be determined by sampling. Parameters to measure include bulk density, porosity, organic carbon content, and water content.

Geostatistics

For large areas where the data are not widely scattered, geostatistical approaches, such as kriging, can be used to estimate sample concentration trends across the exposure area (U.S. EPA, 1989a).

WHERE TO [illegible] FOR FURTHER INFORMATION

For additional copies of this Fact Sheet, call the National Technical Information Service (NTIS) at (703) 487-4650.

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NOTICE: The policies set out in this document are intended solely as guidance; they are not final U.S. Environmental Protection Agency (EPA) actions. These policies are not intended, nor can they be relied upon, to create any rights enforceable by any party in litigation with the United States. EPA officials may decide to follow the guidance provided in this document, or to act at variance with the guidance, based on an analysis of site-specific circumstances. The Agency also reserves the right to change this guidance at any time without public notice.

This guidance is based on policies in the Final Rule of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), which was published on March 8, 1990 (55 *Federal Register* 8666). The NCP should be considered the authoritative source.

Source for RfDo, RfDi, CPSo, CPSi values used to calculate SSLs.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region III
841 Chestnut Street
Philadelphia, Pennsylvania 19107

January 7, 1994

SUBJECT: Risk-Based Concentration Table, First Quarter 1994

FROM: Roy L. Smith, Ph.D., Senior Toxicologist
Technical Support Section (3HW13)

TO: RBC Table mailing list

Attached is the EPA Region III risk-based concentration table, which we have distributed quarterly to all interested parties since 1991. If you are not currently on the mailing list, but would like to be, please contact Anna Poulton (phone: 215-597-3179, fax: 215-597-9890) and give her your name, address, and phone and fax numbers.

The table contains reference doses and carcinogenic potency slopes (obtained from IRIS through January 1, 1994, HEAST through July 1993, OHEA-Cincinnati, and other EPA sources) for nearly 600 chemicals. These toxicity constants have been combined with "standard" exposure scenarios to calculate chemical concentrations corresponding to fixed levels of risk (*i.e.*, a hazard quotient of 1, or lifetime cancer risk of 10^{-6}, whichever occurs at a lower concentration) in water, air, fish tissue, and soil.

The Region III toxicologists use this table as a risk-based screen for Superfund sites, and as a desk reference for emergencies and requests for immediate information. The table also provides a useful benchmark for evaluating site investigation data and preliminary remediation goals. The table has no official status as either regulation or guidance, and should be used only as a predictor of generic single-contaminant health risk estimates. *The table is specifically not intended as (1) a stand-alone decision-making tool, (2) a substitute for EPA guidance for preparing baseline risk assessments, (3) a source of site-specific cleanup levels, or (4) a rule to determine if a waste is hazardous under RCRA.* In general, chemical concentrations above the levels in the table suggest a need for a closer look by a toxicologist, but should not be used as the sole basis for taking any action.

The toxicity information in the table has been assembled by hand, and (despite extensive checking and years of use) may contain errors. It's advisable to cross-check before relying on any numbers in the table. If you find any errors, please send me a note.

This issue of the table is printed in a new format, which was developed because it fits more information on each page, while (hopefully) retaining legibility. The table now includes the CAS number of each contaminant, which should reduce confusion about multi-named compounds. Also, each risk-based concentration is now accompanied by a footnote indicating its basis, whether carcinogenic or non-carcinogenic effects. Finally, all newly revised risk-based concentrations have been placed in shaded boxes for quick recognition, rather than summarized here.

I'd like to express my appreciation to all the users of the RBC Table who have contributed suggestions for improvements over the last three years. I hope your continued interest will help us make the table even better in the future. Have a great 1994!

Attachment

Risk-Based Concentration Table
Background Information

General: Separate carcinogenic and non-carcinogenic risk-based concentrations were calculated for each compound for each pathway. The concentration in the table is the lower of the two, rounded to two significant figures. The following terms and values were used in the calculations:

Exposure variables	Value	Name
1-General:		
Carcinogenic potency slope oral (kg-d/mg):	*	CPSo
Carcinogenic potency slope inhaled (kg-d/mg):	*	CPSi
Reference dose oral (mg/kg/d):	*	RfDo
Reference dose inhaled (mg/kg/d):	*	RfDi
Target cancer risk:	1e-06	TR
Target hazard quotient:	1	THQ
Body weight, adult (kg):	70	BWa
Body weight, age 1-6 (kg):	15	BWc
Averaging time carcinogens (d):	25550	ATc
Averaging time non-carcinogens (d):	ED*365	ATn
Inhalation, adult (m3/d):	20	IRAa
Inhalation, child (m3/d):	12	IRAc
Inhalation factor, age-adjusted (m3-y/kg-d):	11.66	IFAadj
Tap water ingestion, adult (L/d):	2	IRWa
Tap water ingestion, age 1-6 (L/d):	1	IRWc
Tap water ingestion factor, age-adjusted (L-y/kg-d):	1.09	IFWadj
Fish ingestion (g/d):	54	IRF
Soil ingestion, adult (mg/d):	100	IRSa
Soil ingestion, age 1-6 (mg/d):	200	IRSc
Soil ingestion factor, age adjusted (mg-y/kg-d):	114.29	IFSadj
2-Residential:		
Exposure frequency (d/y):	350	EFr
Exposure duration, total (y):	30	EDtot

Exposure variables	Value	Name
Exposure duration, age 1-6 (y):	6	EDc
Volatilization factor (L/m3):	0.5	VF
3-Occupational:		
Exposure frequency (d/y):	250	EFo
Exposure duration (y):	25	EDo
* = Contaminant-specific toxicity parameters		

The priority among sources of toxicological constants was as follows: (1) IRIS, (2) HEAST, (3) HEAST alternative method, (4) ECAO-Cincinnati, (5) withdrawn from IRIS, (6) withdrawn from HEAST, and (7) other EPA documents. Each source was used only if numbers from higher-priority sources were unavailable.

Algorithms:

1. Age-adjusted factors: Because contact rates with tap water, ambient air, and residential soil are different for children and adults, carcinogenic risks during the first 30 years of life were calculated using age-adjusted factors. These factors approximated the integrated exposure from birth until age 30 by combining contact rates, body weights, and exposure durations for two age groups - small children and adults. The age-adjusted factor for soil was obtained from RAGS IB; the others were developed by analogy.

a. Air inhalation ($[m^3 \cdot y]/[kg \cdot d]$):

$$IFAadj = \frac{EDc \cdot IRAc}{BWc} + \frac{(EDtot - EDc) \cdot IRAa}{BWa}$$

b. Tap water ingestion ($[L \cdot y]/[kg \cdot d]$):

$$IFWadj = \frac{EDc \cdot IRWc}{BWc} + \frac{(EDtot - EDc) \cdot IRWa}{BWa}$$

c. Soil ingestion ($[mg \cdot y]/[kg \cdot d]$):

$$IFSadj = \frac{EDc \cdot IRSc}{BWc} + \frac{(EDtot - EDc) \cdot IRSa}{BWa}$$

2. Residential water use (μg/L). Volatilization terms were calculated only for compounds with "****" in the "VOC" column. Compounds having a Henry's Law constant greater than 10^{-5} were considered volatile. The list may be incomplete, but is unlikely to include false positives. The equations and the volatilization factor (VF, above) were obtained from RAGS IB. Oral potency slopes and reference doses were used for both oral and inhaled exposures for volatile compounds lacking inhalation values. Inhaled potency slopes were substituted for unavailable oral potency slopes only for volatile compounds; inhaled RfDs were substituted for unavailable oral RfDs for both volatile and non-volatile compounds.

a. Carcinogens: Calculations were based on combined childhood and adult exposure.

$$\frac{TR \cdot ATc \cdot 1000\frac{\mu g}{mg}}{EFr \cdot ([VF \cdot IFAadj \cdot CPSi] + [IFWadj \cdot CPSo])}$$

b. Non-carcinogens: Calculations were based on adult exposure.

$$\frac{THQ \cdot BWa \cdot ATn \cdot 1000\frac{\mu g}{mg}}{EFr \cdot EDtot \cdot \left(\frac{VF \cdot IRAa}{RfDi} + \frac{IRWa}{RfDo}\right)}$$

3. Air (μg/m³). Oral potency slopes and references were used where inhalation values were not available.

a. Carcinogens: Calculations were based on combined childhood and adult exposure.

$$\frac{TR \cdot ATc \cdot 1000\frac{\mu g}{mg}}{EFr \cdot IFAadj \cdot CPSi}$$

b. Non-carcinogens: Calculations were based on adult exposure.

$$\frac{THQ \cdot RfDi \cdot BWa \cdot ATn \cdot 1000\frac{\mu g}{mg}}{EFr \cdot EDtot \cdot IRAa}$$

4. Fish (mg/kg):

a. Carcinogens: Calculations were based on adult exposure.

$$\frac{TR \cdot BWa \cdot ATc}{EFr \cdot EDtot \cdot \frac{IRF}{1000\frac{g}{kg}} \cdot CPSo}$$

b. Non-carcinogens: Calculations were based on adult exposure.

$$\frac{THQ \cdot RfDo \cdot BWa \cdot ATn}{EFr \cdot EDtot \cdot \frac{IRF}{1000\frac{g}{kg}}}$$

5. Soil commercial/industrial (mg/kg): The default exposure assumption that only 50% of incidental soil ingestion occurs at work has been omitted. Calculations were based on adult occupational exposure.

a. Carcinogens:

$$\frac{TR \cdot BWa \cdot ATc}{EFo \cdot EDo \cdot \frac{IRSa}{10^6\frac{mg}{kg}} \cdot CPSo}$$

b. Non-carcinogens:

$$\frac{THQ \cdot RfDo \cdot BWa \cdot ATn}{EFo \cdot EDo \cdot \frac{IRSa}{10^6\frac{mg}{kg}}}$$

6. Soil residential (mg/kg):

a. Carcinogens: Calculations were based on combined childhood and adult exposure.

$$\frac{TR \cdot ATc}{EFr \cdot \frac{IFSadj}{10^6\frac{mg}{kg}} \cdot CPSo}$$

b. Non-carcinogens: Calculations were based on childhood exposure only.

$$\frac{THQ \cdot RfDo \cdot BWc \cdot ATn}{EFr \cdot EDc \cdot \frac{IRSc}{10^6\frac{mg}{kg}}}$$

Sources i=IRIS h=HEAST a=HEAST ah x=WQ from IRIS w=WQ from HEAST c=EPA-ECAO o=Other EPA docs. Basis of RBC: c=carcinogenic effects n=noncarcinogenic effects.

Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg•d/mg	CPSi kg•d/mg	VOC	Tap water µg/L	Ambient air µg/m3	Fish mg/kg	Industrial soil mg/kg	Residential soil mg/kg
Acephate	30560191	4.00E-03 i		8.70E-03 i			7.7 o	0.72 o	0.36 o	330 o	73 c
Acetaldehyde	75070		2.57E-03 i		7.70E-03 i		94 n	0.81 o			
Acetochlor	34256821	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Acetone	67641	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Acetone cyanohydrin	75865	7.00E-02 h	2.86E-03 h				2600 n	10 n	95 n	72000 n	5500 n
Acetonitrile	75078	6.00E-03 i	1.43E-02 h				220 n	52 n	8.1 n	6100 n	470 n
Acetophenone	98862	1.00E-01 i	5.71E-06 w			•••	0.042 n	0.021 n	140 n	100000 n	7800 n
Acifluorfen	62476599	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
Acrolein	107028	2.00E-02 h	5.71E-06 i				730 n	0.021 n	27 n	20000 n	1600 n
Acrylamide	79061	2.00E-04 i		4.50E+00 i	4.55E+00 i		0.015 o	0.0014 o	0.0007 o	0.64 c	0.14 c
Acrylic acid	79107	8.00E-02 i	8.57E-05 i				2900 n	0.31 n	110 n	82000 n	6300 n
Acrylonitrile	107131		5.71E-04 i	5.40E-01 i	2.38E-01 i		0.12 o	0.026 o	0.0058 c	5.3 o	1.2 c
Alachlor	15972608	1.00E-02 i		8.00E-02 h			0.84 o	0.078 o	0.039 o	36 o	8 c
Alar	1596845	1.50E-01 i					5500 n	550 n	200 n	150000 n	12000 n
Aldicarb	116063	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
Aldicarb sulfone	1646884	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
Aldrin	309002	3.00E-05 i		1.70E+01 i	1.71E+01 i		0.004 c	0.00037 o	0.00019 o	0.17 c	0.038 c
Ally	74223646	2.50E-01 i					9100 n	910 n	340 n	260000 n	20000 n
Allyl alcohol	107186	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Allyl chloride	107051	5.00E-02 w	2.86E-04 i				1800 n	1 n	68 n	51000 n	3900 n
Aluminum	7429905	2.90E+00 o					110000 n	11000 n	3900 n	1000000 n	230000 n
Aluminum phosphide	20859738	4.00E-04 i					15 n	1.5 n	0.54 n	410 n	31 n
Amdro	67485294	3.00E-04 i					11 n	1.1 n	0.41 n	310 n	23 n
Ametryn	834128	9.00E-03 i					330 n	33 n	12 n	9200 n	700 n
m-Aminophenol	591275	7.00E-02 h					2600 n	260 n	95 n	72000 n	5500 n
4-Aminopyridine	504245	2.00E-05 h					0.73 n	0.073 n	0.027 n	20 n	1.6 n
Amitraz	33089611	2.50E-03 i					91 n	9.1 n	3.4 n	2600 n	200 n
Ammonia	7664417		2.86E-02 i				1000 n	100 n			
Ammonium sulfamate	7773060	2.00E-01 i					7300 n	730 n	270 n	200000 n	16000 n
Aniline	62533		2.86E-04 i	5.70E-03 i			10 n	1 n	0.55 o	500 o	110 c
Antimony and compounds	7440360	4.00E-04 i					15 n	1.5 n	0.54 n	410 n	31 n
Antimony pentoxide	1314609	5.00E-04 h					18 n	1.8 n	0.68 n	510 n	39 n
Antimony potassium tartrate	304610	9.00E-04 h					33 n	3.3 n	1.2 n	920 n	70 n
Antimony tetroxide	1332316	4.00E-04 h					15 n	1.5 n	0.54 n	410 n	31 n
Antimony trioxide	1309644	4.00E-04 h					15 n	1.5 n	0.54 n	410 n	31 n
Apollo	74115245	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
Aramite	140578	5.00E-02 h		2.50E-02 i	2.49E-02 i		2.7 o	0.25 o	0.13 o	110 o	26 c
Arsenic	7440382	3.00E-04 i					11 n	1.1 n	0.41 n	310 n	23 n
Arsenic (as carcinogen)	744002	3.00E-04		1.75E+00 i	1.51E+01 i		0.038 o	0.00041 o	0.0018 o	1.6 o	0.37 c
Assure	76578148	9.00E-03 i					330 n	33 n	12 n	9200 n	700 n
Asulam	3337711	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Atrazine	1912249	3.50E-02 i		2.22E-01 h			0.3 o	0.028 o	0.014 o	13 o	2.9 c

Sources: i=IRIS h=HEAST a=HEAST alt. u=W/D from IRIS y=W/D from HEAST e=EPA-ECAO o=Other EPA docs.

Basis of RBC: c=carcinogenic effects n=noncarcinogenic effects.

Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg•d/mg	CPSi kg•d/mg	VOC	Tap water µg/L	Ambient air µg/m3	Fish mg/kg	Industrial soil mg/kg	Residential soil mg/kg
Avermectin B1	65195553	4.00E-04 i					15 n	1.5 n	0.54 n	410 n	31 n
Azobenzene	103333			1.10E-01 i	1.08E-01 i		0.61 c	0.058 c	0.029 c	26 c	5.8 c
Barium and compounds	7440393	7.00E-02 i	1.43E-04 h				2600 n	0.52 n	95 n	72000 n	5500 n
Baygon	114261	4.00E-03 i					150 n	15 n	5.4 n	4100 n	310 n
Bayleton	43121433	3.00E-02 i					1100 n	110 n	41 n	31000 n	2300 n
Baythroid	68359375	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
Benefin	1861401	3.00E-01 i					11000 n	1100 n	410 n	310000 n	23000 n
Benomyl	17804352	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Bentazon	25057890	2.50E-03 i					91 n	9.1 n	3.4 n	2600 n	200 n
Benzaldehyde	100527	1.00E-01 i				***	610 n	370 n	140 n	100000 n	7800 n
Benzene	71432		1.43E-04 e	2.90E-02 i	2.90E-02 i	***	0.36 c	0.22 c	0.11 c	99 c	22 c
Benzidine	92875	3.00E-03 i		2.30E+02 i	2.35E+02 i		0.00029 c	0.000027 c	0.000014 c	0.012 c	0.0028 c
Benzoic acid	65850	4.00E+00 i					150000 n	15000 n	5400 n	1000000 n	310000 n
Benzotrichloride	98077			1.30E+01 i			0.0052 c	0.00048 c	0.00024 c	0.22 c	0.049 c
Benzyl alcohol	100516	3.00E-01 h					11000 n	1100 n	410 n	310000 n	23000 n
Benzyl chloride	100447			1.70E-01 i		***	0.062 c	0.037 c	0.019 c	17 c	3.8 c
Beryllium and compounds	7440417	5.00E-03 i		4.30E+00 i	8.40E+00 i		0.016 c	0.00075 c	0.00073 c	0.67 c	0.15 c
Bidrin	141662	1.00E-04 i					3.7 n	0.37 n	0.14 n	100 n	7.8 n
Biphenthrin (Talstar)	82657043	1.50E-02 i					550 n	55 n	20 n	15000 n	1200 n
1,1-Biphenyl	92524	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Bis(2-chloroethyl)ether	111444			1.10E+00 i	1.16E+00 i	***	0.0092 c	0.0054 c	0.0029 c	2.6 c	0.58 c
Bis(2-chloroisopropyl)ether	39638329	4.00E-02 i		7.00E-02 h	3.50E-02 h	***	0.26 c	0.18 c	0.045 c	41 c	9.1 c
Bis(chloromethyl)ether	542881			2.20E+02 i	2.17E+02 i	***	0.000049 c	0.000029 c	0.000014 c	0.013 c	0.0029 c
Bis(2-chloro-1-methylethyl)ether				7.00E-02 w	7.00E-02 w		0.96 c	0.089 c	0.045 c	41 c	9.1 c
Bis(2-ethylhexyl)phthalate (DEHP)	117817	2.00E-02 i		1.40E-02 i			4.8 c	0.45 c	0.23 c	200 c	46 c
Bisphenol A	80057	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Boron (and borates)	7440428	9.00E-02 i	5.71E-03 h				3300 n	21 n	120 n	92000 n	7000 n
Boron trifluoride	7637072		2.00E-04 h				7.3 n	0.73 n			
Bromodichloromethane	75274	2.00E-02 i		6.20E-02 i		***	0.17 c	0.1 c	0.051 c	46 c	10 c
Bromoethene	593602				1.10E-01 h	***	0.096 c	0.057 c			
Bromoform (tribromomethane)	75252	2.00E-02 i		7.90E-03 i	3.85E-03 i	***	2.4 c	1.6 c	0.4 c	360 c	81 c
Bromomethane	74839	1.40E-03 i	1.43E-03 i			***	8.7 n	5.2 n	1.9 n	1400 n	110 n
4-Bromophenyl phenyl ether	101553	5.80E-02 o					2100 n	210 n	78 n	59000 n	4500 n
Bromophos	2104963	5.00E-03 h					180 n	18 n	6.8 n	5100 n	390 n
Bromoxynil	1689845	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Bromoxynil octanoate	1689992	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
1,3-Butadiene	106990				9.80E-01 i	***	0.011 c	0.0064 c			
1-Butanol	71363	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Butyl benzyl phthalate	85687	2.00E-01 i					7300 n	730 n	270 n	200000 n	16000 n
Butylate	2008415	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
sec-Butylbenzene	135988	1.00E-02 e				***	61 n	37 n	14 n	10000 n	780 n
tert-Bu[illegible]zene	104518	1.00E-02 e				***	61 n	37 n	14 n	1[illegible] n	780 n

Sources i=IRIS h=HEAST a=HEAST alt. x=W/D from IRIS y=W/D from HEAST e=EPA-ECAO o=Other EPA docs. Basis of RBC: c=carcinogenic effects n=noncarcinogenic effects.

Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg*d/mg	CPSi kg*d/mg	VOC	Tap water µg/L	Ambient air µg/m3	Fish mg/kg	Industrial soil mg/kg	Residential soil mg/kg
Butylphthalyl butylglycolate	85701	1.00E+00 i					3700 n	3700 n	1400 n	1000000 n	78000 n
Cacodylic acid	75605	3.00E-03 h					110 n	11 n	4.1 n	3100 n	230 n
Cadmium and compounds	7440439	5.00E-04 i			6.30E+00 i		18 n	0.00009 o	0.68 n	510 n	39 n
Caprolactam	105602	5.00E-01 i					18000 n	1800 n	680 n	510000 n	39000 n
Captafol	2425061	2.00E-01 i		8.60E-03 h			7.8 c	0.73 o	0.37 o	330 o	74 c
Captan	133062	1.30E-01 i		3.50E-03 h			19 o	1.8 o	0.9 o	820 o	180 c
Carbaryl	63252	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Carbazole	86748			2.00E-02 h			3.4 o	0.31 o	0.16 o	140 o	32 c
Carbofuran	1563662	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Carbon disulfide	75150	1.00E-01 i	2.86E-03 h			***	21 n	10 n	140 n	100000 n	7800 n
Carbon tetrachloride	56235	7.00E-04 i	5.71E-04 o	1.30E-01 i	5.25E-02 i	***	0.16 o	0.12 o	0.024 o	22 o	4.9 c
Carbosulfan	55285148	1.00E-02 i					370 n	37 n	14 n	10000 n	780 n
Carboxin	5234684	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Chloral	75876	2.00E-01 i					73 n	7.3 n	2.7 n	2000 n	160 n
Chloramben	133904	1.50E-02 i					550 n	55 n	20 n	15000 n	1200 n
Chloranil	118752			4.03E-01 h			0.17 o	0.016 o	0.0078 o	7.1 o	1.6 c
Chlordane	57749	6.00E-05 i		1.30E+00 i	1.29E+00 i		0.052 o	0.0049 o	0.0024 o	2.2 o	0.49 c
Chlorimuron-ethyl	90982324	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Chlorine dioxide	10049044		5.71E-05 i				2.1 n	0.21 n			
Chloroacetaldehyde	107200	6.90E-03 o					250 n	25 n	9.3 n	7100 n	540 n
Chloroacetic acid	79118	2.00E-03 h					73 n	7.3 n	2.7 n	2000 n	160 n
2-Chloroacetophenone	532274		8.57E-06 i				0.31 n	0.031 n			
4-Chloroaniline	106478	4.00E-03 i					150 n	15 n	5.4 n	4100 n	310 n
Chlorobenzene	108907	2.00E-02 i	5.71E-03 h			***	39 n	21 n	27 n	20000 n	1600 n
Chlorobenzilate	510156	2.00E-02 i		2.70E-01 h	2.70E-01 h		0.25 o	0.023 o	0.012 o	11 o	2.4 c
p-Chlorobenzoic acid	74113	2.00E-01 h					7300 n	730 n	270 n	200000 n	16000 n
4-Chlorobenzotrifluoride	98566	2.00E-02 h					730 n	73 n	27 n	20000 n	1600 n
2-Chloro-1,3-butadiene	126998	2.00E-02 h	2.00E-03 h			***	14 n	7.3 n	27 n	20000 n	1600 n
1-Chlorobutane	109693	4.00E-01 h				***	2400 n	1500 n	540 n	410000 n	31000 n
Chlorodifluoromethane	75456		1.43e+01 i			***	87000 n	52000 n			
Chloroethane	75003	2.00E-02 o	2.86E+00 i			***	710 n	10000 n	27 n	20000 n	1600 n
2-Chloroethyl vinyl ether	110758	2.50E-02 o				***	150 n	91 n	34 n	26000 n	2000 n
Chloroform	67663	1.00E-02 i		6.10E-03 i	8.05E-02 i	***	0.15 o	0.078 o	0.52 o	470 o	100 c
Chloromethane	74873			1.30E-02 h	6.30E-03 h	***	1.4 o	0.99 o	0.24 o	220 o	49 c
4-Chloro-2,2-methylaniline hydrochloride	3165933			4.60E-01 h			0.15 o	0.014 o	0.0069 o	6.2 o	1.4 c
4-Chloro-2-methylaniline	95692			5.80E-01 h			0.12 o	0.011 o	0.0054 o	4.9 o	1.1 c
beta-Chloronaphthalene	91587	8.00E-02 i					2900 n	290 n	110 n	82000 n	6300 n
o-Chloronitrobenzene	88733			2.50E-02 h		***	0.42 o	0.25 o	0.13 o	110 o	26 c
p-Chloronitrobenzene	121733			1.80E-02 h		***	0.59 o	0.35 o	0.18 o	160 o	35 c
2-Chlorophenol	95578	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
2-Chloropropane	75296		2.86E-02 h			***	170 n	100 n			
Chlorothalonil	1897456	1.50E-02 i		1.10E-02 h			6.1 o	0.57 o	0.29 o	260 o	58 c

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Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg•d/mg	CPSi kg•d/mg	VOC	Tap water µg/L	Ambient air µg/m3	Fish mg/kg	Industrial soil mg/kg	Residential soil mg/kg
2-Ethoxyethanol acetate	111159	3.00E-01 h					11000 n	1100 n	410 n	310000 n	23000 n
2-Ethoxyethanol	110805	4.00E-01 h	5.71E-02 i				15000 n	210 n	540 n	410000 n	31000 n
Ethyl acrylate	140885			4.80E-02 h			1.4 c	0.13 c	0.066 c	60 c	13 c
EPTC (S-Ethyl dipropylthiocarbamate)	759944	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
Ethyl ether	60297	2.00E-01 i				•••	1200 n	730 n	270 n	200000 n	16000 n
Ethyl methacrylate	97632	9.00E-02 h					3300 n	330 n	120 n	92000 n	7000 n
Ethyl acetate	141786	9.00E-01 i					33000 n	3300 n	1200 n	920000 n	70000 n
Ethylbenzene	100414	1.00E-01 i	2.86E-01 i			•••	1300 n	1000 n	140 n	100000 n	7800 n
Ethylene cyanohydrin	109784	3.00E-01 h					11000 n	1100 n	410 n	310000 n	23000 n
Ethylene diamine	107153	2.00E-02 h					730 n	73 n	27 n	20000 n	1600 n
Ethylene glycol	107211	2.00E+00 i					73000 n	7300 n	2700 n	1000000 n	160000 n
Ethylene glycol, monobutyl ether	111762		5.71E-03 h				210 n	21 n			
Ethylene oxide	75218			1.02E+00 h	3.50E-01 h		0.066 c	0.018 c	0.0031 c	2.8 c	0.63 c
Ethylene thiourea (ETU)	96457	8.00E-05 i		6.00E-01 h			0.11 c	0.01 c	0.0053 c	4.8 c	1.1 c
Ethyl p-nitrophenyl phenylphosphorothioate	2104645	1.00E-05 i					0.37 n	0.037 n	0.014 n	10 n	0.78 n
Ethylnitrosourea	759739			1.40E+02 w			0.00048 c	0.000045 c	0.000023 c	0.02 c	0.0046 c
Ethylphthalyl ethyl glycolate	84720	3.00E+00 i					110000 n	11000 n	4100 n	1000000 n	230000 n
Express	10120	8.00E-03 i					290 n	29 n	11 n	8200 n	630 n
Fenamiphos	22224926	2.50E-04 i					9.1 n	0.91 n	0.34 n	260 n	20 n
Fluometuron	2164172	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
Fluoride	7782414	6.00E-02 i					2200 n	220 n	81 n	61000 n	4700 n
Fluoridone	59756604	8.00E-02 i					2900 n	290 n	110 n	82000 n	6300 n
Flurprimidol	56425913	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Flutolanil	66332965	6.00E-02 i					2200 n	220 n	81 n	61000 n	4700 n
Fluvalinate	69409945	1.00E-02 i					370 n	37 n	14 n	10000 n	780 n
Folpet	133073	1.00E-01 i		3.50E-03 i			19 c	1.8 c	0.9 c	820 c	180 c
Fonnesafen	72178020			1.90E-01 i			0.35 c	0.033 c	0.017 c	15 c	3.4 c
Fonofos	944229	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
Formaldehyde	50000	2.00E-01 i			4.55E-02 i		7300 n	0.14 c	270 n	200000 n	16000 n
Formic Acid	64186	2.00E+00 h					73000 n	7300 n	2700 n	1000000 n	160000 n
Fosetyl-al	39148248	3.00E+00 i					110000 n	11000 n	4100 n	1000000 n	230000 n
Furan	110009	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
Furazolidone	67458			3.80E+00 h			0.018 c	0.0016 c	0.00083 c	0.75 c	0.17 c
Furfural	98011	3.00E-03 i	1.43E-02 h				110 n	52 n	4.1 n	3100 n	230 n
Furium	531828			5.00E+01 h			0.0013 c	0.00013 c	0.000063 c	0.057 c	0.013 c
Furmecyclox	60568050			3.00E-02 i			2.2 c	0.21 c	0.11 c	95 c	21 c
Glufosinate-ammonium	77182822	4.00E-04 i					15 n	1.5 n	0.54 n	410 n	31 n
Glycidaldehyde	765344	4.00E-04 i	2.86E-04 h				15 n	1 n	0.54 n	410 n	31 n
Glyphosate	1071836	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Haloxyfop-methyl	69806402	5.00E-05 i					1.8 n	0.18 n	0.068 n	51 n	3.9 n
Harmony	79277273	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
HCH (alpha)	319846			6.30E+00 i	6.30E+00 i		0.011 c	0.00099 c	0.0005 c	0.45 c	0.1 c

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Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg•d/mg	CPSi kg•d/mg	VOC	Tap water µg/L	Ambient air µg/m3	Fish mg/kg	Industrial soil mg/kg	Residential soil mg/kg
Diazinon	333415	9.00E-04 h					33 n	3.3 n	1.2 n	920 n	70 n
1,4-Dibromobenzene	106376	1.00E-02 i				***	61 n	37 n	14 n	10000 n	780 n
Dibromochloromethane	124481	2.00E-02 i		8.40E-02 i		***	0.13 o	0.075 o	0.038 o	34 o	7.6 c
1,2-Dibromo-3-chloropropane	96128		5.71E-05 i	1.40E+00 h	6.90E-07 h	***	0.048 o	0.21 n	0.0023 o	2 o	0.46 c
1,2-Dibromoethane	106934		5.71E-05 h	8.50E+01 i	7.70E-01 i	***	0.00075 o	0.0081 o	0.000037 o	0.034 o	0.0075 c
Dibutyl phthalate	84742	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Dicamba	1918009	3.00E-02 i					1100 n	110 n	41 n	31000 n	2300 n
1,2-Dichlorobenzene	95501	9.00E-02 i	5.71E-02 h			***	370 n	210 n	120 n	92000 n	7000 n
1,3-Dichlorobenzene	541731	8.90E-02 o				***	540 n	320 n	120 n	91000 n	7000 n
1,4-Dichlorobenzene	106467		2.29E-01 i	2.40E-02 h		***	0.44 o	0.26 o	0.13 o	120 o	27 c
3,3'-Dichlorobenzidine	91941			4.50E-01 i			0.15 o	0.014 o	0.007 o	6.4 o	1.4 c
1,4-Dichloro-2-butene	764410				9.30E+00 h	***	0.0011 o	0.00067 o			
Dichlorodifluoromethane	75718	2.00E-01 i	5.71E-02 h			***	390 n	210 n	270 n	200000 n	16000 n
1,1-Dichloroethane	75343	1.00E-01 h	1.43E-01 h			***	810 n	520 n	140 n	100000 n	7800 n
1,2-Dichloroethane (EDC)	107062		2.86E-03 o	9.10E-02 i	9.10E-02 i	***	0.12 o	0.069 o	0.035 o	31 o	7 c
1,1-Dichloroethylene	75354	9.00E-03 i		6.00E-01 i	1.75E-01 i	***	0.044 o	0.036 o	0.0053 o	4.8 o	1.1 c
1,2-Dichloroethylene (cis)	156592	1.00E-02 h				***	61 n	37 n	14 n	10000 n	780 n
1,2-Dichloroethylene (trans)	156605	2.00E-02 i				***	120 n	73 n	27 n	20000 n	1600 n
1,2-Dichloroethylene (mixture)	540590	9.00E-03 h				***	55 n	33 n	12 n	9200 n	700 n
2,4-Dichlorophenol	120832	3.00E-03 i					110 n	11 n	4.1 n	3100 n	230 n
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	1.00E-02 i				***	61 n	37 n	14 n	10000 n	780 n
4-(2,4-Dichlorophenoxy)butyric Acid	94826	8.00E-03 i					290 n	29 n	11 n	8200 n	630 n
1,2-Dichloropropane	78875		1.14E-03 i	6.80E-02 h		***	0.16 o	0.092 o	0.046 o	42 o	9.4 c
2,3-Dichloropropanol	616239	3.00E-03 i					110 n	11 n	4.1 n	3100 n	230 n
1,3-Dichloropropene	542756	3.00E-04 i	5.71E-03 i	1.80E-01 h	1.30E-01 h	***	0.077 o	0.048 o	0.018 o	16 o	3.5 c
Dichlorvos	62737	5.00e-04 i		2.90E-01 i			0.23 o	0.022 o	0.011 o	9.9 o	2.2 c
Dicofol	115322			4.40E-01 w			0.15 o	0.014 o	0.0072 o	6.5 o	1.5 c
Dicyclopentadiene	77736	3.00E-02 h	5.71E-05 h			***	0.42 n	0.21 n	41 n	31000 n	2300 n
Dieldrin	60571	5.00E-05 i		1.60E+01 i	1.61E+01 i		0.0042 o	0.00039 o	0.0002 o	0.18 o	0.04 c
Diesel emissions			1.43E-03 i				52 n	5.2 n			
Diethyl phthalate	84662	8.00E-01 i					29000 n	2900 n	1100 n	820000 n	63000 n
Diethylene glycol, monobutyl ether	112345		5.71E-03 h				210 n	21 n			
Diethylene glycol, monoethyl ether	111900	2.00E+00 h					73000 n	7300 n	2700 n	1000000 n	160000 n
Diethylforamide	617845	1.10E-02 h					400 n	40 n	15 n	11000 n	860 n
Di(2-ethylhexyl)adipate	103231	6.00E-01 i		1.20E-03 i			56 o	5.2 o	2.6 o	2400 o	530 c
Diethylstilbestrol	56531			4.70E+03 h			0.000014 o	1.30E-06 o	6.70E-07 o	0.00061 o	0.00014 c
Difenzoquat (Avenge)	43222486	8.00E-02 i					2900 n	290 n	110 n	82000 n	6300 n
Diflubenzuron	35367385	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Diisopropyl methylphosphonate (DIMP)	1445756	8.00E-02 i					2900 n	290 n	110 n	82000 n	6300 n
Dimethipin	55290647	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Dimethoate	60515	2.00E-04 i					7.3 n	0.73 n	0.27 n	200 n	16 n
3,3'-Dimethoxybenzidine	119904			1.40E-02 h			4.8 o	0.45 o	0.23 o	200 o	46 c

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Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg•d/mg	CPSi kg•d/mg	VOC	Tap water µg/L	Ambient air µg/m3	Fish mg/kg	Industrial soil mg/kg	Residential soil mg/kg
Dimethyl phthalate	131113	1.00E+01 h					370000 n	37000 n	14000 n	1000000 n	780000 n
Dimethyl terephthalate	120616	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Dimethylamine	124403		5.71E-06 w				0.21 n	0.021 n			
2,4-Dimethylaniline hydrochloride	21436964			5.80E-01 h			0.12 o	0.011 o	0.0054 o	4.9 o	1.1 c
2,4-Dimethylaniline	95681			7.50E-01 h			0.09 o	0.0083 o	0.0042 o	3.8 o	0.85 c
N-N-Dimethylaniline	121697	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
3,3'-Dimethylbenzidine	119937			9.20E+00 h			0.0073 o	0.00068 o	0.00034 o	0.31 o	0.069 c
N,N-Dimethylformamide	68122	1.00E-01 h	8.57E-03 i				3700 n	31 n	140 n	100000 n	7800 n
1,1-Dimethylhydrazine	57147			2.60E+00 h	3.50E+00 h		0.026 o	0.0018 o	0.0012 o	1.1 o	0.25 c
1,2-Dimethylhydrazine	540738			3.70E+01 w	3.70E+01 w		0.0018 o	0.00017 o	0.000085 o	0.077 o	0.017 c
2,4-Dimethylphenol	105679	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
2,6-Dimethylphenol	576261	6.00E-04 i					22 n	2.2 n	0.81 n	610 n	47 n
3,4-Dimethylphenol	95658	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
1,2-Dinitrobenzene	528290	4.00E-04 h					15 n	1.5 n	0.54 n	410 n	31 n
1,3-Dinitrobenzene	99650	1.00E-04 i					3.7 n	0.37 n	0.14 n	100 n	7.8 n
1,4-Dinitrobenzene	100254	4.00E-04 h					15 n	1.5 n	0.54 n	410 n	31 n
4,6-Dinitro-o-cyclohexyl phenol	131895	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
2,4-Dinitrophenol	51285	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
Dinitrotoluene mixture				6.80E-01 i			0.099 o	0.0092 o	0.0046 o	4.2 o	0.94 c
2,4-Dinitrotoluene	121142	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
2,6-Dinitrotoluene	606202	1.00E-03 h					37 n	3.7 n	1.4 n	1000 n	78 n
Dinoseb	88857	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
di-n-Octyl phthalate	117840	2.00E-02 h					730 n	73 n	27 n	20000 n	1600 n
1,4-Dioxane	123911			1.10E-02 i			6.1 o	0.57 o	0.29 o	260 o	58 c
Diphenamid	957517	3.00E-02 i					1100 n	110 n	41 n	31000 n	2300 n
Diphenylamine	122394	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
1,2-Diphenylhydrazine	122667			8.00E-01 i	7.70E-01 i		0.084 o	0.0081 o	0.0039 o	3.6 o	0.8 c
Diquat	85007	2.20E-03 i					80 n	8 n	3 n	2200 n	170 n
Direct Black 38	1937377			8.60E+00 h			0.0078 o	0.00073 o	0.00037 o	0.33 o	0.074 c
Direct Blue 6	2602462			8.10E+00 h			0.0083 o	0.00077 o	0.00039 o	0.35 o	0.079 c
Direct brown 95	16071866			9.30E+00 h			0.0072 o	0.00067 o	0.00034 o	0.31 o	0.069 c
Disulfoton	298044	4.00E-05 i					1.5 n	0.15 n	0.054 n	41 n	3.1 n
1,4-Dithiane	505293	1.00E-02 i					370 n	37 n	14 n	10000 n	780 n
Diuron	330541	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
Dodine	2439103	4.00E-03 i					150 n	15 n	5.4 n	4100 n	310 n
Endosulfan	115297	6.00E-03 h					220 n	22 n	8.1 n	6100 n	470 n
Endothall	145733	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Endrin	72208	3.00E-04 i					11 n	1.1 n	0.41 n	310 n	23 n
Epichlorohydrin	106898	2.00E-03 h	2.86E-04 i	9.90E-03 i	4.20E-03 i		6.8 o	1 n	0.32 o	290 o	65 c
1,2-Epoxybutane	106887		5.71E-03 i				210 n	21 n			
Ethephon (2-chloroethyl phosphonic acid)	16672870	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Ethion	563122	5.00E-04 i					18 n	1.8 n	0.68 n	n	39 n

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2-Ethoxyethanol acetate	111159	3.00E-01 h					11000 n	1100 n	410 n	310000 n	23000 n
2-Ethoxyethanol	110805	4.00E-01 h	5.71E-02 i				15000 n	210 n	540 n	410000 n	31000 n
Ethyl acrylate	140885			4.80E-02 h			1.4 c	0.13 c	0.066 c	60 c	13 c
EPTC (S-Ethyl dipropylthiocarbamate)	759944	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
Ethyl ether	60297	2.00E-01 i				•••	1200 n	730 n	270 n	200000 n	16000 n
Ethyl methacrylate	97632	9.00E-02 h					3300 n	330 n	120 n	92000 n	7000 n
Ethyl acetate	141786	9.00E-01 i					33000 n	3300 n	1200 n	920000 n	70000 n
Ethylbenzene	100414	1.00E-01 i	2.86E-01 i			•••	1300 n	1000 n	140 n	100000 n	7800 n
Ethylene cyanohydrin	109784	3.00E-01 h					11000 n	1100 n	410 n	310000 n	23000 n
Ethylene diamine	107153	2.00E-02 h					730 n	73 n	27 n	20000 n	1600 n
Ethylene glycol	107211	2.00E+00 i					73000 n	7300 n	2700 n	1000000 n	160000 n
Ethylene glycol, monobutyl ether	111762		5.71E-03 h				210 n	21 n			
Ethylene oxide	75218			1.02E+00 h	3.50E-01 h		0.066 c	0.018 c	0.0031 c	2.8 c	0.63 c
Ethylene thiourea (ETU)	96457	8.00E-05 i		6.00E-01 h			0.11 c	0.01 c	0.0053 c	4.8 c	1.1 c
Ethyl p-nitrophenyl phenylphosphorothioate	2104645	1.00E-05 i					0.37 n	0.037 n	0.014 n	10 n	0.78 n
Ethylnitrosourea	759739			1.40E+02 w			0.00048 c	0.000045 c	0.000023 c	0.02 c	0.0046 c
Ethylphthalyl ethyl glycolate	84720	3.00E+00 i					110000 n	11000 n	4100 n	1000000 n	230000 n
Express	10120	8.00E-03 i					290 n	29 n	11 n	8200 n	630 n
Fenamiphos	22224926	2.50E-04 i					9.1 n	0.91 n	0.34 n	260 n	20 n
Fluometuron	2164172	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
Fluoride	7782414	6.00E-02 i					2200 n	220 n	81 n	61000 n	4700 n
Fluoridone	59756604	8.00E-02 i					2900 n	290 n	110 n	82000 n	6300 n
Flurprimidol	56425913	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Flutolanil	66332965	6.00E-02 i					2200 n	220 n	81 n	61000 n	4700 n
Fluvalinate	69409945	1.00E-02 i					370 n	37 n	14 n	10000 n	780 n
Folpet	133073	1.00E-01 i		3.50E-03 i			19 c	1.8 c	0.9 c	820 c	180 c
Fomesafen	72178020			1.90E-01 i			0.35 c	0.033 c	0.017 c	15 c	3.4 c
Fonofos	944229	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
Formaldehyde	50000	2.00E-01 i			4.55E-02 i		7300 n	0.14 c	270 n	200000 n	16000 n
Formic Acid	64186	2.00E+00 h					73000 n	7300 n	2700 n	1000000 n	160000 n
Fosetyl-al	39148248	3.00E+00 i					110000 n	11000 n	4100 n	1000000 n	230000 n
Furan	110009	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
Furazolidone	67458			3.80E+00 h			0.018 c	0.0016 c	0.00083 c	0.75 c	0.17 c
Furfural	98011	3.00E-03 i	1.43E-02 h				110 n	52 n	4.1 n	3100 n	230 n
Furium	531828			5.00E+01 h			0.0013 c	0.00013 c	0.000063 c	0.057 c	0.013 c
Furmecyclox	60568050			3.00E-02 i			2.2 c	0.21 c	0.11 c	95 c	21 c
Glufosinate-ammonium	77182822	4.00E-04 i					15 n	1.5 n	0.54 n	410 n	31 n
Glycidaldehyde	765344	4.00E-04 i	2.86E-04 h				15 n	1 n	0.54 n	410 n	31 n
Glyphosate	1071836	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Haloxyfop-methyl	69806402	5.00E-05 i					1.8 n	0.18 n	0.068 n	51 n	3.9 n
Harmony	79277273	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
HCH (alpha)	319846			6.30E+00 i	6.30E+00 i		0.011 c	0.00099 c	0.0005 c	0.45 c	0.1 c

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Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg•d/mg	CPSi kg•d/mg	VOC	Tap water µg/L	Ambient air µg/m3	Fish mg/kg	Industrial soil mg/kg	Residential soil mg/kg
HCH (beta)	319857			1.80E+00 i	1.80E+00 i		0.037 o	0.0035 o	0.0018 o	1.6 o	0.35 c
HCH (gamma) Lindane	58899	3.00E-04 i		1.30E+00 h			0.052 o	0.0048 o	0.0024 o	2.2 o	0.49 c
HCH-technical	608731			1.80E+00 i	1.79E+00 i		0.037 o	0.0035 o	0.0018 o	1.6 o	0.35 c
Heptachlor	76448	5.00E-04 i		4.50E+00 i	4.55E+00 i	***	0.0023 o	0.0014 o	0.0007 o	0.64 o	0.14 c
Heptachlor epoxide	1024573	1.30E-05 i		9.10E+00 i	9.10E+00 i	***	0.0012 o	0.00069 o	0.00035 o	0.31 o	0.07 c
Hexabromobenzene	87821	2.00E-03 i				***	12 n	7.3 n	2.7 n	2000 n	160 n
Hexachlorobenzene	118741	8.00E-04 i		1.60E+00 i	1.61E+00 i	***	0.0066 o	0.0039 o	0.002 o	1.8 o	0.4 c
Hexachlorobutadiene	87683	2.00E-04 h		7.80E-02 i	7.70E-02 i	***	0.14 o	0.081 o	0.04 o	37 o	8.2 c
Hexachlorocyclopentadiene	77474	7.00E-03 i	2.00E-05 h			***	0.15 n	0.073 n	9.5 n	7200 n	550 n
Hexachlorodibenzo-p-dioxin mixture	19408743			6.20E+03 i	4.55E+03 i		0.000011 o	1.40E-06 o	5.10E-07 o	0.00046 o	0.0001 c
Hexachloroethane	67721	1.00E-03 i		1.40E-02 i	1.40E-02 i	***	0.75 o	0.45 o	0.23 o	200 o	46 c
Hexachlorophene	70304	3.00E-04 i					11 n	1.1 n	0.41 n	310 n	23 n
Hexahydro-1,3,5-trinitro-1,3,5-triazine	121824	3.00E-03 i		1.10E-01 i			0.61 o	0.057 o	0.029 o	26 o	5.8 c
n-Hexane	110543	6.00E-02 h	5.71E-02 i			***	350 n	210 n	81 n	61000 n	4700 n
Hexazinone	51235042	3.30E-02 i					1200 n	120 n	45 n	34000 n	2600 n
Hydrazine, hydrazine sulfate	302012			3.00E+00 i	1.71E+01 i		0.022 o	0.00037 o	0.0011 o	0.95 o	0.21 c
Hydrogen chloride	7647010		2.00E-03 i				73 n	7.3 n			
Hydrogen sulfide	7783064	3.00E-03 i	2.57E-04 i				110 n	0.94 n	4.1 n	3100 n	230 n
Hydroquinone	123319	4.00E-02 h					1500 n	150 n	54 n	41000 n	3100 n
Imazalil	35554440	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
Imazaquin	81335377	2.50E-01 i					9100 n	910 n	340 n	260000 n	20000 n
Iprodione	36734197	4.00E-02 i					1500 n	150 n	54 n	41000 n	3100 n
Isobutanol	78831	3.00E-01 i				***	1800 n	1100 n	410 n	310000 n	23000 n
Isophorone	78591	2.00E-01 i		9.50E-04 i			71 o	6.6 o	3.3 o	3000 o	670 c
Isopropalin	33820530	1.50E-02 i					550 n	55 n	20 n	15000 n	1200 n
Isopropyl methyl phosphonic acid	1832548	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Isoxaben	82558507	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Kepone	143500			1.80E+01 o			0.0037 o	0.00035 o	0.00018 o	0.16 o	0.035 c
Lactofen	77501634	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
Lead (tetraethyl)	78002	1.00E-07 i					0.0037 n	0.00037 n	0.00014 n	0.1 n	0.0078 n
Linuron	330552	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
Lithium	7439932	2.00E-02 o					730 n	73 n	27 n	20000 n	1600 n
Londax	83056996	2.00E-01 i					7300 n	730 n	270 n	200000 n	16000 n
Malathion	121755	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Maleic anhydride	108316	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Maleic hydrazide	123331	5.00E-01 i					18000 n	1800 n	680 n	510000 n	39000 n
Malononitrile	109773	2.00E-05 h					0.73 n	0.073 n	0.027 n	20 n	1.6 n
Mancozeb	8018017	3.00E-02 h					1100 n	110 n	41 n	31000 n	2300 n
Maneb	12427382	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Manganese and compounds	7439965	5.00E-03 i	1.43e-05 i				180 n	0.052 n	6.8 n	5100 n	390 n
Mephosfolan	950107	9.00E-05 h					3.3 n	0.33 n	0.12 n	92 n	7 n
Mepiqua[illegible]ide	24307264	3.00E-02 i					1100 n	110 n	41 n	3[illegible] n	2300 n

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Mercury (inorganic)	7439976	3.00E-04 h	8.57E-05 n				11 n	0.31 n	0.41 n	310 n	23 n
Mercury (methyl)	22967926	3.00E-04 i					11 n	1.1 n	0.41 n	310 n	23 n
Merphos	150505	3.00E-05 i					1.1 n	0.11 n	0.041 n	31 n	2.3 n
Merphos oxide	78488	3.00E-05 i					1.1 n	0.11 n	0.041 n	31 n	2.3 n
Metalaxyl	57837191	6.00E-02 i					2200 n	220 n	81 n	61000 n	4700 n
Methacrylonitrile	126987	1.00E-04 i	2.00E-04 h				3.7 n	0.73 n	0.14 n	100 n	7.8 n
Methamidophos	10265926	5.00E-05 i					1.8 n	0.18 n	0.068 n	51 n	3.9 n
Methanol	67561	5.00E-01 i					18000 n	1800 n	680 n	510000 n	39000 n
Methidathion	950378	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
Methomyl	16752775	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
Methoxychlor	72435	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
2-Methoxyethanol acetate	110496	2.00E-03 h					73 n	7.3 n	2.7 n	2000 n	160 n
2-Methoxyethanol	109864	1.00E-03 h	5.71E-03 i				37 n	21 n	1.4 n	1000 n	78 n
2-Methoxy-5-nitroaniline	99592			4.60E-02 h			1.5 o	0.14 o	0.069 o	62 o	14 c
Methyl acetate	79209	1.00E+00 n					37000 n	3700 n	1400 n	1000000 n	78000 n
Methyl acrylate	96333	3.00E-02 h					1100 n	110 n	41 n	31000 n	2300 n
2-Methylaniline hydrochloride	636215			1.80E-01 h			0.37 o	0.035 o	0.018 o	16 o	3.5 c
2-Methylaniline	95534			2.40E-01 h			0.28 o	0.026 o	0.013 o	12 o	2.7 c
Methyl chlorocarbonate	79221	1.00E+00 w					37000 n	3700 n	1400 n	1000000 n	78000 n
4-(2-Methyl-4-chlorophenoxy) butyric acid	94815	1.00E-02 i					370 n	37 n	14 n	10000 n	780 n
2-Methyl-4-chlorophenoxyacetic acid	94746	5.00E-04 i					18 n	1.8 n	0.68 n	510 n	39 n
2-(2-Methyl-14-chlorophenoxy)propionic acid	93652	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
Methylcyclohexane	108872		8.57E-01 h				31000 n	3100 n			
Methylene bromide	74953	1.00E-02 h				***	61 n	37 n	14 n	10000 n	780 n
Methylene chloride	75092	6.00E-02 i	8.57E-01 h	7.50E-03 i	1.64E-03 i	***	4.1 o	3.8 o	0.42 o	380 o	85 c
4,4'-Methylene bis(2-chloroaniline)	101144	7.00E-04 h		1.30E-01 h	1.30E-01 h		0.52 o	0.048 o	0.024 o	22 o	4.9 c
4,4'-Methylenebisbenzeneamine	101779			2.50E-01 h			0.27 o	0.025 o	0.013 o	11 o	2.6 c
4,4'-Methylene bis(N,N'-dimethyl)aniline	101611			4.60E-02 i			1.5 o	0.14 o	0.069 o	62 o	14 c
4,4'-Methylenediphenyl isocyanate	101688		5.71E-06 h			***	0.035 n	0.021 n			
Methyl ethyl ketone	78933	6.00E-01 i	2.86E-01 i				22000 n	1000 n	810 n	610000 n	47000 n
Methyl hydrazine	60344			1.10E+00 h			0.061 o	0.0057 o	0.0029 o	2.6 o	0.58 c
Methyl isobutyl ketone	108101	5.00E-02 n	2.29E-02 h				1800 n	84 n	68 n	51000 n	3900 n
Methyl methacrylate	80626	8.00E-02 h					2900 n	290 n	110 n	82000 n	6300 n
2-Methyl-5-nitroaniline	99558			3.30E-02 h			2 o	0.19 o	0.096 o	87 o	19 c
Methyl parathion	298000	2.50E-04 i					9.1 n	0.91 n	0.34 n	260 n	20 n
2-Methylphenol (o-cresol)	95487	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
3-Methylphenol (m-cresol)	103394	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
4-Methylphenol (p-cresol)	106445	5.00E-03 h					180 n	18 n	6.8 n	5100 n	390 n
Methyl styrene (mixture)	25013154	6.00E-03 h	1.14E-02 h			***	60 n	42 n	8.1 n	6100 n	470 n
Methyl styrene (alpha)	98839	7.00E-02 h				***	430 n	260 n	95 n	72000 n	5500 n
Methyl tertbutyl ether (MTBE)	1634044	5.00E-03 o	8.57E-01 i			***	180 n	3100 n	6.8 n	5100 n	390 n
Metolachlor (Dual)	51218452	1.50E-01 i					5500 n	550 n	200 n	150000 n	12000 n

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Metribuzin	21807649	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
Mirex	2385855	2.00E-04 i		1.80E+00 h			0.037 o	0.0035 o	0.0018 o	1.6 o	0.35 c
Molinate	2212671	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
Molybdenum	7439987	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Monochloramine	10599903	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Naled	300765	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
Napropamide	15299997	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Nickel refinery dust					8.40E-01 i			0.0075 o			
Nickel (soluble salts)	7440020	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Nickel subsulfide	12035722				1.70E+00 i			0.0037 o			
Nitrapyrin	1929824	1.50E-03 w					55 n	5.5 n	2 n	1500 n	120 n
Nitrate	14797558	1.60E+00 i					58000 n	5800 n	2200 n	1000000 n	130000 n
Nitric Oxide	10102439	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Nitrite	14797650	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
2-Nitroaniline	88744	6.00E-05 w	5.71E-05 h				2.2 n	0.21 n	0.081 n	61 n	4.7 n
3-Nitroaniline	99092	3.00E-03 o					110 n	11 n	4.1 n	3100 n	230 n
4-Nitroaniline	100016	3.00E-03 o					110 n	11 n	4.1 n	3100 n	230 n
Nitrobenzene	98953	5.00E-04 i	5.71E-04 h			***	3.4 n	2.1 n	0.68 n	510 n	39 n
Nitrofurantoin	67209	7.00E-02 h					2600 n	260 n	95 n	72000 n	5500 n
Nitrofurazone	59870			1.50E+00 h	9.40E+00 h		0.045 o	0.00067 o	0.0021 o	1.9 o	0.43 c
Nitrogen dioxide	10102440	1.00E+00 i					37000 n	3700 n	1400 n	1000000 n	78000 n
Nitroguanidine	556887	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
4-Nitrophenol	100027	6.20E-02 o					2300 n	230 n	84 n	63000 n	4800 n
2-Nitropropane	79469		5.71E-03 i		9.40E+00 h		210 n	0.00067 o			
N-Nitrosodi-n-butylamine	924163			5.40E+00 i	5.60E+00 i		0.012 o	0.0011 o	0.00058 o	0.53 o	0.12 c
N-Nitrosodiethanolamine	1116547			2.80E+00 i			0.024 o	0.0022 o	0.0011 o	1 o	0.23 c
N-Nitrosodiethylamine	55185			1.50E+02 i	1.51E+02 i		0.00045 o	0.000041 o	0.000021 o	0.019 o	0.0043 c
N-Nitrosodimethylamine	62759			5.10E+01 i	4.90E+01 i		0.0013 o	0.00013 o	0.000062 o	0.056 o	0.013 c
N-Nitrosodiphenylamine	86306			4.90E-03 i			14 o	1.3 o	0.64 o	580 o	130 c
N-Nitroso di-n-propylamine	621647			7.00E+00 i			0.0096 o	0.00089 o	0.00045 o	0.41 o	0.091 c
N-Nitroso-N-methylethylamine	10595956			2.20E+01 i			0.0031 o	0.00028 o	0.00014 o	0.13 o	0.029 c
N-Nitrosopyrrolidine	930552			2.10E+00 i	2.13E+00 i		0.032 o	0.0029 o	0.0015 o	1.4 o	0.3 c
m-Nitrotoluene	99081	1.00E-02 h				***	61 n	37 n	14 n	10000 n	780 n
o-Nitrotoluene	88722	1.00E-02 h				***	61 n	37 n	14 n	10000 n	780 n
p-Nitrotoluene	99990	1.00E-02 h				***	61 n	37 n	14 n	10000 n	780 n
Norflurazon	27314132	4.00E-02 i					1500 n	150 n	54 n	41000 n	3100 n
NuStar	85509199	7.00E-04 i					26 n	2.6 n	0.95 n	720 n	55 n
Octabromodiphenyl ether	32536520	3.00E-03 i					110 n	11 n	4.1 n	3100 n	230 n
Octahydro-1357-tetranitro-1357-tetrazocine	2691410	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Octamethylpyrophosphoramide	152169	2.00E-03 h					73 n	7.3 n	2.7 n	2000 n	160 n
Oryzalin	19044883	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Oxadiazon	19666309	5.00E-03 i					180 n	18 n	6.8 n	n	390 n

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Oxamyl	23135220	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
Oxyfluorfen	42874033	3.00E-03 i					110 n	11 n	4.1 n	3100 n	230 n
Paclobutrazol	76738620	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
Paraquat	1910425	4.50E-03 i					160 n	16 n	6.1 n	4600 n	350 n
Parathion	56382	6.00E-03 h					220 n	22 n	8.1 n	6100 n	470 n
Pebulate	1114712	5.00E-02 h					1800 n	180 n	68 n	51000 n	3900 n
Pendimethalin	40487421	4.00E-02 i					1500 n	150 n	54 n	41000 n	3100 n
Pentabromo-6-chloro cyclohexane	87843			2.30E-02 h			2.9 o	0.27 o	0.14 o	120 o	28 c
Pentabromodiphenyl ether	32534819	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
Pentachlorobenzene	608935	8.00E-04 i				***	4.9 n	2.9 n	1.1 n	820 n	63 n
Pentachloronitrobenzene	82688	3.00E-03 i		2.60E-01 h		***	0.041 o	0.024 o	0.012 o	11 o	2.5 c
Pentachlorophenol	87865	3.00E-02 i		1.20E-01 i			0.56 o	0.052 o	0.026 o	24 o	5.3 c
Permethrin	52645531	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Phenmedipham	13684634	2.50E-01 i					9100 n	910 n	340 n	260000 n	20000 n
Phenol	108952	6.00E-01 i					22000 n	2200 n	810 n	610000 n	47000 n
m-Phenylenediamine	108452	6.00E-03 i					220 n	22 n	8.1 n	6100 n	470 n
o-Phenylenediamine	95545	6.00E-03 h					220 n	22 n	8.1 n	6100 n	470 n
p-Phenylenediamine	106503	1.90E-01 h					6900 n	690 n	260 n	190000 n	15000 n
Phenylmercuric acetate	62384	8.00E-05 i					2.9 n	0.29 n	0.11 n	82 n	6.3 n
2-Phenylphenol	90437			1.94E-03 h			35 o	3.2 o	1.6 o	1500 o	330 c
Phorate	298022	2.00E-04 h					7.3 n	0.73 n	0.27 n	200 n	16 n
Phosmet	732116	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Phosphine	7803512	3.00E-04 i	8.57E-06 h				11 n	0.031 n	0.41 n	310 n	23 n
Phosphorus (white)	7723140	2.00E-05 i					0.73 n	0.073 n	0.027 n	20 n	1.6 n
p-Phthalic acid	100210	1.00E+00 h					37000 n	3700 n	1400 n	1000000 n	78000 n
Phthalic anhydride	85449	2.00E+00 i	3.43E-01 h				73000 n	1300 n	2700 n	1000000 n	160000 n
Picloram	1918021	7.00E-02 i					2600 n	260 n	95 n	72000 n	5500 n
Pirimiphos-methyl	29232937	1.00E-02 i					370 n	37 n	14 n	10000 n	780 n
Polybrominated biphenyls		7.00E-06 h		8.90E+00 h			0.0076 o	0.0007 o	0.00035 o	0.32 o	0.072 c
Polychlorinated biphenyls (PCBs)	1336361			7.70E+00 i			0.0087 o	0.00081 o	0.00041 o	0.37 o	0.083 c
Aroclor 1016	12674112	7.00E-05 i					2.6 n	0.26 n	0.095 n	72 n	5.5 n
Polychlorinated terphenyls (PCTs)				4.50E+00 o			0.015 o	0.0014 o	0.0007 o	0.64 o	0.14 c
Polynuclear aromatic hydrocarbons											
Acenaphthene	83329	6.00E-02 i					2200 n	220 n	81 n	61000 n	4700 n
Anthracene	120127	3.00E-01 i					11000 n	1100 n	410 n	310000 n	23000 n
Benzo[a]pyrene	50328			7.30E+00 i	6.10E+00 h		0.0092 o	0.001 o	0.00043 o	0.39 o	0.088 c
Benzo[b]fluoranthene	205992			7.30E-01 o	6.10E-01 o		0.092 o	0.01 o	0.0043 o	3.9 o	0.88 c
Benzo[k]fluoranthene	207089			7.30E-02 o	6.10E-02 o		0.92 o	0.1 o	0.043 o	39 o	8.8 c
Benz[a]anthracene	56553			7.30E-01 o	6.10E-01 o		0.092 o	0.01 o	0.0043 o	3.9 o	0.88 c
Chrysene	218019			7.30E-03 o	6.10E-03 o		9.2 o	1 o	0.43 o	390 o	88 c
Dibenz[ah]anthracene	53703			7.30E+00 o	6.10E+00 o		0.0092 o	0.001 o	0.00043 o	0.39 o	0.088 c
Fluoranthene	206440	4.00E-02 i					1500 n	150 n	54 n	41000 n	3100 n

EPA Region III Risk-Based Concentrations: R.L. Smith (07-Jan-94)

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Basis of RBC: c=carcinogenic effects n=noncarcinogenic effects.

Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg•d/mg	CPSi kg•d/mg	VOC	Tap water µg/L	Ambient air µg/m3	Fish mg/kg	Industrial soil mg/kg	Residential soil mg/kg
Fluorene	86737	4.00E-02 i					1500 n	150 n	54 n	41000 n	3100 n
Indeno[1,2,3-cd]pyrene	193395			7.30E-01 o	6.10E-01 o		0.092 c	0.01 c	0.0043 c	3.9 c	0.88 c
Naphthalene	91203	4.00E-02 x					1500 n	150 n	54 n	41000 n	3100 n
Pyrene	129000	3.00E-02 i					1100 n	110 n	41 n	31000 n	2300 n
Prochloraz	67747095	9.00E-03 i		1.50E-01 i			0.45 c	0.042 c	0.021 c	19 c	4.3 c
Profluralin	26399360	6.00E-03 h					220 n	22 n	8.1 n	6100 n	470 n
Prometon	1610180	1.50E-02 i					550 n	55 n	20 n	15000 n	1200 n
Prometryn	7287196	4.00E-03 i					150 n	15 n	5.4 n	4100 n	310 n
Pronamide	23950585	7.50E-02 i					2700 n	270 n	100 n	77000 n	5900 n
Propachlor	1918167	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
Propanil	709988	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Propargite	2312358	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Propargyl alcohol	107197	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
Propazine	139402	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Propham	122429	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Propiconazole	60207901	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
Propylene glycol	57556	2.00E+01 h					730000 n	73000 n	27000 n	1000000 n	1000000 n
Propylene glycol, monoethyl ether	52125538	7.00E-01 h					26000 n	2600 n	950 n	720000 n	55000 n
Propylene glycol, monomethyl ether	107982	7.00E-01 h	5.71E-01 i				26000 n	2100 n	950 n	720000 n	55000 n
Propylene oxide	75569		8.57E-03 i	2.40E-01 i	1.29E-02 i		0.28 c	0.49 c	0.013 c	12 c	2.7 c
Pursuit	81335775	2.50E-01 i					9100 n	910 n	340 n	260000 n	20000 n
Pydrin	51630581	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
Pyridine	110861	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
Quinalphos	13593038	5.00E-04 i					18 n	1.8 n	0.68 n	510 n	39 n
Quinoline	91225			1.20E+01 h			0.0056 c	0.00052 c	0.00026 c	0.24 c	0.053 c
Resmethrin	10453868	3.00E-02 i					1100 n	110 n	41 n	31000 n	2300 n
Ronnel	299843	5.00E-02 h					1800 n	180 n	68 n	51000 n	3900 n
Rotenone	83794	4.00E-03 i					150 n	15 n	5.4 n	4100 n	310 n
Savey	78587050	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
Selenious Acid	778[illegible]	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Selenium	7782492	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Selenourea	630104	5.00E-03 h					180 n	18 n	6.8 n	5100 n	390 n
Sethoxydim	74051802	9.00E-02 i					3300 n	330 n	120 n	92000 n	7000 n
Silver and compounds	7440224	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Simazine	122349	5.00E-03 i		1.20E-01 h			0.56 c	0.052 c	0.026 c	24 c	5.3 c
Sodium azide	26628228	4.00E-03 i					150 n	15 n	5.4 n	4100 n	310 n
Sodium diethyldithiocarbamate	148185	3.00E-02 i		2.70E-01 h			0.25 c	0.023 c	0.012 c	11 c	2.4 c
Sodium fluoroacetate	62748	2.00E-05 i					0.73 n	0.073 n	0.027 n	20 n	1.6 n
Sodium metavanadate	13718268	1.00E-03 h					37 n	3.7 n	1.4 n	1000 n	78 n
Strontium, stable	7440246	6.00E-01 i					22000 n	2200 n	810 n	610000 n	47000 n
Strychnine	[illegible]	1.00E-04 i					11 n	1.1 n	0.41 n	310 n	23 n
Styrene	[illegible]	2.00E-01 i	2.86E-				[illegible] n	[illegible] n	270 n	2[illegible]	16000 n

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Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg•d/mg	CPSi kg•d/mg	VOC	Tap water µg/L	Ambient air µg/m3	Fish mg/kg	Industrial soil mg/kg	Residential soil mg/kg
Systhane	88671890	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
2,3,7,8-TCDD (dioxin)	1746016			1.50E+05 h	1.50E+05 h		4.50E-07 o	4.20E-08 o	2.10E-08 o	0.000019 o	4.30E-06 c
Tebuthiuron	34014181	7.00E-02 i					2600 n	260 n	95 n	72000 n	5500 n
Temephos	3383968	2.00E-02 h					730 n	73 n	27 n	20000 n	1600 n
Terbacil	5902512	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
Terbufos	13071799	2.50E-05 h					0.91 n	0.091 n	0.034 n	26 n	2 n
Terbutryn	886500	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
1,2,4,5-Tetrachlorobenzene	95943	3.00E-04 i				***	1.8 n	1.1 n	0.41 n	310 n	23 n
1,1,1,2-Tetrachloroethane	630206	3.00E-02 i		2.60E-02 i	2.59E-02 i	***	0.41 o	0.24 o	0.12 o	110 o	25 c
1,1,2,2-Tetrachloroethane	630206			2.00E-01 i	2.03E-01 i	***	0.052 o	0.031 o	0.016 o	14 o	3.2 c
Tetrachloroethylene (PCE)	127184	1.00E-02 i		5.20E-02 o	2.03E-03 o	***	1.1 o	3.1 o	0.061 o	55 o	12 c
2,3,4,6-Tetrachlorophenol	58902	3.00E-02 i					1100 n	110 n	41 n	31000 n	2300 n
p,a,a,a-Tetrachlorotoluene	5216251			2.00E+01 h		***	0.00053 o	0.00031 o	0.00016 o	0.14 o	0.032 c
Tetrachlorovinphos	961115	3.00E-02 i		2.40E-02 h			2.8 o	0.26 o	0.13 o	120 o	27 c
Tetraethyldithiopyrophosphate	3689245	5.00E-04 i					18 n	1.8 n	0.68 n	510 n	39 n
Thallic oxide	1314325	7.00E-05 h					2.6 n	0.26 n	0.095 n	72 n	5.5 n
Thallium											
Thallium acetate	563688	9.00E-05 i					3.3 n	0.33 n	0.12 n	92 n	7 n
Thallium carbonate	6533739	8.00E-05 i					2.9 n	0.29 n	0.11 n	82 n	6.3 n
Thallium chloride	7791120	8.00E-05 i					2.9 n	0.29 n	0.11 n	82 n	6.3 n
Thallium nitrate	10102451	9.00E-05 i					3.3 n	0.33 n	0.12 n	92 n	7 n
Thallium selenite	12039520	9.00E-05 w					3.3 n	0.33 n	0.12 n	92 n	7 n
Thallium sulfate	7446186	8.00E-05 i					2.9 n	0.29 n	0.11 n	82 n	6.3 n
Thiobencarb	28249776	1.00E-02 i					370 n	37 n	14 n	10000 n	780 n
2-(Thiocyanomethylthio)-benzothiazole	21564170	3.00E-02 h					1100 n	110 n	41 n	31000 n	2300 n
Thiofanox	39196184	3.00E-04 h					11 n	1.1 n	0.41 n	310 n	23 n
Thiophanate-methyl	23564058	8.00E-02 i					2900 n	290 n	110 n	82000 n	6300 n
Thiram	137268	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Tin and compounds		6.00E-01 h					22000 n	2200 n	810 n	610000 n	47000 n
Toluene	108883	2.00E-01 i	1.14E-01 w			***	750 n	420 n	270 n	200000 n	16000 n
Toluene-2,4-diamine	95807			3.20E+00 h			0.021 o	0.002 o	0.00099 o	0.89 o	0.2 c
Toluene-2,5-diamine	95705	6.00E-01 h					22000 n	2200 n	810 n	610000 n	47000 n
Toluene-2,6-diamine	823405	2.00E-01 h					7300 n	730 n	270 n	200000 n	16000 n
p-Toluidine	106490			1.90E-01 h			0.35 o	0.033 o	0.017 o	15 o	3.4 c
Toxaphene	8001352			1.10E+00 i	1.12E+00 i		0.061 o	0.0056 o	0.0029 o	2.6 o	0.58 c
Tralomethrin	66841256	7.50E-03 i					270 n	27 n	10 n	7700 n	590 n
Triallate	2303175	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
Triasulfuron	82097505	1.00E-02 i					370 n	37 n	14 n	10000 n	780 n
1,2,4-Tribromobenzene	615543	5.00E-03 i				***	30 n	18 n	6.8 n	5100 n	390 n
Tributyltin oxide (TBTO)	56359	3.00E-05 i					1.1 n	0.11 n	0.041 n	31 n	2.3 n
2,4,6-Trichloroaniline hydrochloride	33663502			2.90E-02 h			2.3 o	0.22 o	0.11 o	99 o	22 c
2,4,6-Trichloroaniline	634935			3.40E-02 h			2 o	0.18 o	0.093 o	84 o	19 c

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Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg•d/mg	CPSi kg•d/mg	VOC	Tap water µg/L	Ambient air µg/m3	Fish mg/kg	Industrial soil mg/kg	Residential soil mg/kg
1,2,4-Trichlorobenzene	120821	1.00E-02 i	2.57E-03 h			---	18 n	9.4 n	14 n	10000 n	780 n
1,1,1-Trichloroethane	71556	9.00E-02 w	2.86E-01 w			---	1300 n	1000 n	120 n	92000 n	7000 n
1,1,2-Trichloroethane	79005	4.00E-03 i		5.70E-02 i	5.60E-02 i	---	0.19 c	0.11 c	0.055 c	50 c	11 c
Trichloroethylene (TCE)	79016	6.00E-03 e		1.10E-02 w	6.00E-03 e	---	1.6 c	1 c	0.29 c	260 c	58 c
Trichlorofluoromethane	75694	3.00E-01 i	2.00E-01 h			---	1300 n	730 n	410 n	310000 n	23000 n
2,4,5-Trichlorophenol	95954	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
2,4,6-Trichlorophenol	88062			1.10E-02 i	1.09E-02 i		6.1 c	0.57 c	0.29 c	260 c	58 c
2,4,5-Trichlorophenoxyacetic acid	93765	1.00E-02 i					370 n	37 n	14 n	10000 n	780 n
2-(2,4,5-Trichlorophenoxy)propionic acid	93721	8.00E-03 i					290 n	29 n	11 n	8200 n	630 n
1,1,2-Trichloropropane	598776	5.00E-03 i				---	30 n	18 n	6.8 n	5100 n	390 n
1,2,3-Trichloropropane	96184	6.00E-03 i				---	37 n	22 n	8.1 n	6100 n	470 n
1,2,3-TCP as carcinogen	96184			2.70E+00 e		---	0.0039 c	0.0023 c	0.0012 c	1.1 c	0.24 c
1,2,3-Trichloropropene	96195	5.00E-03 h				---	30 n	18 n	6.8 n	5100 n	390 n
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	3.00E+01 i	8.57E+00 h			---	59000 n	31000 n	41000 n	1000000 n	1000000 n
Tridiphane	58138082	3.00E-03 i					110 n	11 n	4.1 n	3100 n	230 n
Triethylamine	121448		2.00E-03 i				73 n	7.3 n			
Trifluralin	1582098	7.50E-03 i		7.70E-03 i			8.7 c	0.81 c	0.41 c	370 c	83 c
Trimethyl phosphate	512561			3.70E-02 h			1.8 c	0.17 c	0.085 c	77 c	17 c
1,2,4-Trimethylbenzene	95636	5.00e-04 e				---	3 n	1.8 n	0.68 n	510 n	39 n
1,3,5-Trimethylbenzene	108678	4.00e-04 e				---	2.4 n	1.5 n	0.54 n	410 n	31 n
1,3,5-Trinitrobenzene	99354	5.00E-05 i					1.8 n	0.18 n	0.068 n	51 n	3.9 n
Trinitrophenylmethylnitramine	479458	1.00E-02 h					370 n	37 n	14 n	10000 n	780 n
2,4,6-Trinitrotoluene	118967	5.00E-04 i		3.00E-02 i			2.2 c	0.21 c	0.11 c	95 c	21 c
Uranium (soluble salts)	7440611	3.00E-03 i					110 n	11 n	4.1 n	3100 n	230 n
Vanadium	7440622	7.00E-03 h					260 n	26 n	9.5 n	7200 n	550 n
Vanadium pentoxide	1314621	9.00E-01 i					330 n	33 n	12 n	9200 n	700 n
Vanadium sulfate	36907421	2.00E-02 h					730 n	73 n	27 n	20000 n	1600 n
Vernam	1929777	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
Vindozolin	50471448	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
Vinyl acetate	108054	1.00E+00 h	5.71E-02 i				37000 n	210 n	1400 n	1000000 n	78000 n
Vinyl bromide	593602		8.57E-04 i			---	5.2 n	3.1 n			
Vinyl chloride	75014			1.90E+00 h	3.00E-01 h	---	0.019 c	0.021 c	0.0017 c	1.5 c	0.34 c
Warfarin	81812	3.00E-04 i					11 n	1.1 n	0.41 n	310 n	23 n
m-Xylene	108323	2.00E+00 h	2.00E-01 w			---	1400 n	730 n	2700 n	1000000 n	160000 n
o-Xylene	95476	2.00E+00 h	2.00E-01 w			---	1400 n	730 n	2700 n	1000000 n	160000 n
p-Xylene	106423		8.57E-02 w			---	520 n	310 n			

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APPENDIX D
NEW JERSEY PROPOSED SOIL CLEANUP STANDARDS

responsible for conducting the remediation establishes, through the use of site-specific soil and ground water data, that subsurface soil contamination does not cause concentrations of contaminants in the ground water above the applicable ground water cleanup standards, an alternate subsurface soil cleanup standard may be available.

Ground water cleanup standards, on the other hand, are not a single set of standards which are applicable generically throughout the State. Instead, the Department developed the ground water cleanup standards based upon the existing quality and uses of ground water as established in the ground water quality standards. Therefore, site-specific considerations such as the ground water classification in the area of the contaminated site and the existence of potential human and ecological receptors, are critical factors in the identification of ground water cleanup standards.

Application to New Discharges

This issue concerns whether discharges which occur after the promulgation of the cleanup standards must be cleaned up to pre-discharge concentrations or whether they can be cleaned up to the regulatory standards.

Central to this discussion are the issues of pollution prevention and providing appropriate disincentive for new discharges. This is consistent with the Department's policy of antidegradation. All discharges which occur after the effective date of these rules, therefore, shall be remediated to the lowest level achievable through the application of the best available technology in order to remove as much of the discharged contaminant as possible. All discharges that occurred prior to the effective date of these rules are subject to the other numeric and narrative cleanup standards.

Finality of Cleanups

The final major policy issue is whether or not previously approved cleanups must continually meet upgraded regulatory cleanup standards.

The resolution of this issue depends on the person's relationship to the discharge which caused the contamination. The discharger, including all those who are in any way responsible for the discharge, remains liable if additional remediation is necessary (that is, more stringent standards are adopted). Those persons who are not in any way responsible for the discharge, but conduct remediation to the current cleanup standards or get a determination that no further action is required based on the current standards, have no continuing liability when the Department amends the cleanup standards to be more stringent.

This approach is a reasonable compromise between the need to provide finality to remedial decisions, and the policy of holding those responsible for the discharge liable for the costs of their actions. Property should be available for purchase and development by persons who are not responsible for the discharge. Such persons should have clarity on the issue of their liability. Banks and other lenders should be able to quantify the potential costs of remediating a contaminated site to the cleanup standards, unless the loan is to a person who is in any way responsible for the discharge. The proposed cleanup standards were designed to support these concerns.

Summary of Rules

General Provisions

Subchapter 1 includes the scope of the proposed rules, certifications, definitions, construction, and severability provisions. In addition, subchapter 1 summarizes the Department's overall objectives in developing the cleanup standards. The Department's objectives are to:

- Ensure protection of human health and the environment based on sound technical and scientific principles;
- Ensure that protectiveness over time;
- Implement the Department's antidegradation policy by requiring all new discharges to be removed to the maximum extent possible;
- Ensure consistent procedures for the identification of cleanup standards;
- Provide notice of the procedures to identify cleanup standards to the regulated community and the public;
- Establish clear, objective cleanup standards to encourage voluntary and expeditious remediation of contaminated sites; and
- Minimize time and money necessary to identify cleanup standards applicable to a contaminated site.

The cleanup standards apply to all site remediations performed pursuant to any Department program area, including without limitation, decision, remediation of contamination from underground storage tanks, RCRA corrective action decisions, publicly conducted remediation, and cleanup and removal actions pursuant to the Spill Act or other applicable statutes.

These cleanup standards, therefore, will supplement all State and Federal site remediation programs including those with rules already in place. In this manner the cleanup standards will apply to any site with contaminants in concentrations higher than the concentrations established in these cleanup standards.

As discussed above, many of the contaminated sites in this State result from decades of industrial activity and the Department has developed these cleanup standards to address this situation. For discharges after the effective date of these rules, however, the person responsible for conducting the remediation must apply the best, demonstrated commercially available, technology designed to completely remove the discharged contaminants. In this way, the Department hopes to ensure that future decades of continued developmental activity do not further degrade areas of the State which have concentrations of contaminants below the cleanup standards. This provision is specifically designed as an anti-degradation policy.

N.J.A.C. 7:26D-1.[illegible] contains definitions relevant to this chapter. It is important to note that if the definitions of words or phrases in this chapter are different from the definitions in other rules in regulatory programs to which this chapter applies, the definitions in this chapter apply and control all of the words and phrases used in this chapter. An example of this is the difference between the definition of a "discharge" proposed in this chapter and the definitions of "discharge" and "leak" the Department adopted in N.J.A.C. 7:1E-6 (see 23 N.J.R. 2656(a)). In N.J.A.C. 7:1E-1.6, the Department defined a discharge to specifically exclude a leak for the purposes of N.J.A.C. 7:1E. The Department has defined a leak in N.J.A.C. 7:1E-1.6 as:

> any escape of a hazardous substance from the ordinary containers employed in the normal course of storage, transfer, processing or use, into a secondary containment or diversion system or onto a surface from which it is cleaned up and removed prior to its escape into the waters or onto the lands of the State.

For the purpose of the cleanup standards being proposed here, the rationale in N.J.A.C. 7:1E for differentiating a leak from a discharge does not apply. The Department has not, therefore, included a definition of a leak separate from a discharge, but has included a leak within the definition of a discharge.

N.J.A.C. 7:26D-1.[illegible] states the Department policy that these cleanup standards be considered as applicable or relevant and appropriate requirements (ARARs), as defined in the National Contingency Plan (NCP) at sites undergoing remediation pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, 42 U.S.C. 9600 et seq.

Building Interior Cleanup Standards

Subchapter 2 describes the Department's cleanup standards for building interiors which have been contaminated by a discharge. Building interiors include the surfaces of all floors, walls, windows, stairs, ceilings and room fixtures which may be contaminated. In addition to surfaces, porous building materials which have the potential to become contaminated through the absorption of contaminants are also subject to cleanup. Building interiors also include interior air if that air has the potential to become contaminated by contaminants on floors, walls, windows, stairs, ceilings, and room fixtures.

N.J.A.C. 7:26D-[illegible] presents the building interior cleanup standards. Accessible interior surface areas or room fixtures are those surfaces, including the floor, which extend to six feet in height above the floor. These areas are considered accessible because they are within the direct contact range of standing people. The choice of six feet is based on the definition of a high contact area described in EPA's or PCB spill cleanup policy, 40 CFR Part 761. Inaccessible interior surface areas or room fixtures are those surfaces more than six feet in height above the floor. These areas are less likely to be in the range of direct contact for standing people.

The Department's cleanup standard for lead for building interiors is based upon the September 1990 U.S. Department of Housing and Urban Development (HUD) clearance criteria for lead abatement projects. This is the most recent published regulatory guidance concerning interior lead concentrations. The HUD clearance criteria describe those levels of lead in dust which must be attained before a building may be reoccupied [illegible]

sills and window wells and remaining surfaces because, historically, window casements have received multiple coats of lead-based paint and have been subject to greater weathering. The less stringent standard for window areas reflect the practical difficulty of achieving greater cleanup reductions. Consistent with the HUD guidance, there is no distinction for lead in the Department's cleanup standards for areas above and below six feet. While most states have not developed cleanup standards for interior lead, the states of Maryland and Massachusetts use the HUD criteria for lead on interior surfaces.

When a contaminant, such as mercury, has the potential to enter the air from a contaminated surface, an air standard is appropriate. Mercury is volatile and known to present a human health risk by the inhalation route of exposure.

For a building interior contaminants which does not have a cleanup standard identified in this subchapter, the Department may develop a cleanup standard pursuant to subchapter 6. This approach will only be necessary in instances where the contaminants of concern is a significant factor in selecting a final remedial action for a site. Unique chemical, toxicological or physical properties of a contaminant may require the use of different procedures from those described in subchapter 6.

The Department has provided a mechanism in subchapter 7 for petitioning for an alternate cleanup standard or a deferral of a cleanup standard.

N.J.A.C. 7:26D-2.3 presents the mechanism to determine compliance with the building interior cleanup standards. Appropriate sampling to determine compliance with the cleanup is in part dependent on the medium of material to be sampled. For surface dust samples, a wipe sample is required. For measuring contamination which has been adsorbed into structural materials such as concrete or wood, a chip or bulk sample must be taken. Contaminants in air in most cases require that contaminants be filtered from the air and concentrated before an analysis can be performed. The Department's "Field Sampling Procedures Manual" presents acceptable sampling procedures. Compliance with building interior cleanup standards is achieved when no single post-remediation sample exceeds the applicable building interior cleanup standard.

Soil Cleanup Standards

Subchapter 3 presents the soil cleanup standards. Cleanup standards for individual contaminants are presented in Table 3-1 for surface soil and subsurface soil. Surface soil cleanup standards are based upon contact between a human receptor and the contaminated soil. There are two types of exceptions to this basis for the surface soil cleanup standards. The surface soil cleanup standards for zinc and copper are based on general phytotoxicity, and in those instances where an ecological assessment conducted pursuant to subchapter 5 results in a more stringent standard to protect an ecological receptor. The residential surface soil standards allow for unrestricted use of the property.

Contamination of surface water bodies may occur via erosion of soil particles containing absorbed contaminants or via transport of a contaminated solution in runoff water. Wind erosion is also a potential means of spreading contaminants offsite. These transport mechanisms to surface water may present a substantial risk for human exposure, especially if such contaminants can accumulate in tissues of aquatic organisms and/or biomagnify in the food chain. While the Department recognizes the need to incorporate such considerations into the derivation of standards for particular contaminants, site-specific factors are important to properly evaluate these pathways. Thus, satisfactory models need to be developed so that the Department can develop protective standards for this indirect exposure pathway. The Department welcomes comments on how best to incorporate these considerations into these cleanup standards and will be scheduling public workshops to discuss this issue. Until such incorporation, the Department has developed decision criteria (see subchapter 5) to determine which sites will require an ecological assessment.

The proposed human health-based criteria for contaminants in soil are based on protection from chronic toxicity resulting from ingestion of a relatively small amount of soil on a daily basis for a long time period. Children are known, on occasion, to ingest significantly higher quantities of soil than the daily amount of exposure which was used for the derivation of the surface soil cleanup standards. The dose of a chemical which produces an adverse health effect from acute exposure is usually considerably greater than the dose which causes health effects when exposure to the contaminant occurs on a daily basis over a period of months or years. Information on acute toxic effects for chemicals has been less adequately summarized in the regulatory and scientific literature than that for chronic effects, which is reflected in the EPA reference doses. The Department is currently evaluating whether consideration of this scenario will result in more stringent cleanup standards for some chemicals. As part of this proposal, the Department is soliciting any comments on how this concern could be evaluated. After reviewing these comments and evaluating all information on this issue, the Department will determine if any subsequent amendments are warranted.

The subsurface soil cleanup standards are intended for the protection of ground water, surface water and structures which may be affected by contaminants in subsurface soil. The subsurface soil cleanup standards are based on the potential mobility of contaminants to ground water and protection of ground water uses. The subsurface soil cleanup standards presented in the rules were developed to protect ground water quality in the areas where ground water is used as a potable drinking water source. Subsurface soil cleanup standards for volatile organic compounds were developed using a model to predict the percentage of total contamination that may leach to ground water over 70 years. Cleanup standards for the semivolatile organic contaminants and the pesticides were developed using a ranking system which considers solubility, biodegradation and toxicity.

The Department has determined that vapor hazards may result from soils containing volatile organic compound contamination. Field experience has shown that soil gas vapors can migrate through subsurface soils and impact subsurface spaces. Of particular concern are those situations occurring in developed areas where building and utility line excavations have disturbed natural soils which result in low resistance pathways for gas vapor migration. Therefore, the Department has determined that for those situations where volatile organic compounds are found in soil at concentrations of 100 ppm or above and they are also detected in the gas phase in this soil, the concentration in milligrams per cubic meter (mg/m^3) of the contaminant in a residential living space reasonably expected to be impacted must be determined and shall not exceed the chronic inhalation reference dose for habitable structures or 10 percent of the lower explosive limit for that compound.

N.J.A.C. 7:26A-3.3 presents the procedures to determine compliance with the soil cleanup standards. Surface soil standard compliance will be determined in the top two feet of the existing grade throughout an area of environmental concern.

Compliance with subsurface soil cleanup standards will be determined throughout the soil column down to the water table when the subsurface soil standards are more stringent than the surface soil standards. This ensures protection of ground water uses. If subsurface soil standards are greater than the surface soil standards, the subsurface soil standards will be applied from two feet below grade to the water table.

For a soil contaminant which does not have a cleanup standard identified in this subchapter, the Department will develop a cleanup standard pursuant to subchapter 6. This approach will only be necessary in instances where the contaminant of concern is a significant factor in selecting a final remedial action for a site.

The Department has provided a mechanism for petitioning for an alternate soil cleanup standard or a deferral of a soil cleanup standard pursuant to subchapter 7.

Ground Water Cleanup Standards

Subchapter 4 presents the ground water cleanup standards. There are three primary objectives embodied in the rules. The first is the preservation of New Jersey's ground and surface waters through the development of ground water cleanup standards that protect the designated uses of these waters. The second is acknowledgement of the limitations of active ground water remedial technologies. Third is the use of natural ground water remediation in achieving the ground water cleanup standards.

N.J.A.C. 7:26D-4.2 presents the cleanup standards for ground water which is currently affecting, or has the potential to affect, a receptor. Receptors include surface water, wells, well head protection areas, ground water of different classes, sensitive ecosystems and subsurface structures.

Ground water cleanup standards protective of ground water classifications are based on the primary receptors within that class as established pursuant to the New Jersey Ground Water Quality Standards at N.J.A.C. 7:9-6. (Note: The Department proposed amendments to N.J.A.C. 7:9-6 in the January 21, 1992 New Jersey Register.) Class I ground waters replenish sensitive ecosystems. As such, the Department has established natural ground water quality as the cleanup standard for all contaminants in Class IA and I-Pinelands (Preservation Area) ground

"Soil" means the unconsolidated mineral and organic matter on the surface of the earth that has been subjected to and influenced by geologic and other environmental factors.

"Steady state" means the achievement of asymptotic contaminant concentrations in ground water demonstrated by a first order decay rate curve (that is, decrease in contaminant concentration over time), the lower limit of which is substantially linear.

"Subsurface soil" means the soil more than two feet below grade and extending downward to the top of the seasonally high water table.

"Surface soil" means the top two feet of soil below grade.

"Technically impracticable" means that, from an engineering perspective, no demonstrated commercially available technology can achieve a cleanup standard, or that it is physically impracticable to achieve a cleanup standard (for example, the contamination is under a building).

"Total petroleum hydrocarbons" means those materials which can be extracted from sample matrices with freon 113 having chemical characterization which allow passage of the extract through a silica gel column with detection at 2,970 cm^{-1} ± 150 wave number using either a fixed wave length or scanning wavelength infrared detector. Petroleum hydrocarbons may also be characterized by gas chromotography fingerprint analysis.

"Total organic contaminants" means those analytes determined from the summation, of all analytes and from their respective concentrations, as determined from all pertinent organic analytical methodologies employed.

"Total volatile organic contaminants" means analytes whose vapor pressure is >1mHg at normal temperature (20 degrees C) and pressure (one atm) and may be sampled by static and dynamic heated and ambient temperature headspace analysis, direct injection, and thermal desorption of the sample or sampling media, separated by either packed or capillary columns and analyzed by specific detectors (such as Hall, PID, FID, TCD, or FPD) or a universal detector (such as a mass spectrometry).

"Unit risk factor" means the factor which relates the concentration of a contaminant in air to the additional lifetime cancer risk as follows:

air concentration (ug/m3) × (unit risk factor (ug/m³))⁻¹ = additional lifetime cancer risk.

A unit risk factor is calculated for a contaminant for which a risk assessment is based on carcinogenic effects from inhalation.

"Water table" means the seasonally high level in the saturated zone at which the hydraulic pressure is equal to atmospheric pressure.

"Weight of evidence for human carcinogenicity" means the classification of a contaminant, for the purpose of risk assessment, according to the criteria described in the EPA "Guidelines for Risk Assessment" (51 Fed. Reg. 33992, 1986), into one of the following categories:

Group A: Human carcinogen—sufficient evidence from human epidemiological studies;

Group B: Probable human carcinogen—

Group B1: limited evidence from human epidemiological studies;

Group B2: sufficient evidence from animal studies and inadequate or no data from human epidemiological studies;

Group C: Possible human carcinogen—limited evidence of carcinogenicity from animal studies in the absence of human data;

Group D: Not classifiable as to human carcinogenicity—Inadequate human and animal evidence for carcinogenicity or no data available; and

Group E: Evidence of noncarcinogenicity for humans—No evidence for carcinogenicity in at least two adequate human epidemiological and animal studies.

"Well head protection area" means the surface and subsurface area surrounding a public water supply well or wellfield, supplying one or more wells, through which contaminants are reasonably likely to move toward and reach such well or wellfield.

"Well restriction area" means the surface and subsurface area the Department delineates within which the Department either prohibits or restricts the construction and use of wells.

7:26D-1.8 Liberal construction

These rules, being necessary to promote the public health, safety and welfare, and the protection of the environment, shall be liberally construed in order to allow the Commissioner and the Department to effectuate the purposes of the law.

7:26D-1.9 Severability

If any section, subsection, provision, clause or portion of this chapter is adjudged invalid or unconstitutional by a court of competent jurisdiction, the remainder of the chapter shall not be affected.

SUBCHAPTER 2. BUILDING INTERIOR CLEANUP STANDARDS

7:26D-2.1 Scope

This subchapter presents the cleanup standards for building interiors.

7:26D-2.2 Identification of building interior cleanup standards

(a) Building interior cleanup standards are as follows:

1. The cleanup standard for a contaminant, other than lead, on building interior surfaces up to six feet above the floor (accessible areas) is presented in Table 2-1 below;

2. The cleanup standard for a contaminant, other than lead, on building interior surface areas more than six feet above the floor (inaccessible areas) is presented in Table 2-1;

3. For a contaminant, other than lead and mercury, without an applicable cleanup standard in Table 2-1, the Department may develop a cleanup standard pursuant to 7:26D-6;

4. The cleanup standard for lead on window wells, window sills, and all other surfaces is presented in Table 2-2 below;

5. The cleanup standard for mercury in building interior air is presented in Table 2-3 below; and

6. The Department may require the use of institutional controls pursuant to N.J.A.C. 7:26D-8 when necessary to protect human health and the environment.

(b) Any person may initiate the process, pursuant to N.J.A.C. 7:26D-7, for an alternate building interior cleanup standard, or for a deferral of a building interior cleanup standard.

7:26D-2.3 Compliance

(a) The person responsible for conducting the remediation shall conduct sampling to determine compliance with this subchapter in the areas of concern determined in accordance with generally accepted practices or as approved by the Department. Wipe samples, chip samples and air samples consistent with generally accepted sampling procedures, such as those detailed in the most recent revision of the Department's "Field Sampling Procedures Manual," should be used, as applicable.

TABLE 2-1: BUILDING INTERIOR SURFACE CLEANUP STANDARDS

Contaminant	CASRN	Standard: From Floor To 6 Feet	Standard: Higher Than 6 Feet
Antimony	7440-36-0	30	60
Arsenic (Total)	7440-38-2	0.22	0.44
Cadmium	7440-43-9	28	56
Mercury (Total)	7439-97-6	24	48
PCBs (Polychlorinated biphenyls) (Total)	1336-36-3		
Porous Surfaces, chip sample, ug/g		0.055	0.11
Non-Porous Surfaces, wipe sample		0.27	0.54

All units are reported as mg/m² unless otherwise noted.

TABLE 2-2: BUILDING INTERIOR LEAD CLEANUP STANDARDS

Contaminant	CASRN	Standard
Lead (Total), mg/m²		
Window Wells	7439-92-1	8.6
Window Sills		5.4
All Other Surfaces		2.1

TABLE 2-3: BUILDING INTERIOR AIR CLEANUP STANDARD

Contaminant	CASRN	Standard
Mercury (Total) ug/m³	7439-97-6	0.3

(b) Compliance with applicable building interior cleanup standards is achieved when no single sample exceeds the applicable building interior cleanup standard.

SUBCHAPTER 3. SOIL STANDARDS

7:26D-3.1 Scope

This subchapter presents the cleanup standards for the soil, except when more stringent cleanup standards are developed pursuant to N.J.A.C. 7:26D-5.

7:26D-3.2 Identification of soil cleanup standards

(a) The surface soil cleanup standards are:

1. The surface soil cleanup standards in Table 3-1 below;

i. For a contaminant not included in Table 3-1, the Department may develop a surface soil cleanup standard pursuant to N.J.A.C. 7:26D-6;

ii. If the subsurface soil cleanup standard for a contaminant, identified pursuant to (b) below, is numerically less than the surface soil cleanup standard for that contaminant identified pursuant to (a)1 above, then that subsurface soil cleanup standard shall apply to both the surface and subsurface soil; and

2. The soil cleanup standards identified pursuant to (c) below.

(b) The subsurface soil cleanup standards are as follows:

1. For organic contaminants in any area where contaminated ground water has migrated to, or has the potential to migrate to, a Class I or Class IIA aquifer the subsurface soil cleanup standards are:

i. Presented in Table 3-1;

ii. For an organic contaminant in areas identified pursuant to (b)1 above, without a subsurface soil cleanup standard in Table 3-1, the Department may develop a subsurface soil cleanup standard pursuant to N.J.A.C. 7:26D-6;

2. For inorganic contaminants the Department will determine the subsurface soil cleanup standard on a site-specific basis through an assessment of contaminant toxicity and potential or demonstrated mobility, including, without limitation, the consideration of such soil chemical and physical characteristics as:

i. Total organic carbon (TOC);

ii. Cation exchange capacity (CEC);

iii. Particle size distribution;

iv. Permeability; and

v. Chemical state of the contaminant; and

3. The soil cleanup standards identified pursuant to (c) below.

(c) The following soil standards apply to both surface and subsurface soil:

1. Total organic contaminants, which includes total petroleum hydrocarbons (TPHC), shall not exceed 10,000 mg/kg;

2. When total volatile organic contaminants are present at concentrations greater than or equal to 1,000 mg/kg, the cleanup standard for total volatile organic contaminants shall be 1,000 mg/kg, except as provided in (c)3 below;

3. When total volatile organic contaminants are present at concentrations greater than 100 mg/kg, but less than 1,000 mg/kg, the cleanup standard for total volatile organic contaminants shall be based on an evaluation of actual and potential impacts to any subsurface structures and shall include:

i. If total volatile organic contaminants are detected in the gas phase in this soil, the concentration in mg/m³ of the contaminant in a residential living space shall not exceed the lower of either:

(1) The chronic inhalation reference concentration impacted by the soil for habitable structures; or

(2) Ten percent of the lower explosive limit for an enclosure; and

ii. In all other circumstances, reduction to the maximum extent possible of any such actual or potential impact;

4. No soil shall exhibit the hazardous waste characteristics of ignitability, corrosivity and reactivity as defined in the hazardous waste regulations at N.J.A.C. 7:26-8 due to the presence of contaminants; and

5. The Department may require the use of institutional controls pursuant to N.J.A.C. 7:26D-8 when necessary to protect human health and the environment.

(d) Any person may initiate the process, pursuant to N.J.A.C. 7:26D-7, for an alternate soil cleanup standard, or a deferral of a soil cleanup standard.

i. Be more stringent than a cleanup standard presented elsewhere in this chapter for the same contaminant; and

ii. Include any institutional controls, pursuant to N.J.A.C. 7:26D-8, necessary to adequately protect sensitive ecological receptors.

(b) Any person may initiate the process, pursuant to N.J.A.C. 7:26D-7, for an alternate ecology-based cleanup standard or for a deferral of an ecology-based cleanup standard.

SUBCHAPTER 6. DERIVATION OF ADDITIONAL NUMERIC CLEANUP STANDARDS

7:26D-6.1 Scope

(a) This subchapter constitutes the Department's procedures to develop numeric cleanup standards for contaminants:

1. Which are the driving force for the remediation of a contaminated site; and

2. Not otherwise included in this chapter.

(b) For some contaminants with unique toxicological considerations which require that the assumptions and approaches for derivation of human health-based criteria differ from those provided in this subchapter, the Department may develop alternate approaches for development of human health-based criteria as necessary to protect human health.

7:26D-6.2 Derivation process

The numeric cleanup standard for a contaminant shall be the health-based criterion derived pursuant to N.J.A.C. 7:26D-6.3 through 6.9; unless the factors presented in N.J.A.C. 7:26D-6.10 result in a lower concentration, in which case the numeric cleanup standard is developed pursuant to the factors in N.J.A.C. 7:26D-6.10.

7:26D-6.3 Approach for human health-based criteria development

(a) The approach for derivation of the health-based criteria for each contaminant shall be determined by:

1. Its weight of evidence for human carcinogenicity;

2. Its chemical-specific toxicity factor (carcinogen potency factor, unit risk factor, reference dose, or reference concentration);

3. The exposure assumptions presented in this subchapter; and

4. The equations presented in this subchapter.

(b) The weight of evidence for human carcinogenicity as described in the EPA "Guidelines for Risk Assessment" (51 Fed. Reg. 33992, 1986) shall be applied as follows:

1. For a contaminant classified in Group A or Group B, the human health-based criterion is calculated from the potency factor or unit risk factor based on an additional lifetime cancer risk of 1×10^{-6};

2. For a contaminant classified in Group C, the health-based criterion shall be derived as follows:

i. If a chronic reference dose is available from the sources listed in N.J.A.C. 7:26D-6.5, the health-based criterion is derived based on the non-carcinogenic effects and is calculated by incorporating an additional uncertainty factor of 10; this is achieved by dividing the chronic reference dose or reference concentration by 10; or

ii. If no reference dose is available from the sources cited in N.J.A.C. 7:26D-6.5(a), the health-based criterion is derived from the carcinogenic effects and is calculated from the potency factor or unit risk factor based on an additional lifetime cancer risk of 1×10^{-6};

3. For a contaminant classified in Group D or Group E, the human health-based criterion shall be calculated from the chronic reference dose or chronic reference concentration; and

4. When the weight of evidence for human carcinogenicity, potency factor, or reference dose differs for oral and inhalation routes of exposure:

i. The oral information is used for developing contaminant-specific human health-based criterion for interior building surfaces, direct contact with surface soil, and ground water; and

ii. The inhalation information is used for developing a contaminant-specific human health based criterion for inhalation of a contaminant from surface soil or air in buildings.

7:26D-6.4 Assumptions

(a) The Department shall use the following assumptions to develop the human health-based criterion.

1. Body weight (BWA) of an adult male = 70 kilograms (kg);

2. Body weight of a child for risk assessments based on potency factor (BWC_p) = 16 kg;

3. Body weight of a child for risk assessments based on reference dose (BWC_{rd}) = 11.3 kg;

4. Length of a lifetime (LL) = 70 years;

5. Number of years spent at a non-residential property (NRP) = 25 years;

6. Number of years spent at a residential property (RP) = 30 years;

7. Non-residential time factor (NRTF), is the fraction of days each year spent at a non-residential property (NRP): (5/7 days) × (49/52 weeks) = 0.673;

8. Residential time factor (RTF), which is the fraction of each year spent at a residential property (RP) = 1.0;

9. Soil ingestion rate for a child (SIC) = 200 milligrams (mg)/day, assumed to occur between 0.5 years and six years of age;

10. Soil ingestion rate for an adult (SIA) = 100 mg/day;

11. Drinking water consumption rate (DWC) = 2 liters/day;

12. Source contribution factor (SCF) for drinking water is used for health-based criteria based on non-carcinogenic effects and is the fraction of the total daily dose of contaminant which comes from drinking water: 0.2;

13. Mean dietary intake (MDI), is the exposure to a contaminant via diet which is taken into account in the development of surface soil standards and interior building surface standards for non-carcinogens when information is available from the following sources:

i. Food and Drug Administration Total Diet Studies; and

ii. Agency for Toxic Substances and Disease Registry (ATSDR) Toxicity Profiles;

14. Fraction of interior building surface contamination which results in exposure to an individual = 0.5;

15. Accessible surface area of a room (AS), up to six feet above the floor, = 8.9 m^2; and

16. Inaccessible surface area of a room (IS), higher than six feet above floor, = 0.19 m^2.

7:26D-6.5 Data sources for human health toxicity factors

(a) In developing contaminant-specific health-based criteria, the Department shall use information from the sources listed below in order of priority, for toxicity information including, without limitation, the weight of evidence for human carcinogenicity, reference doses (RfD), reference concentrations (RfC), potency factors (PF), and unit risk factors (URF):

1. Information which forms the basis for drinking water standards adopted by the Department pursuant to the Safe Drinking Water Act, N.J.S.A. 58:12A-1 et seq., at N.J.A.C. 7:10;

2. The United States Environmental Protection Agency's (EPA) Integrated Risk Information System (IRIS) database; and

3. The EPA's Health Effects Assessment Summary Tables (HEAST) (September 1990).

(b) For a contaminant which is not addressed in the sources cited in (a) above, the Department shall develop toxicity factors based on a review of pertinent data.

7:26D-6.6 Human health-based criterion for building interiors

(a) The Department shall use the equations and approaches in this section to develop contaminant-specific human health-based criteria for building interior surfaces and for air in building interiors.

(b) A human health-based criterion for a contaminant on a building interior surface shall be developed as follows:

1. For a contaminant classified in Group A or Group B, the risk specific dose (RSD) from interior surfaces shall be calculated from the potency factor (PF) as follows:

$$RSD\ (mg/kg/day) = \frac{1 \times 10^{-6}}{PF\ (mg/kg/day)^{-1}}$$

i. A criterion for a contaminant on accessible surfaces (AS) shall be calculated as follows:

Criterion for AS (mg/m^2) =

$$\frac{RSD \times BWA \times \text{lifetime} \times 365 \text{ days/yr}}{0.5\,[AS + (2 \times IS)]}$$

Where: 0.5 = fraction of contamination which results in exposure to individual

ii. A criterion for a contaminant on inaccessible surfaces (IS) shall be calculated as follows:

Criterion for IS (mg/m^2) = 2 × criterion for AS (mg/m^2)

2. For a contaminant classified in Group D or Group E, the human health-based criterion shall be calculated as follows:

i. For a contaminant on accessible surfaces (AS):

Criterion for AS (mg/m^2) =

$$\frac{[RFD - MDI] \times BW \times NRTF \times (NRP/LL)}{0.5\,[AS + (2 \times IS)]}$$

Where: 0.5 = fraction of contamination which results in exposure to individual

ii. For a contaminant on inaccessible surfaces (IS):

Criterion for IS = 2 × criterion for AS

3. The human health-based criterion for a contaminant classified as Group C shall be calculated as follows:

i. For a contaminant for which an oral reference dose is available from the data sources cited in N.J.A.C. 7:26D-6.5(a), the criterion shall be derived as in (b)2 above, with incorporation of an additional uncertainty factor of 10 into the reference dose;

ii. For a contaminant for which an oral reference dose is not available from the data sources cited in N.J.A.C. 7:26D-6.5(a), the criterion shall be derived as in (b)1 above, based on an additional lifetime cancer risk of 1×10^{-6}.

(c) A health-based criterion for air in building interiors (C_{air}) shall be developed as follows:

1. For a contaminant classified in Group A or Group B, C_{air} shall be calculated from the unit risk factor (URF) as follows:

$$C_{air} = \frac{1 \times 10^{-6} \times (RP/LL)}{URF^{-1}}$$

Where: 1×10^{-6} = additional lifetime cancer risk;

2. For a contaminant classified in Group D or Group E, the health-based criterion (C_{air} (ug/m^3)) shall be the reference concentration; and

3. For a contaminant classified as Group C, the health-based criterion shall be calculated as follows:

i. For a contaminant for which a reference concentration is available from the sources given in N.J.A.C. 7:26D-6.5(a), the target air concentration shall be derived as in (c)2 above, with the incorporation of an additional uncertainty factor of 10 into the reference concentration.

ii. For a contaminant for which a reference concentration is not available from the sources given in N.J.A.C. 7:26D-6.5(a), the target air concentration shall be derived as in (c)1 above, based on an additional lifetime cancer risk of 1×10^{-6}.

7:26D-6.7 Human health-based criterion for surface soil

(a) The Department shall use the risk assessment approaches and assumptions in this section in developing contaminant-specific human health-based criterion for a contaminant in surface soil for the direct contact with soil, including incidental soil ingestion, and inhalation exposure pathways. The more stringent of the health-based criterion for direct contact and inhalation shall be the basis for the numeric cleanup standard.

(b) The Department shall use the following models to develop a contaminant-specific human health-based criteria for the direct

1. For a contaminant classified in Group A or Group B, the risk specific dose (RSD) of the contaminant shall be calculated from the potency factor (PF) as follows:

$$RSD\ (mg/kg/day) = \frac{1 \times 10^{-6}}{PF\ (mg/kg/day)^{-1}}$$

Where: 1×10^{-6} = additional lifetime cancer risk.

i. The human health-based criterion for a contaminant at a non-residential property (non-residential criterion) shall be calculated as follows:

Non-residential Criterion (ppm) =

$$\frac{RSD \times BWA \times 1 \times 10^{6}}{SIA \times NRTF \times (NRP/LL)}$$

Where: 1×10^{6} = factor to convert from mg to kg.

ii. The residential health-based criterion for a contaminant shall be calculated as follows:

Residential Criterion (ppm) =

$$\frac{RSD \times 1 \times 10^{6}}{\left(\frac{SIC}{BWC_c} \times \frac{5.5 \text{ years}}{LL}\right) + \left(\frac{SIA}{BWA} \times \frac{24 \text{ years}}{LL}\right)}$$

Where: 5.5 years = length of time for child soil ingestion rate;
24 years = length of time for adult soil ingestion rate, based on total of 30 years at residential site; and
1×10^{6} = factor to convert from mg to kg.

2. For a contaminant classified in Group D or Group E, the health-based criterion based on direct contact with soil shall be calculated from the reference dose (RfD) as follows:

i. The criterion for non-residential property shall be calculated as follows:

Non-residential Criterion (ppm) =

$$\frac{(RFD - MDI) \times BWA \times 1 \times 10^{6}}{SIA \times NRTF}$$

Where: 1×10^{6} = factor to convert from mg to kg.

ii. The human health-based criterion for a contaminant at a residential property shall be calculated as follows:

Residential Criterion (ppm) =

$$\frac{(RFD - MDI) \times BWC_c \times 1 \times 10^{6}}{SIC}$$

Where: 1×10^{6} = factor to convert from mg to kg.

3. Human health-based criterion for a contaminant classified as Group C shall be derived as follows:

i. For a contaminant for which a reference dose is available from one of the data sources cited in N.J.A.C. 7:26D-6.5(a), the criterion shall be derived as described in (b)2 above, with an additional uncertainty factor of 10 incorporated into the reference dose; and

ii. For a contaminant for which a reference dose is not available from one of the data sources cited in N.J.A.C. 7:26D-6.5(a), the criterion shall be derived as described in (b)1 above, based on an additional lifetime cancer risk of 1×10^{-6}.

(c) The Department shall use the models and assumptions given below to evaluate the risks from contaminants in the surface soil through the inhalation route of exposure. Inhalation of particulate matter (consisting of semivolatile organic compounds, pesticides and metals) through wind and vehicle erosion, and inhalation of volatile and semivolatile organic compounds through volatilization, are evaluated for this purpose.

1. A contaminant-specific target air concentrations (C_{air}) based on inhalation of volatile and semivolatile organic compounds through volatilization, shall be calculated as follows:

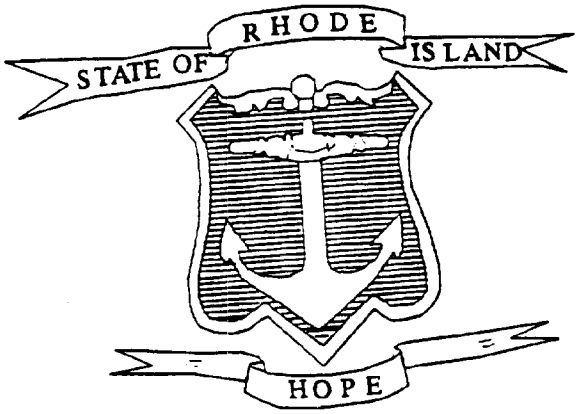
i. For a contaminant classified in Group A or Group B, a C_{air}

RULES AND REGULATIONS FOR LEAD POISONING PREVENTION

[R 23-24.6-PB]

FEBRUARY 1992 (E)

AS AMENDED
MARCH 1992 (E)
JULY 1992 (E)
OCTOBER 1992
FEBRUARY 1993 (E)
MAY 1993



RHODE ISLAND DEPARTMENT OF HEALTH

ENVIRONMENTAL LEAD PROGRAM

PART B
COMPREHENSIVE ENVIRONMENTAL LEAD INSPECTIONS, ENVIRONMENTAL LEAD STANDARDS, METHODS OF MEASUREMENT, AND REPORTING REQUIREMENTS

B.1 COMPREHENSIVE ENVIRONMENTAL LEAD INSPECTIONS

B.1.1 General Requirement. (a) A Comprehensive Environmental Lead Inspection shall be required for determining lead-safe or lead-free status. Comprehensive Environmental Lead Inspections shall be conducted only by an Environmental Lead Inspector or Environmental Lead Inspector Technician certified pursuant to Subpart D.3 of these regulations.

(1) Meaning of Lead-Free. A condition or state requiring no lead hazard reduction because either there is no lead present or there is lead present in amounts less than the standards established in Subpart B.2 of these regulations. The identification of a surface, object, material, substance, or medium (e.g. water, soil, dust) as being lead-free (i.e. as having an acceptable lead level) indicates that, at the time of inspection/evaluation, it does not contain sufficient available lead to contribute in a meaningful or significant way to lead poisoning for a child who might potentially be exposed to it. A lead-free condition would be expected to persist (i.e. remain lead-free) indefinitely unless additional lead is added to the surface, object, material, substance, or medium. A dwelling, dwelling unit, or premises shall only be fully lead-free if all of the surfaces, objects, materials, substances, and media within or on it are lead-free.

(2) Meaning of Lead-Safe. A condition or state posing no significant environmental lead exposure hazard to occupants or other persons, despite the presence of materials, surfaces or substances with lead concentrations above acceptable lead levels, as a result of actions and/or conditions established in Subpart B.2 of these regulations. The identification of a surface, object, material, substance, or medium (e.g. water, soil, dust) as being lead-safe indicates that, at the time of inspection/evaluation, it is in a condition that prevents inherently-contained lead from being accessible to a child in sufficient amounts to contribute in a meaningful or significant way to lead poisoning for a child exposed to it. A lead-safe condition persists (i.e. remains lead-safe) only for as long as the conditions or factors providing protection from the inherently-contained lead remain intact and effective. A dwelling, dwelling unit, or premises shall only be fully lead-safe if all of the surfaces, objects, materials, substances, and media within or on it are lead-safe.

(b) Notwithstanding the provisions of Paragraph B.1.1(a) of these regulations, the notification and reporting requirements specified by Subpart B.5 of these regulations, as well as any recommendations to owners or occupants regarding lead hazard reduction, shall only be performed by an Environmental Lead Inspector certified pursuant to Subpart D.3 of these regulations.

(c) Applicability and Scope. Comprehensive Environmental Lead Inspections shall be performed to identify:

(1) Significant environmental lead hazards, as defined in these regulations, which are required to undergo lead hazard reduction activities in accordance with Part C of these regulations; and

(2) Potential lead exposure hazards which are required to be addressed by an Environmental Lead Management Plan, as specified in Section B.1 7 of these regulations.

(d) A Comprehensive Environmental Lead Inspection shall be conducted for a dwelling, dwelling unit, or premises as follows:

(1) The Department shall conduct Comprehensive Environmental Lead Inspections of the homes of significantly lead poisoned children as part of treatment and follow-up;

(2) The Department shall conduct Comprehensive Environmental Lead Inspections of all licensed child care facilities in the State, including licensed preschools, day-cares, nursery schools, public and private elementary schools, playgrounds, and shelters and foster homes serving children under seventy-two (72) months of age;

B.2.3(b)(2)(i)(b)

(b) Prevent infants from contacting floors and carpets by placing them on blankets, sheets or other washable coverings; and

(c) Control excessive ingestion of dust by children under seventy-two (72) months of age.

(ii) Five hundred (500) ppm to one thousand (1000) ppm if the Environmental Lead Management Plan includes requirements to:

(a) Control dust generation and abrasion of lead-containing paint; and

(b) Prevent infants from contacting floors and carpets by placing them on blankets, sheets or other washable coverings; and

(c) Control excessive ingestion of dust by children under seventy-two (72) months of age; and

(d) Prevent dust accumulation.

(3) Unacceptable Levels. Lead levels that are in excess of one thousand (1000) ppm in interior dus shall be considered significant lead hazards (unacceptable) and shall require lead hazard reductior in accordance with Part C of these regulations.

(c) Wipe Samples. The standards for wipe samples shall be defined as follows:

(1) The permissible standard for lead in interior dust (standard for lead-safe) shall be less than tw hundred micrograms per square foot (200 ug/ft^2) on floors, and/or less than five hundred (500 ug/ft^2 on window sills, and/or less than eight hundred (800) ug/ft^2 in window wells, if the Environmental Lead Management Plan includes requirements to:

(i) Control dust generation and abrasion of lead-containing paint; and

(ii) Control excessive ingestion of dust by children under seventy-two (72) months of age; an

(iii) Prevent dust accumulation; and

(iv) Cover floors of the area(s) where children spend most of their time playing with throw rugs washable spreads or other coverings which can be thoroughly cleaned.

(2) Unacceptable Levels. Lead levels in interior dust that are in excess of two hundred (200) ug/ft on floors, and/or in excess of five hundred (500) ug/ft^2 on window sills, and/or in excess of eigh hundred (800) ug/ft^2 in window wells shall be considered significant lead hazards (unacceptable and shall require lead hazard reduction in accordance with Part C of these regulations.

(3) Composite Samples. In the case of composite samples from window sills and window wells criteria for window sills (i.e. less than five hundred (500) ug/ft^2) shall be used.

B.2.4 Lead in Soil and Exterior Dust. (a) The acceptable, permissible and unacceptable concentrations o lead in soil and in exterior dust shall be determined by the technique used to collect the sample and, fc wipe samples, the area which is sampled.

(b) Vacuum Samples. The standards for vacuum samples shall be defined as follows:

(1) The acceptable standard for lead in soil and in exterior dust (standard for lead-free) shall be les than one hundred and fifty (150) ppm.

(2) The permissible standard for lead in soil and in exterior dust (standard for lead-safe) shall be

(i) One hundred and fifty (150) ppm to five hundred (500) ppm if the Environmental Lea Management Plan includes requirements to prevent:

Draft

U.S. DEPARTMENT OF THE NAVY
INSTALLATION RESTORATION PROGRAM

VOLUME II
REMEDIAL INVESTIGATION REPORT:

HUMAN HEALTH RISK ASSESSMENT
TECHNICAL REPORT & APPENDICES A-Q

NAVAL CONSTRUCTION BATTALION CENTER
DAVISVILLE, RHODE ISLAND

Contract No. N62472-86-C-1282
November, 1993

Prepared For:
Northern Division
Naval Facilities Engineering Command
Lester, Pennsylvania

TRC
TRC Environmental Corporation

5 Waterside Crossing
Windsor, CT 06095
(203) 289-8631 FAX (203) 298-6399

TABLE 2-2
SUMMARY OF BACKGROUND DATA FOR INORGANICS IN SURFACE SOIL
NCBC - DAVISVILLE

	Range of Concentrations at NCBC Background Locations (a) (mg/kg)	Range of Concentrations at Eastern U.S. Background Locations (b) (mg/kg)
INORGANICS		
Aluminum	1,170-12,600	7-100,000
Antimony	ND-3	ND-8.8
Arsenic	0.59-8.1	ND-73
Barium	5.6-19.8	10-1,500
Beryllium	ND-0.77	ND-7
Cadmium	ND-0.46	NA
Calcium	62.7-628	100-280,000
Chromium	ND-11	1-1,000
Cobalt	ND-4.6	ND-70
Copper	ND-15	ND-700
Cyanide	ND-0.17	NA
Iron	3,810-13,200	100-100,000
Lead	3.4-55.9	ND-300
Magnesium	325-1,220	50-50,000
Manganese	21.8-150	ND-7,000
Mercury	ND-0.06	ND-3.4
Nickel	ND-7.5	ND-700
Potassium	ND-728	50-37,000
Selenium	ND-0.77	ND-3.9
Silver	ND-0.22	NA
Sodium	ND-139	ND-50,000
Thallium	ND-0.24	NA
Vanadium	3.3-24.6	ND-300
Zinc	10.3-172	ND-2,900

NA = not available
ND = not detected
(a) Collected from unimpacted areas at Sites 02, 07, 09, and 10, and wooded areas east of Sites 06, 11, and 13
(b) U.S.G.S (1984)

Tygon™ tubing was obtained for use in the peristaltic pumps instead of the approved silicon tubing. This was not detected until after TRC had mobilized into the field. A decision was made to proceed with ground water sampling using the Tygon™ tubing in the peristaltic pumps. Silicon tubing was ordered and the ground water sampling proceeded. The silicon tubing arrived at the end of the first week of ground water sampling and was used exclusively during the second week of ground water sampling.

Upon receipt of SVOC ground water data the following trend was noted. All ground water samples collected using the Tygon™ tubing in the peristaltic pump detected bis(2-ethylhexyl)phthalate. TRC believes that bis(2-ethylhexyl)phthalate leached from the Tygon™ tubing. The low flow ground water sampling technique used required that the outflow from the peristaltic pump be throttled down to <500 ml/minute. The low flow caused the Tygon™ tubing in the peristaltic pump to heat up. The increased heat of the tubing along with longer contact time with the ground water allowed high concentrations of bis(2-ethylhexyl)phthalate to leach into the ground water samples.

The presence of bis(2-ethylhexyl)phthalate in the ground water is attributed to sampling contamination rather than physical contamination of the aquifer.

10) A total of 22 background soil samples were collected during Phase II (see Figure 2-3). Background samples were collected in unimpacted areas located as close to the NCBC sites as possible. Identification of areas at or near each site that have not been impacted by NCBC activities was made on the basis of historical aerial photographs. For Sites 02, 07, 09, and 10, unimpacted areas were identified on-site. For Sites 06, 11, and 13, background locations were identified in wooded areas located east of these sites. The concentrations of inorganics in the NCBC background samples are used as a screening method to evaluate whether these constituents in site surface soils are naturally occurring or of anthropogenic origin. Constituents of anthropogenic origin (i.e., present as a result of human activities) may or may not be site-related. An inorganic is excluded from the HHRA if 95% or more of the detected concentrations fall below the maximum background concentration reported for the NCBC facility for that constituent. Table 2-2 provides the range of concentrations for each inorganic constituent at NCBC Davisville. For comparison, the ranges for background levels in eastern U.S. soils are also provided. As shown, the maximum detected background concentrations at NCBC consistently fall below those reported for eastern U.S. soils. Organic constituents present in background samples are not considered naturally occurring and are not used to evaluate the presence and concentration of organics in site samples (EPA, 1992b). Background ground water data for the NCBC facility or national/regional data are unavailable.

DRINKING WATER REGULATIONS

AND HEALTH ADVISORIES

by

Office of Water
U.S. Environmental Protection Agency
Washington, D.C.
202-260-7571

SAFE DRINKING WATER HOTLINE
1-800-426-4791
Monday thru Friday, 8:30 AM to 5:00 PM EST

December 1993

LEGEND

Abbreviations column descriptions are:

MCLG - Maximum Contaminant Level Goal. A non-enforceable concentration of a drinking water contaminant that is protective of adverse human health effects and allows an adequate margin of safety.

MCL - Maximum Contaminant Level. Maximum permissible level of a contaminant in water which is delivered to any user of a public water system.

RfD - Reference Dose. An estimate of a daily exposure to the human population that is likely to be without appreciable risk of deleterious effects over a lifetime.

DWEL - Drinking Water Equivalent Level. A lifetime exposure concentration protective of adverse, non-cancer health effects, that assumes all of the exposure to a contaminant is from a drinking water source.

(*) The codes for the Status Reg and Status HA columns are as follows:

F - final
D - draft
L - listed for regulation
P - proposed
T - tentative

Other codes found in the table include the following:

NA - not applicable
PS - performance standard 0.5 NTU - 1.0 NTU
TT - treatment technique

** - No more than 5% of the samples per month may be positive. For systems collecting fewer than 40 samples/month, no more than 1 sample per month may be positive.

*** - guidance

- Large discrepancies between Lifetime and Longer-term HA values may occur because of the Agency's conservative policies, especially with regard to carcinogenicity, relative source contribution, and less than lifetime exposures in chronic toxicity testing. These factors can result in a cumulative UF (uncertainty factor) of 10 to 1000 when calculating a Lifetime HA.

Drinking Water Standards and Health Advisories

December 1993

Chemicals	Standards			Status HA	Health Advisories								Cancer Group
					10-kg Child			70-kg Adult					
	Status Reg.	MCLG (mg/l)	MCL (mg/l)		One-day (mg/l)	Ten-day (mg/l)	Longer-term (mg/l)	Longer-term (mg/l)	RfD (mg/kg/day)	DWEL (mg/l)	Lifetime (mg/l)	mg/l at 10^{-4} Cancer Risk	
ORGANICS													
Acenaphthene	-	-	-	-	-	-	-	-	0.06	-	-	-	-
Acifluorfen	T	zero	-	F	2	2	0.1	0.4	0.013	0.4	-	0.1	B2
Acrylamide	F	zero	TT	F	*0.2*	*0.2*	*0.01*	*0.04*	*0.001*	*0.04*	-	0.001	B2
Acrylonitrile	T	zero	-	D	-	-	-	-	-	-	-	0.006	B1*
Adipate (diethylhexyl)	*F*	*0.4*	*0.4*	-	*20*	*20*	*20*	*60*	*0.6*	*20*	*0.4*	*3*	C
Alachlor	F	zero	0.002	F	0.1	0.1	-	-	0.01	0.4	-	0.04	B2
Aldicarb	*D*	*0.007*	*0.007*	*D*	-	-	-	-	0.001	0.035	0.007	-	D
Aldicarb sulfone	*D*	*0.007*	*0.007*	*D*	-	-	-	-	0.001	0.035	0.007	-	D
Aldicarb sulfoxide	*D*	*0.007*	*0.007*	*D*	-	-	-	-	0.001	0.035	0.007	-	D
Aldrin	-	-	-	D	0.0003	0.0003	0.0003	0.0003	0.00003	0.001	-	0.0002	B2
Ametryn	-	-	-	F	9	9	0.9	3	0.009	0.3	0.06	-	D
Ammonium sulfamate	-	-	-	F	20	20	20	80	0.28	8	2	-	D
Anthracene (PAH)	-	-	-	-	-	-	-	-	0.3	-	-	-	D
Atrazine	F	0.003	0.003	F	0.1	0.1	0.05	0.2	0.035	0.2*	0.003*	-	C
Baygon	-	-	-	F	0.04	0.04	0.04	0.1	0.004	0.1	0.003	-	C
Bentazon	T	0.02	-	F	0.3	0.3	0.3	0.9	0.0025	0.09	0.02	-	D
Benz(a)anthracene (PAH)	P	zero	0.0001	-	-	-	-	-	-	-	-	-	B2
Benzene	F	zero	0.005	F	0.2	0.2	-	-	-	-	-	0.1	A
Benzo(a)pyrene (PAH)	F	zero	0.0002	-	-	-	-	-	-	-	-	-	B2*
Benzo(b)fluoranthene (PAH)	P	zero	0.0002	-	-	-	-	-	-	-	-	-	B2
Benzo(g,h,i)perylene (PAH)	-	-	-	-	-	-	-	-	-	-	-	-	D
Benzo(k)fluoranthene (PAH)	P	zero	0.0002	-	-	-	-	-	-	-	-	-	B2
bis-2-Chloroisopropyl ether	-	-	-	-	-	-	-	-	-	-	-	-	D
Bromacil	L	-	-	F	4	4	4	13	0.04	1	0.3	-	C
Bromobenzene	L	-	-	F	5	5	3	9	0.13	5	0.09	-	-
				D	-	-	-	-	-	-	-	-	-

* Under review.

NOTE: Anthracene and Benzo(g,h,i)perylene — not proposed in Phase V.

NOTE: Changes from the last version are noted in Italic and Bold Face print.

Drinking Water Standards and Health Advisories

ɜmber 1993

Chemicals	Standards			Status HA	Health Advisories								Cancer Group
					10-kg Child			70-kg Adult					
	Status Reg.	MCLG (mg/l)	MCL (mg/l)		One-day (mg/l)	Ten-day (mg/l)	Longer-term (mg/l)	Longer-term (mg/l)	RfD (mg/kg/day)	DWEL (mg/l)	Lifetime (mg/l)	mg/l at 10^{-4} Cancer Risk	
omochloroacetonitrile	L	-	-	D	-	-	-	-	-	-	-	-	-
omochloromethane	-	-	-	F	60	1	1	5	0.013	0.5	0.09	-	-
omodichloromethane (THM)	T	zero	0.1* +	D	7	7	4	13	0.02	0.7	-	0.06	B2
romoform (THM)	T	zero	0.1* +	D	6	2	2	6	0.02	0.7	-	0.4	B2
romomethane	T	-	-	F	0.1	0.1	0.1	0.5	0.001	0.04	0.01	-	D
utyl benzyl phthalate (PAE)	P	zero	0.1	-	-	-	-	-	0.2	6	-	-	C
utylate	-	-	-	F	2	2	1	4	0.05	2	0.35	-	D
utylbenzene n-	-	-	-	D	-	-	-	-	-	-	-	-	-
utylbenzene sec-	-	-	-	D	-	-	-	-	-	-	-	-	-
utylbenzene tert-	-	-	-	D	-	-	-	-	-	-	-	-	-
arbaryl	-	-	-	F	1	1	1	1	0.1	4	0.7	-	D
arbofuran	F	0.04	0.04	F	0.05	0.05	0.05	0.2	0.005	0.2	0.04	-	E
arbon tetrachloride	F	zero	0.005	F	4	0.2	0.07	0.3	0.0007	0.03	-	0.03	B2
arboxin	-	-	-	F	1	1	1	4	0.1	4	0.7	-	D
hloral hydrate	T	0.06	-	D	7	1.4	0.2	0.6	0.0002	0.07	0.06	-	C
hloramben	-	-	-	F	3	3	0.2	0.5	0.015	0.5	0.1	-	D
hlordane	F	zero	0.002	F	0.06	0.06	-	-	0.00006	0.002	-	0.003	B2
hlorodibromomethane (THM)	T	zero	0.1* +	D	7	7	2	8	0.02	0.7	0.06	-	C
hloroethane	L	-	-	D	-	-	-	-	-	-	-	-	-
hloroform (THM)	T	zero	0.1* +	D	4	4	0.1	0.4	0.01	0.4	-	0.6	B2
hloromethane	L	-	-	F	9	0.4	0.4	1	0.004	0.1	0.003	-	C
Chlorophenol (2-)	-	-	-	D	0.05	0.05	0.05	0.2	0.005	0.2	0.04	-	D
p-Chlorophenyl methyl sulfide/sulfone/sulfoxide	-	-	-	-	-	-	-	-	-	-	-	-	D
Chloropicrin	L	-	-	-	-	-	-	-	-	-	-	-	-
Chlorothalonil	-	-	-	F	0.2	0.2	0.2	0.5	0.015	0.5	-	0.15	B2
Chlorotoluene o-	L	-	-	F	2	2	2	7	0.02	0.7	0.1	-	D
Chlorotoluene p-	L	-	-	F	2	2	2	7	0.02	0.7	0.1	-	D
Chlorpyrifos	-	-	-	F	0.03	0.03	0.03	0.1	0.003	0.1	0.02	-	D
Chrysene (PAH)	P	zero	0.0002	-	-	-	-	-	-	-	-	-	B2
Cyanazine	T	0.001	-	D	0.1	0.1	0.02	0.07	0.002	0.07	0.001	-	C

Total cannot exceed 0.1 for all THMS NOTE: Chrysene was proposed in second option.

Drinking Water Standards and Health Advisories

December 1993

Chemicals	Standards			Status HA	Health Advisories								Cancer Group
					10-kg Child			70-kg Adult					
	Status Reg.	MCLG (mg/l)	MCL (mg/l)		One-day (mg/l)	Ten-day (mg/l)	Longer-term (mg/l)	Longer-term (mg/l)	RfD (mg/kg/day)	DWEL (mg/l)	Lifetime (mg/l)	mg/l at 10^{-4} Cancer Risk	
Cyanogen chloride	L	-	-	-	-	-	-	-	-	-	-	-	-
Cymene p-	-	-	-	D	-	-	-	-	-	-	-	-	-
2,4-D	F	0.07	0.07	F	1	0.3	0.1	0.4	0.01	0.4	0.07	-	D
DCPA (Dacthal)	L	-	-	F	80	80	5	20	0.5	20	4	-	D
Dalapon	F	0.2	0.2	F	3	3	0.3	0.9	0.026	0.9	0.2	-	D
Di(2-ethylhexyl)adipate	F	0.4	0.4	-	20	20	20	60	0.6	20	0.4	3	C
Diazinon	-	-	-	F	0.02	0.02	0.005	0.02	0.00009	0.003	0.0006	-	E
✓ Dibenz(a,h)anthracene (PAH)	P	zero	0.0003	-	-	-	-	-	-	-	-	-	B2
Dibromoacetonitrile	L	-	-	D	2	2	2	8	0.02	0.8	0.02	-	C
Dibromochloropropane (DBCP)	F	zero	0.0002	F	0.2	0.05	-	-	-	-	-	0.003	B2
Dibromomethane	L	-	-	-	-	-	-	-	-	-	-	-	D
Dibutyl phthalate (PAE)	-	-	-	-	-	-	-	-	-	-	-	-	D
Dicamba	L	-	-	F	0.3	0.3	0.3	-	0.1	4	-	-	D
Dichloroacetaldehyde	L	-	-	D	-	-	-	1	0.03	1	0.2	-	D
Dichloroacetic acid	T	zero	-	D	1	1	1	-	-	-	-	-	-
Dichloroacetonitrile	L	-	-	D	1	1	0.8	4	0.04	0.1	-	-	B2
✓ Dichlorobenzene o- (1,2 1,4)	F	0.6	0.6	F	9	9	9	3	0.008	0.3	0.006	-	C
Dichlorobenzene m- * (1,3)	F	0.6	0.6	F	9	9	9	30	0.09	3	0.6	-	D
✓ Dichlorobenzene p- (1,4-)	F	0.075	0.075	F	10	10	10	30	0.09	3	0.6	-	D
Dichlorodifluoromethane	L	-	-	F	40	40	9	40	0.1	4	0.075	-	C
✓ Dichloroethane (1,1-)	L	-	-	D	-	-	-	30	0.2	5	1	-	D
✓ Dichloroethane (1,2-)	F	zero	0.005	F	0.7	0.7	0.7	-	-	-	-	-	-
✓ Dichloroethylene (1,1-)	F	0.007	0.007	F	2	1	1	2.6	-	-	-	0.04	B2
✓ Dichloroethylene (cis-1,2-)	F	0.07	0.07	F	4	3	3	4	0.009	0.4	0.007	-	C
Dichloroethylene (trans-1,2-)	F	0.1	0.1	F	20	2	2	11	0.01	0.4	0.07	-	D
✓ Dichloromethane	F	zero	0.005	F	10	2	-	6	0.02	0.6	0.1	-	D
Dichlorophenol (2,4-)	-	-	-	D	0.03	0.03	0.03	-	0.06	2	-	0.5	B2
Dichloropropane (1,1-)	-	-	-	D	-	-	-	0.1	0.003	0.1	0.02	-	D
✓ Dichloropropane (1,2-)	F	zero	0.005	F	-	0.09	-	-	-	-	-	-	-
Dichloropropane (1,3-)	L	-	-	D	-	-	-	-	-	-	-	0.05	B2

* The values for m-dichlorobenzene are based on data for o-dichlorobenzene.

Drinking Water Standards and Health Advisories

cember 1993

Chemicals	Standards			Status HA	Health Advisories								Cancer Group
					10-kg Child			70-kg Adult					
	Status Reg.	MCLG (mg/l)	MCL (mg/l)		One-day (mg/l)	Ten-day (mg/l)	Longer-term (mg/l)	Longer-term (mg/l)	RfD (mg/kg/day)	DWEL (mg/l)	Lifetime (mg/l)	mg/l at 10^{-4} Cancer Risk	
Dichloropropane (2,2-)	L	-	-	D	-	-	-	-	-	-	-	-	-
Dichloropropene (1,1-)	L	-	-	D	-	-	-	-	-	-	-	-	-
Dichloropropene (1,3-)	T	zero	-	F	0.03	0.03	0.03	*0.09*	0.0003	0.01	-	0.02	B2
Dieldrin	-	-	-	F	0.0005	0.0005	0.0005	0.002	0.00005	0.002	-	0.0002	B2
Diethyl phthalate (PAE)	-	-	-	D	-	-	-	-	0.8	30	6	-	D
Diethylene glycol dinitrate	-	-	-	**	-	-	-	-	-	-	-	-	-
Diethylhexyl phthalate (PAE)	F	zero	0.006	D	-	-	-	-	0.02	0.7	-	0.3	B2*
Diisopropyl methylphosphonate	-	-	-	F	8	8	8	30	0.08	3	0.6	-	D
Dimethrin	-	-	-	F	10	10	10	40	0.3	10	2	-	D
Dimethyl methylphosphonate	-	-	-	F	2	2	2	6	0.2	7	0.1	0.7	C
Dimethyl phthalate (PAE)	-	-	-	-	-	-	-	-	-	-	-	-	D
1,3-Dinitrobenzene	-	-	-	F	0.04	0.04	0.04	0.14	0.0001	0.005	0.001	-	D
Dinitrotoluene (2,4-)	L	-	-	F	0.50	0.50	0.30	1	0.002	0.1	-	-	-
Dinitrotoluene (2,6-)	L	-	-	F	0.40	0.40	0.40	1	0.001	0.04	-	-	-
tg 2,6 & 2,4 dinitrotoluene ***	-	-	-	-	-	-	-	-	-	-	-	0.005	B2
Dinoseb	F	0.007	0.007	F	0.3	0.3	0.01	0.04	0.001	0.04	0.007	-	D
Dioxane p-	-	-	-	F	4	0.4	-	-	-	-	-	0.7	B2
Diphenamid	-	-	-	F	0.3	0.3	0.3	1	0.03	1	0.2	-	D
Diphenylamine	-	-	-	F	1	1	0.3	1	0.03	1	0.2		D
Diquat	F	0.02	0.02	-	-	-	-	-	0.0022	0.08	0.02	-	D
Disulfoton	-	-	-	F	0.01	0.01	0.003	0.009	0.00004	0.001	0.0003	-	E
Dithiane (1,4-)	-	-	-	F	0.4	0.4	0.4	1	0.01	0.4	0.08	-	D
Diuron	-	-	-	F	1	1	0.3	0.9	0.002	0.07	0.01	-	D
Endothall	F	0.1	0.1	F	0.8	0.8	0.2	0.2	0.02	0.7	0.1	-	D
Endrin	F	0.002	0.002	F	0.02	0.02	0.003	0.01	0.0003	0.01	0.002	-	D
Epichlorohydrin	F	zero	TT	F	0.1	0.1	0.07	0.07	0.002	0.07	-	0.4	B2
Ethylbenzene	F	0.7	0.7	F	30	3	1	3	0.1	3	0.7	-	D
Ethylene dibromide (EDB)	F	zero	0.00005	F	0.008	0.008	-	-	-	-	-	0.00004	B2
Ethylene glycol	-	-	-	F	20	6	6	20	2	40	7	-	D
ETU	L	-	-	F	0.3	0.3	0.1	0.4	0.00008	0.003	-	0.03	B2
Fenamiphos	-	-	-	F	0.009	0.009	0.005	0.02	0.00025	0.009	0.002	-	D

... developed due to insufficient data; a "Database Deficiency Report" has been published.

Drinking Water Standards and Health Advisories

December 1993

Chemicals	Standards			Status HA	Health Advisories								Cancer Group
					10-kg Child			70-kg Adult					
	Status Reg.	MCLG (mg/l)	MCL (mg/l)		One-day (mg/l)	Ten-day (mg/l)	Longer-term (mg/l)	Longer-term (mg/l)	RfD (mg/kg/day)	DWEL (mg/l)	Lifetime (mg/l)	mg/l at 10^{-4} Cancer Risk	
Fluometron	-	-	-	F	2	2	2	6	0.013	0.4	0.09	-	D
Fluorene (PAH)	-	-	-	-	-	-	-	-	0.04	-	-	-	D
Fluorotrichloromethane	L	-	-	F	7	7	3	10	0.3	10	2	-	D
Fog Oil	-	-	-	D	-	-	-	-	-	-	-	-	-
Fonofos	-	-	-	F	0.02	0.02	0.02	0.07	0.002	0.07	0.01	-	D
Formaldehyde	-	-	-	D	10	5	5	20	0.15	5	1	-	B1
Gasoline, unleaded (benzene)	-	-	-	D	-	-	-	-	-	-	0.005	-	-
Glyphosate	F	0.7	0.7	F	20	20	1	1	0.1	4	0.7	-	E
Heptachlor	F	zero	0.0004	F	0.01	0.01	0.005	0.005	0.0005	0.02	-	0.0008	B2
Heptachlor epoxide	F	zero	0.0002	F	0.01	-	0.0001	0.0001	1E-5	0.0004	-	0.0004	B2
Hexachlorobenzene	F	zero	0.001	F	0.05	0.05	0.05	0.2	0.0008	0.03	-	0.002	B2
Hexachlorobutadiene	T	0.001	-	F	0.3	0.3	0.1	0.4	0.002	0.07	0.001	-	C
Hexachlorocyclopentadiene	F	0.05	0.05	-	-	-	-	-	0.007	0.2	-	-	D
Hexachloroethane	L	-	-	F	5	5	0.1	0.5	0.001	0.04	0.001	-	C
Hexane (n-)	-	-	-	F	10	4	4	10	-	-	-	-	D
Hexazinone	-	-	-	F	3	3	3	9	0.033	1	0.2	-	D
HMX	-	-	-	F	5	5	5	20	0.05	2	0.4	-	D
Indeno(1,2,3,-c,d)pyrene (PAH)	P	zero	0.0004	D	-	-	-	-	-	-	-	-	B2
Isophorone	L	-	-	F	15	15	15	15	0.2	7	0.1	4	C
Isopropyl methylphosphonate	-	-	-	D	30	30	30	100	0.1	4.0	0.7	-	D
Isopropylbenzene	-	-	-	D	-	-	-	-	-	-	-	-	-
Lindane	F	0.0002	0.0002	F	1	1	0.03	0.1	0.0003	0.01	0.0002	-	C
Malathion	-	-	-	F	0.2	0.2	0.2	0.8	0.02	0.8	0.2	-	D
Maleic hydrazide	-	-	-	F	10	10	5	20	0.5	20	4	-	D
MCPA	-	-	-	F	0.1	0.1	0.1	0.4	0.0015	0.05	0.01	-	E
Methomyl	L	-	-	F	0.3	0.3	0.3	0.3	0.025	0.9	0.2	-	D
Methoxychlor	F	0.04	0.04	F	0.05	0.05	0.05	0.2	0.005	0.2	0.04	-	D
Methyl ethyl ketone	-	-	-	F	-	-	-	-	-	-	-	-	*
Methyl parathion	-	-	-	F	0.3	0.3	0.03	0.1	0.00025	0.009	0.002	-	D

Under review.

Drinking Water Standards and Health Advisories

ember 1993

Chemicals	Standards			Status HA	Health Advisories								Cancer Group
					10-kg Child			70-kg Adult					
	Status Reg.	MCLG (mg/l)	MCL (mg/l)		One-day (mg/l)	Ten-day (mg/l)	Longer-term (mg/l)	Longer-term (mg/l)	RfD (mg/kg/day)	DWEL (mg/l)	Lifetime (mg/l)	mg/l at 10^{-4} Cancer Risk	
Methyl tert butyl ether	L	-	-	D	3	3	0.5	2	0.005	0.2	0.04	-	D
Metolachlor	L	-	-	F	2	2	2	5	0.15	5	0.1	-	C
Metribuzin	L	-	-	F	5	5	0.3	0.9	0.025	0.9	0.2	-	D
Monochloroacetic acid	L	-	-	D	-	-	-	-	-	-	-	-	-
Monochlorobenzene	F	0.1	0.1	F	2	2	2	7	0.02	0.7	0.1	-	D
Naphthalene	-	-	-	F	0.5	0.5	0.4	1	0.004	0.1	0.02	-	D
Nitrocellulose (non-toxic)	-	-	-	F	-	-	-	-	-	-	-	-	-
Nitroguanidine	-	-	-	F	10	10	10	40	0.1	4	0.7	-	D
Nitrophenol p-	-	-	-	F	0.8	0.8	0.8	3	0.008	0.3	0.06	-	D
Oxamyl (Vydate)	F	0.2	0.2	F	0.2	0.2	0.2	0.9	0.025	0.9	0.2	-	E
Paraquat	-	-	-	F	0.1	0.1	0.05	0.2	0.0045	0.2	0.03	-	E
Pentachloroethane	-	-	-	D	-	-	-	-	-	-	-	-	-
Pentachlorophenol	F	zero	0.001	F	1	0.3	0.3	1	0.03	1	-	0.03	B2
Phenanthrene (PAH)	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenol	-	-	-	D	6	6	6	20	0.6	20	4	-	D
Picloram	F	0.5	0.5	F	20	20	0.7	2	0.07	2	0.5	-	D
Polychlorinated biphenyls (PCBs)	F	zero	0.0005	P	-	-	-	-	-	-	-	0.0005	B2
Prometon	L	-	-	F	0.2	0.2	0.2	0.5	0.015*	0.5*	0.1*	-	D
Pronamide	-	-	-	F	0.8	0.8	0.8	3	0.075	3	0.05	-	C
Propachlor	-	-	-	F	0.5	0.5	0.1	0.5	0.013	0.5	0.09	-	D
Propazine	-	-	-	F	1	1	0.5	2	0.02	0.7	0.01	-	C
Propham	-	-	-	F	5	5	5	20	0.02	0.6	0.1	-	D
Propylbenzene n-	-	-	-	D	-	-	-	-	-	-	-	-	-
Pyrene (PAH)	-	-	-	-	-	-	-	-	0.03	-	-	-	D
RDX	-	-	-	F	0.1	0.1	0.1	0.4	0.003	0.1	0.002	0.03	C
Simazine	F	0.004	0.004	F	0.07	0.07	0.07	0.07	0.005	0.2	0.004	-	C
Styrene	F	0.1	0.1	F	20	2	2	7	0.2	7	0.1	-	C
2,4,5-T	L	-	-	F	0.8	0.8	0.8	1	0.01	0.35	0.07	-	D
2,3,7,8-TCDD (Dioxin)	F	zero	3E-08	F	1E-06	1E-07	1E-08	4E-08	1E-09	4E-08	-	2E-08	B2

Under review. NOTE: Phenanthrene — not proposed.

Drinking Water Standards and Health Advisories

December 1993

Chemicals	Standards			Status HA	Health Advisories								Cancer Group
					10-kg Child			70-kg Adult					
	Status Reg.	MCLG (mg/l)	MCL (mg/l)		One-day (mg/l)	Ten-day (mg/l)	Longer-term (mg/l)	Longer-term (mg/l)	RfD (mg/kg/day)	DWEL (mg/l)	Lifetime (mg/l)	mg/l at 10^{-4} Cancer Risk	
Tebuthiuron	-	-	-	F	3	3	0.7	2	0.07	2	0.5	-	D
Terbacil	-	-	-	F	0.3	0.3	0.3	0.9	0.013	0.4	0.09	-	E
Terbufos	-	-	-	F	0.005	0.005	0.001	0.005	0.00013	0.005	0.0009	-	D
Tetrachloroethane (1,1,1,2-)	L	-	-	F	2	2	0.9	3	0.03	1	0.07	0.1	C
Tetrachloroethane (1,1,2,2-)	L	-	-	D	-	-	-	-	-	-	-	-	-
Tetrachloroethylene	F	zero	0.005	F	2	2	1	5	0.01	0.5	-	0.07	-
Tetranitromethane	-	-	-	**	-	-	-	-	-	-	-	-	-
Toluene	F	1	1	F	20	2	2	7	0.2	7	1	-	D
Toxaphene	F	zero	0.003	F	0.5	0.04	-	-	0.1	0.0035	-	0.003	B2
2,4,5-TP	F	0.05	0.05	F	0.2	0.2	0.07	0.3	0.0075	0.3	0.05	-	D
1,1,2-Trichloro-1,2,2-trifluoroethane	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroacetic acid	T	0.1	-	D	4	4	4	13	0.1	4.0	0.3	-	C
Trichloroacetonitrile	L	-	-	D	0.05	0.05	-	-	-	-	-	-	-
Trichlorobenzene (1,2,4-)	F	0.07	0.07	F	0.1	0.1	0.1	0.5	0.01	0.4	0.07	-	D
Trichlorobenzene (1,3,5-)	-	-	-	F	0.6	0.6	0.6	2	0.006	0.2	0.04	-	D
Trichloroethane (1,1,1-)	F	0.2	0.2	F	100	40	40	100	0.035	1	0.2	-	D
Trichloroethane (1,1,2-)	F	0.003	0.005	F	0.6	0.4	0.4	1	0.004	0.1	0.003	-	C
Trichloroethanol (2,2,2-)	L	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethylene	F	zero	0.005	F	-	-	-	-	-	0.3	-	0.3	B2
Trichlorophenol (2,4,6-)	L	-	-	D	-	-	-	-	-	-	-	0.3	B2
Trichloropropane (1,1,1-)	-	-	-	D	-	-	-	-	-	-	-	-	-
Trichloropropane (1,2,3-)	L	-	-	F	0.6	0.6	0.6	2	0.006	0.2	0.04	-	B2
Trifluralin	L	-	-	F	0.08	0.08	0.08	0.3	0.0075	0.3	0.005	0.5	C
Trimethylbenzene (1,2,4-)	-	-	-	D	-	-	-	-	-	-	-	-	-
Trimethylbenzene (1,3,5-)	-	-	-	D	-	-	-	-	-	-	-	-	-
Trinitroglycerol	-	-	-	F	0.005	0.005	0.005	0.005	-	-	0.005	-	-
Trinitrotoluene	-	-	-	F	0.02	0.02	0.02	0.02	0.0005	0.02	0.002	0.1	C
Vinyl chloride	F	zero	0.002	F	3	3	0.01	0.05	-	-	-	0.0015	A
Xylenes	F	10	10	F	40	40	40	100	2	60	10	-	D

** A HA will not be developed due to insufficient data; a "Database Deficiency Report" has been published.

Drinking Water Standards and Health Advisories

cember 1993

Chemicals	Standards			Status HA	Health Advisories								Cancer Group
					10-kg Child			70-kg Adult					
	Status Reg.	MCLG (mg/l)	MCL (mg/l)		One-day (mg/l)	Ten-day (mg/l)	Longer-term (mg/l)	Longer-term (mg/l)	RfD (mg/kg/day)	DWEL (mg/l)	Lifetime (mg/l)	mg/l at 10^{-4} Cancer Risk	
INORGANICS													
Aluminum	L	-	-	D	-	-	-	-	-	-	-	-	-
Ammonia	-	-	-	D	-	-	-	-	-	-	30	-	D
Antimony	F	0.006	0.006	F	*0.01*	*0.01*	*0.01*	0.015	0.0004	*0.01*	0.003	-	D
Arsenic	•	-	0.05	D	-	-	-	-	-	-	-	0.002	A
Asbestos (fibers/l > 10μm length)	F	7 MFL	7 MFL	-	-	-	-	-	-	-	-	700 MFL	A
Barium	F	2	2	F	-	-	-	-	0.07	2	2	-	D
Beryllium	F	0.004	0.004	D	30	30	4	20	0.005	0.2	-	0.0008	B2
Boron	L	-	-	D	4	0.9	0.9	3	0.09	3	0.6	•	D
Cadmium	F	0.005	0.005	F	0.04	0.04	0.005	0.02	0.0005	0.02	0.005	-	D
Chloramine	T	4	-	D	1	1	1	1	0.1	3.3	2.6	-	-
Chlorate	L	-	-	D	-	-	-	-	-	-	-	-	-
Chlorine	T	4	-	D	-	-	-	-	*0.08*	-	-	-	-
Chlorine dioxide	T	0.08	-	D	-	-	-	-	0.003	0.1	0.08	-	D
Chlorite	L	-	-	D	-	-	-	-	-	-	-	-	D
Chromium (total)	F	0.1	0.1	F	1	1	0.2	0.8	0.005	0.2	0.1	-	D
Copper	F	1.3	TT**	-	-	-	-	-	-	-	-	-	D
Cyanide	P	0.2	0.2	F	0.2	0.2	0.2	0.8	0.022	0.8	0.2	-	D
Fluoride*	F	4	4	-	-	-	-	-	0.12	-	-	-	-
Hypochlorite	T	4	-	-	-	-	-	-	-	-	-	-	-
Hypochlorous acid	T	4	-	-	-	-	-	-	-	-	-	-	-
Lead (at tap)	F	zero	TT**	-	-	-	-	-	-	-	-	-	-
Manganese	L	-	-	D	-	-	-	-	0.14/ 0.005	-	-	-	-
Mercury (inorganic)	F	0.002	0.002	F	-	-	-	0.002	0.0003	0.01	0.002	-	D
Molybdenum	L	-	-	D	-	0.08	0.01	0.05	0.005	0.2	0.04	-	D
Nickel	F	0.1	0.1	F	1	1	0.5	1.7	0.02	0.6	0.1	-	D
Nitrate (as N)	F	10	10	F	-	10*	-	-	1.6	-	-	-	•

• Under review.

Chemicals	Status Reg.	MCLG (mg/l)	MCL (mg/l)	Status HA	10-kg Child One-day (mg/l)	10-kg Child Ten-day (mg/l)	10-kg Child Longer-term (mg/l)	Adult Longer-term (mg/l)	Adult RfD (mg/kg/day)	Adult DWEL (mg/l)	Adult Lifetime (mg/l)	Adult mg/l at 10^{-4} Cancer Risk	Group
Nitrite (as N)	F	1	1	F	-	1*	-	-	0.16*	-	-	-	*
Nitrate + Nitrite (both as N)	F	10	10	F	-	-	-	-	-	-	-	-	*
Selenium	F	0.05	0.05	-	-	-	-	-	0.005	-	-	-	-
Silver	-	-	-	D	0.2	0.2	0.2	0.2	0.005	0.2	0.1	-	D
Sodium	-	-	-	D	-	-	-	-	-	20***	-	-	-
Strontium	-	-	-	D	25	25	25	90	0.6	90	17	-	D
Sulfate	L	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	P	**	**	F	0.007	0.007	0.007	0.02	0.00007	0.002	0.0004	-	D
Vanadium	F	0.0005	0.002	D	-	-	-	-	-	-	-	-	D
White phosphorous	L	-	-	F	-	-	-	-	0.00002	0.0005	0.0001		D
Zinc	-	-	-	F	6	6	3	12	0.3	11	2	-	D
Zinc chloride (measured as Zinc)	L	-	-	F	6	6	3	12	0.3	11	2	-	D
RADIONUCLIDES													
Beta particle and photon activity (formerly man-made radionuclides)	P	zero	4 mrem	-	-	-	-	-	-	-	-	4 mrem/y	A
Gross alpha particle activity	P	zero	15 pCi/L	-	-	-	-	-	-	-	-	15 pCi/L	A
Radium 226	P	zero	20 pCi/L	-	-	-	-	-	-	-	-	20 pCi/L	A
Radium 228	P	zero	20 pCi/L	-	-	-	-	-	-	-	-	20 pCi/L	A
Radon	P	zero	300 pCi/L	-	-	-	-	-	-	-	-	150 pCi/L	A
Uranium	P	zero	20 µg/L	-	-	-	-	-	0.003	-	-	70 µg/L	A

* Under review.
** Deferred.
*** Guidance

Secondary Maximum Contaminant Levels

Chemicals	Status	SMCLs (mg/L)
Aluminum	F	0.05 to 0.2
Chloride	F	250
Color	F	15 color units
Copper	F	1.0
Corrosivity	F	non-corrosive
Fluoride*	F	2.0
Foaming agents	F	0.5
Iron	F	0.3
Manganese	F	0.05
Odor	F	3 threshold odor numbers
pH	F	6.5 – 8.5
Silver	F	0.1
Sulfate	F	250
Total dissolved solids (TDS)	F	500
Zinc	F	5

Status Codes: P – proposed, F – final

* Under review.

	Status	MCLG	MCL
Cryptosporidium	L	-	-
Giardia lamblia	F	zero	TT
Legionella	F'	zero	TT
Standard Plate Count	F'	NA	TT
Total Coliforms (after 12/31/90)	F	zero	••
Turbidity (after 12/31/90)	F	NA	PS
Viruses	F'	zero	TT

Key: PS, TT, F, defined as previously stated.

' Final for systems using surface water; also being considered for regulation under groundwater disinfection rule.