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DRAFT REMEDIAL INVESTIGATION REPORT OF FORMER HERBICIDE STORAGE SITE WITH TRANSMITTAL NCBC GULFPORT MS
11/30/1988
DAMES AND MOORE

DRAFT

U.S. AIR FORCE
INSTALLATION RESTORATION PROGRAM

REMEDIAL INVESTIGATION OF FORMER HERBICIDE STORAGE SITE AT THE NAVAL CONSTRUCTION BATTALION CENTER, GULFPORT, MISSISSIPPI

November 30, 1988

Prepared by:

DAMES & MOORE
A Professional Limited Partnership
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Under Subcontract No. 89B-97383C
Task Order X-02

Submitted by:

HAZWRAP SUPPORT CONTRACTOR OFFICE
Oak Ridge, Tennessee 37831
Operated by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

Submitted to:

U.S. AIR FORCE/LEEVO
Bolling AFB, Washington, D.C.
Under Interagency Agreement #1489-1489-84

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November 30, 1988

Mr. Richard S. Burns
Oak Ridge National Laboratory
FEDC Building
104 Union Valley Road
Oak Ridge, TN 37831

Re: Transmittal of Draft Report
U.S. Air Force (USAF) Installation
Restoration Program (IRP)
Remedial Investigation (RI)
for the Naval Construction Battalion
Center (NCBC),
Gulfport, Mississippi
General Order No. 89B-97383C
Task Order X-02

Dear Mr. Burns:

This letter presents the Draft RI report for NCBC. To prepare this document, Dames & Moore synthesized and reformatted the seven primary documents listed in Section 1.0, page 1-1, of this report and performed some technical editing and proofreading.

This report has been prepared in the same manner as the recent report for Johnston Island. The report format conforms with the U.S. Environmental Protection Agency's (EPA) guidelines on RI report format, but also includes additional information required in the USAF Phase II IRP report format. All available information provided to Dames & Moore has been incorporated; any missing items as required by either the EPA or IRP report formats were not available.

It should be noted that our copy of one of the seven documents--the December 18, 1985, consultative letter by Col. Markland--was missing its two attachments (a figure and a table). We understand that these items could not be found, and we have been able to work around them. However, you will note an obvious gap in the discussions of the corresponding contamination surveys, in that we do not have a map showing all of the sampling locations. If the attachments are found, we will incorporate them into the final report. Alternatively, if information on the "missing" sampling locations is provided, it can be included in existing figures.

Please do not hesitate to contact me if you have any questions. We await your comments, which will be incorporated to produce the final report.

Sincerely,

DAMES & MOORE

Stephen Lemont
Stephen Lemont
Project Manager

SL/js

cc: Capt. C. Howell, USAF/LEEVO

Enclosures - R. S. Burns (4 copies)
- Capt. C. Howell (6 copies)

NOTICE

This remedial investigation report has been prepared for the United States Air Force for the purpose of aiding in the implementation of the Air Force Installation Restoration Program. It represents a synthesis and reformatting by Dames & Moore of seven primary study documents--produced by the Engineering & Services Laboratory of the Air Force Engineering & Services Center, the U.S. Air Force Occupational and Environmental Health Laboratory, and EG&G Idaho, Inc.--plus other related materials on the former Herbicide Orange storage site and surrounding areas at the Naval Construction Battalion Center, Gulfport Mississippi. The resulting document has been prepared to conform with the U.S. Environmental Protection Agency's format guidelines for remedial investigation reports. It is not an endorsement of any product. The views expressed herein are those of the original report authors and do not necessarily reflect the official views of the publishing agency, the United States Air Force, or the Department of Defense.

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This document represents a synthesis and reformatting by Dames & Moore of seven primary documents and other related materials originally produced by other organizations.

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	2,4-D; 2,4-Dichlorophenoxyacetic acid; Dioxin; Herbicide Orange; Naval Construction Battalion Center; 2,4,5-T; TCDD; 2,3,7,8-Tetrachlorodibenzo-p-dioxin; 2,4,5-Trichlorophenoxyacetic acid

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This report represents a synthesis and reformatting of seven primary documents and other related materials on soils, groundwater, surface water and sediments, and biota investigations conducted at the Naval Construction Battalion Center (NCBC), Gulfport, Mississippi, to characterize contamination resulting from storage of 850,000 gallons of Herbicide Orange (HO) from 1968 through 1977. The individual study components comprise the Remedial Investigation (RI) of the former HO storage site at NCBC. Samples of site soils, groundwater, surface water, sediments, and aquatic organisms were collected and analyzed for HO-derived 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and also, in some cases, for 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T). A literature study was also conducted to evaluate site geohydrologic conditions and assess potential impacts on groundwater.

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19. Abstract (cont'd)

Potable groundwater from NCBC well heads was found to be uncontaminated by TCDD. This confirms the conclusion of the literature study regarding the improbability of contamination of deep aquifers by TCDD in the NCBC area. However, TCDD contamination of and migration into the shallow water table aquifer is considered possible.

Studies of TCDD migration via the former HO storage site drainage system showed no contamination of surface water, but low levels of TCDD were detected in drainage ditch sediments and in biological specimens from the system at concentrations that decreased with greater distance from the former storage site. The highest levels were found at locations closest to the storage site, and all were on base. Biological samples collected at these locations were found to contain TCDD levels exceeding the guidelines of 25 to 50 parts per trillion (ppT) established by the U.S. Food and Drug Administration (FDA); TCDD levels in other biota samples were below these guidelines, and most were nondetectable. It was concluded that this observation would result in little concern regarding people consuming fish/crayfish caught in the drainage system, because the low levels of TCDD contamination, combined with the scarcity of edible organisms, would make it virtually impossible for anyone to consume a TCDD dose of any significance.

The major component of the RI was a comprehensive soil characterization study of the former storage facility. While analysis of data for two study areas--Areas B and C--is currently pending, detailed data analysis and conclusions have been presented for the investigation of a third area--Area A. In both studies, portions of the old storage site were sampled in a systematic grid pattern to produce total site contamination maps. Over 1,700 samples were collected from 1,300 plots in Area A; Area B and C sampling included collection of 740 and 133 samples, respectively. Surface samples were analyzed for TCDD. In Area A, subsurface samples were collected from areas known to be "hot spots" at 1-foot intervals to a depth of 5 feet. Subsurface samples were analyzed for TCDD; 2,4-D; and 2,4,5-T.

The validated data for Area A indicate that TCDD contamination of the former fenced storage area is highly variable and random, but is highest where the drums were known to be stored or handled, and decreases as the drainage path moves away from the drum storage area. TCDD concentrations on the surface ranged from less than a detection limit (DL) of 0.01 parts per billion (ppb) to 646 ppb. The arithmetic mean for all surface plots inside the fenced area was 10.7 ppb. Based on the results of subsurface sampling, it appears that, except for three samples, TCDD concentrations above 1 ppb were limited to 2 feet in depth, with a maximum of 310 ppb in the 0- to 3-inch interval, 93 ppb in the 3- to 7-inch interval, and 12 ppb in the 8- to 12-inch interval. The maximum concentration in the cement-stabilized soil at the site is 1,000 ppb. There is a definite trend in the data of decreasing concentration with depth. The major contamination occurs in the surface, the soil/cement, and 6 inches beneath the soil/cement

19. Abstract (cont'd)

layer. One sample had a TCDD concentration of 5.1 ppb at 5 feet. The highest value obtained was a TCDD concentration of 1,000 ppb in the soil/cement layer. For the 15 subsurface samples that were analyzed for 2,4-D and 2,4,5-T, the concentration values ranged from detection levels (5,000 ppb) to a maximum for 2,4-D of 20,800,000 ppb and a maximum for 2,4,5-T of 27,700,000 ppb. The highest concentrations were in the soil/cement layer.

The volume of material requiring excavation for a TCDD cleanup effort has been calculated at the 65- and 95-percent confidence levels for a conservative excavation depth of 2 feet. The 95-percent confidence value for a cleanup criterion of 1 ppb TCDD is 728,800 cubic feet (26,990 cubic yards). If excavation in 6-inch intervals was performed, followed by sampling the bottom of the hole, it is estimated from the data that this value would be reduced to approximately 182,200 cubic feet (6,750 cubic yards).

It is also indicated that the Centers for Disease Control (CDC) considered levels of less than 50 ppb TCDD to be acceptable in an industrial setting such as the old HO storage site at NCBC. The combination of the low average level of TCDD detected and CDC's statement regarding allowable TCDD concentrations greater than 1 ppb should play an important role in the decision process for future site cleanup at NCBC.

PREFACE

This report represents a synthesis and reformatting by Dames & Moore (A Professional Limited Partnership), 7101 Wisconsin Avenue, Suite 700, Bethesda, Maryland 20814, of seven primary study documents--originally produced by the Engineering & Services Laboratory of the Air Force Engineering & Services Center, Tyndall Air Force Base, Florida 32403; the U.S. Air Force Occupational and Environmental Health Laboratory, Brooks Air Force Base, Texas 78235; and EG&G Idaho, Inc., P.O. Box 1625, Idaho Falls, Idaho 83415--plus other related materials on the former Herbicide Orange (HO) storage site and surrounding areas at the Naval Construction Battalion Center (NCBC), Gulfport, Mississippi. The seven reports are as follows:

1. Channell, R.E., and T.L. Stoddart, April 1984. Herbicide Orange Monitoring Program, Interim Report: January 1980-December 1982, ESL-TR-83-56, Engineering & Services Laboratory, Air Force Engineering & Services Center, Tyndall Air Force Base, Florida.

2. Rhodes, A.N., May 1985. Herbicide Orange Monitoring Program, Addendum I: January 1980-February 1985, ESL-TR-83-56, Engineering & Services Laboratory, Air Force Engineering & Services Center, Tyndall Air Force Base, Florida.

3. Markland, Col. Darryl T., December 18, 1985. Dioxin Contamination at Naval Construction Battalion Center (NCBC), Gulfport, MS, Consultative Letter 85-185EQ1001MBC, to Commanding Officer, NCBC, Gulfport, Mississippi.

4. Barraclough, J.T., and K.S. Wade, January 1986. Geohydrologic Summary and Proposed Monitoring Wells for Herbicide Residues at Eglin Air Force Base, Florida, and the Naval Construction Battalion Center, Mississippi, EG&G Idaho, Inc., Idaho Falls, Idaho.

5. Markland, Col. Darryl T., September 12, 1986. Dioxin Contamination Surveys, Naval Construction Battalion Center (NCBC), Gulfport, MS, Consultative Letter 86-076EQ1001HBC, to Commanding Officer, NCBC, Gulfport, Mississippi.

6. Crockett, A. B., A. Propp, and T. Kimes, EG&G Idaho, Inc., Idaho Falls, Idaho, January 1987. Herbicide Orange Site Characterization Study, Naval Construction Battalion Center, Final Report, April 1984-September 1986, ESL-TR-86-21, Engineering & Services Laboratory, Air Force Engineering & Services Center, Tyndall Air Force Base, Florida.

7. Friedrich, C. E., EG&G Idaho, Inc., Idaho Falls, Idaho, May 23, 1988. Final NCBC Site Characterization Data - CEF-29-88, Letter to Captain C. R. Howell, HQ USAF/LEEVQ, Bolling Air Force Base, Washington, DC.

This report was prepared under a subcontract agreement from Martin Marietta Energy Systems, Inc./Hazardous Waste Remedial Actions Program (MMES/HAZWRAP), Oak Ridge, Tennessee 37831, General Order No. 89B-97383C, Task Order X-02.

This report covers work performed between July 1977 and May 1988. The MMES/HAZWRAP project officer is Mr. Richard S. Burns. The seven original reports and related materials were synthesized and reformatted by Dames & Moore in November 1988 to conform with the U.S. Environmental Protection Agency's format guidelines for remedial investigation reports, while also including the elements required in the U.S. Air Force Phase II Installation Restoration Program report format.

This report presents the results of environmental sampling and analysis programs for soils, surface water and sediments, and biota for characterizing contamination at and in the vicinity of the former HO storage facility at NCBC. A geohydrologic summary to assess potential impacts on groundwater in the NCBC area is also presented.

CONTENTS

CONTENTS (cont'd)

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FIGURES

FIGURES (cont'd)

FIGURES (cont'd)

FIGURES (cont'd)

FIGURES (cont'd)

TABLES

TABLES (cont'd)

ABSTRACT

This remedial investigation (RI) report represents a synthesis and reformatting of seven primary documents and other materials on investigations conducted at the Naval Construction Battalion Center (NCBC), Gulfport, Mississippi, to characterize contamination resulting from storage of 850,000 gallons of Herbicide Orange (HO) from 1968 through 1977. Samples of site soils, groundwater, surface water, sediments, and aquatic organisms were collected and analyzed for HO-derived 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), and some also were analyzed for the major HO components 2,4-dichlorophenoxyacetic acid (2,4,-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T).

Potable groundwater from a deep aquifer at the site was found to be free of TCDD contamination, confirming the conclusion of a literature study assessing groundwater contamination potential. However, this literature study did identify the possibility of TCDD contamination of the shallow aquifer. Contamination of storage site drainage system sediments and biota was found to be concentrated close to the site, and decreased with greater distance from the site and at off base locations. The occurrence of TCDD in some biological samples--at levels exceeding the U.S. Food and Drug Administration guidelines of 25 to 50 parts per trillion--may not be of concern because of the generally low levels of TCDD and the scarcity of edible organisms that can be caught for consumption.

The major RI component was a comprehensive soil characterization study, which involved the collection and analysis of over 1,700 surface and subsurface soil samples from one portion of the storage site. This study concluded that the study area would have to be excavated to a depth of 2 feet (amounting to a volume of 26,990 cubic yards) if a cleanup criterion of 1 part per billion (ppb) was to be reached at the 95-percent confidence level. (The sample analysis results for two other portions of the site have not yet been evaluated.) It is noted that excavation in 6-inch intervals, followed by sampling the bottom of the hole, would result in a reduction of the excavated volume to 6,750 cubic yards.

However, it is indicated that the Centers for Disease Control (CDC) considered levels of less than 50 ppb TCDD to be acceptable in an industrial setting such as the old HO storage site. The combination of the low average level of TCDD detected and CDC's statement should play an important role in the decision process for future site cleanup at NCBC.

EXECUTIVE SUMMARY

The Naval Construction Battalion Center (NCBC) is located within the city of Gulfport, Mississippi, about 2 miles from the Gulf of Mexico. From 1968 through 1977, about 12 acres of the base were used for storage and handling of approximately 850,000 gallons of Herbicide Orange (HO) in 55-gallon drums. During the period of storage, spills and leaks occurred, prompting the need for a sampling and analysis program to determine the magnitude and extent of HO-derived contamination in site soils, as well as the potential contaminant migration via surface runoff for contamination of surface water, sediments, and biological organisms in the storage site drainage system. Contamination in the drainage system was of particular concern because of the possibility of human consumption of fish and crayfish caught in off base areas. Evaluation of groundwater contamination potential also was deemed necessary, because deep potable water supplies exist in the NCBC area. This study program began immediately following destruction of the HO stored at NCBC, along with 1.37 million gallons of HO from Johnston Island (JI) in the Pacific Ocean, by high-temperature incineration at sea in the South Pacific in the summer of 1977. HO, which was formulated to contain a 50-50 mixture of the active ingredients 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), was determined to contain 2 parts per million (ppm) 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), a compound shown to have teratogenic effects.

This document is the report on the Remedial Investigation (RI) of the former NCBC storage site. It represents a synthesis and reformatting of seven primary study documents and other related materials on the storage site and surrounding areas. These studies were conducted by the U.S. Air Force (USAF) Occupational and Environmental Health Laboratory (OEHL); Air Force Engineering & Services Center (AFESC) Engineering & Services Laboratory (ESL); and EG&G Idaho, Inc. The major RI study components, periods of performance, focus of each study with regard to environmental media evaluated, and associated reference documents are identified in Table ES-1.

The objectives, scope, and major findings of each of these RI study components are summarized in the following sections.

TABLE ES-1

RI Study Components for Former HO Storage Site and Vicinity at NCBC

RI Study Component	Period of Performance	Environmental Media Evaluated: Soils	Groundwater	Surface water	Sediments	Biota	Reference Document(s)
1. Initial HO Monitoring Programs by OEHL and ESL	July 1977-March 1984	X		X	X	X	Channell, R.E., and T.L. Stoddart, April 1984. Herbicide Orange Monitoring Program, Interim Report, January 1980-December 1982, ESL-TR-83-56, ESL, AFESC, Tyndall Air Force Base, Florida. Rhodes, A.N., May 1985. Herbicide Orange Monitoring Program, Addendum I: January 1980-February 1985, ESL-TR-83-56, ESL, AFESC, Tyndall Air Force Base, Florida.
2. Comprehensive Soil Characterization Study	April 1984-May 1988	X			X		Crockett, A.B., A. Propp, and T. Kimes, January 1987. Herbicide Orange Site Characterization Study, Naval Construction Battalion Center, Final Report, April 1984-September 1986, ESL-TR-86-21, ESL, AFESC, Tyndall Air Force Base, Florida. Friedrich, C.E., May 23, 1988. Final NCBC Site Characterization Data - CEF-29-88, Letter to Captain C.R. Howell, HQ USAF/LEEVO, Bolling Air Force Base, Washington, DC.
3. Offsite Dioxin Contamination Surveys	1985-1986		X		X	X	Markland, Col. Darryl T., December 18, 1985. Dioxin Contamination at Naval Construction Battalion Center (NCBC), Gulfport, MS, Consultative Letter 85-185EQ1001MBC, to Commanding Officer, NCBC, Gulfport, Mississippi. Markland, Col. Darryl T., September 12, 1986. Dioxin Contamination Surveys, Naval Construction Battalion Center (NCBC), Gulfport, MS, Consultative Letter 86-076EQ1001HBC, to Commanding Officer, NCBC, Gulfport, Mississippi.

TABLE ES-1 (cont'd)

RI Study Component	Period of Performance	Environmental Media Evaluated					Reference Document(s)
		Soils	Ground-water	Surface water	Sediments	Biota	
4. Geohydrologic Summary to Assess Impacts on Groundwater	1985		X				Barraclough, J. T., and K. S. Wade, January 1986. Geohydrologic Summary and Proposed Monitoring Wells for Herbicide Residues at Eglin Air Force Base, Florida, and the Naval Construction Battalion Center, Mississippi, EG&G Idaho, Inc., Idaho Falls, Idaho.

ES.1 INITIAL HO MONITORING PROGRAM BY OEHL AND ESL

Implementation of the initial HO monitoring program was the result of the USAF's commitment in the USAF Plan and U.S. Environmental Protection Agency's (EPA) permits for the at-sea incineration of HO. This study had the following major objectives:

- To determine if offsite migration of dioxin is occurring.
- To assess levels of TCDD, 2,4,5-T, and 2,4-D contamination at the storage facility.
- To determine if long-term degradation of the phenoxy herbicides and dioxin occurs.
- To determine if vertical migration of dioxin takes place.

This study provided the initial problem definition at NCBC, as a result of HO leakage and spillage, through conduct of limited sampling and analysis programs. The potential for offsite migration was evaluated through sampling and analysis of sediments and biological specimens taken from the storage site drainage system within the storage site itself, offsite but within NCBC, and off base. Soils contamination at the storage facility was defined through limited sampling of surface soils. Soil sampling was conducted over time to assess the degradation potential of contaminants.

The major findings/conclusions of this program are as follows:

- Approximately 2 to 4 acres of the 12-acre former storage site are contaminated with HO and associated TCDD.
- Soil levels of 2,4-D and 2,4,5-T decreased approximately 60 percent over a 6-month period between 1981 and 1982.
- Based on available data, no accurate estimate of TCDD persistence is possible.
- TCDD levels in the surface water drainage system--in sediment and biological samples--were two orders of magnitude below those found in soils of the former storage site. The TCDD level decreases significantly with distance from the former storage site and was nondetectable at most locations to a detection limit (DL) of 10 parts

per trillion (ppT). No TCDD has been detected in surface waters of the drainage system. Low levels of TCDD (< 50 ppT) were detected 2,000 feet offsite in sediment and biological specimens. Sediment and biological contamination were comparable for each sampling site.

- The movement of dioxin from the storage site seems to occur primarily through soil erosion, caused by water, wind, or human activity.

The results of this study showed that additional soil characterization was needed to define the exact area(s) and quantities of soil requiring remediation. It also prompted further confirming study of potential offsite TCDD migration in the storage site drainage system through additional sampling of sediments and biota.

ES.2 COMPREHENSIVE SOIL CHARACTERIZATION STUDY

The purpose of this study was to determine the horizontal and vertical extent of HO-derived TCDD in addition to the vertical extent of herbicides 2,4-D and 2,4,5-T in soils at the former HO storage site. In addition to the detailed delineation of the areal and vertical extent of contamination (i.e., refinement of the initial HO monitoring program results), this study provides an estimate of the quantity of contaminated soil potentially requiring remediation.

The original sampling/analysis program conducted by EG&G Idaho, Inc., focused on a portion of the storage site now designated as Area A. This was believed to be the area where HO drum storage had occurred. However, following initial publication of the EG&G study report in October 1986, two additional areas designated as Areas B and C--located outside the "original" HO storage area (Area A)--were identified and verified as sites of additional drum storage (Friedrich, 1988). Crockett et al. (1987) have conducted and present a detailed analysis of the sampling data from Area A. This study is summarized below. A brief discussion of the follow-on study of Areas B and C (Friedrich, 1988)--for which only raw data have thus far been reported--follows the Area A summary.

ES.2.1 Investigation of Area A and Vicinity

The comprehensive investigation of Area A and vicinity involved collection of over 1,700 soil samples from and around the storage area in accordance with a previously approved sampling protocol. Eleven of these samples were sediments from ditches of the Area A drainage system. In addition to the soil samples, over

200 laboratory analyses were performed and reported for a variety of quality assurance (QA) criteria.

Samples were composited for 20- x 20-foot plots, both inside and outside the former fenced storage area. A total of 1,300 plots were sampled. To determine the depth of TCDD into the cement-stabilized soil at the site, 35 locations were sampled in intervals up to 22 inches in depth. At 15 locations, subsurface samples were collected to a depth of 5 feet. The vertical distribution of the herbicides 2,4-D and 2,4,5-T also was investigated by analyzing all subsurface samples for these compounds.

The validated data indicate that TCDD contamination of the former fenced storage area is highly variable and random, but is highest where the drums were known to be stored or handled, and decreases as the drainage path moves away from the drum storage area. TCDD concentrations on the surface ranged from less than a DL of 0.01 ppb to 646 ppb. The arithmetic mean for all surface plots inside the fenced area was 10.7 ppb.

Based on the results of subsurface sampling, it appears that, except for three samples, TCDD concentrations above 1 ppb were limited to 2 feet in depth, with a maximum of 310 ppb in the 0- to 3-inch interval, 93 ppb in the 3- to 7-inch interval, and 12 ppb in the 8- to 12-inch interval. The maximum concentration in the soil/cement is 1,000 ppb. There is a definite trend in the data of decreasing concentration with depth. The major contamination occurs in the surface, the soil/cement, and 6 inches beneath the soil/cement layer. One sample had a TCDD concentration of 5.1 ppb at 5 feet. The highest value obtained was a TCDD concentration of 1,000 ppb in the soil/cement layer.

The 15 subsurface samples were analyzed for 2,4-D and 2,4,5-T, the main components of HO. The concentration values ranged from detection levels (5,000 ppb) to a maximum for 2,4-D of 20,800,000 ppb and a maximum for 2,4,5-T of 27,700,000 ppb. The highest concentrations were in the soil/cement layer.

The volume of material requiring excavation for a TCDD cleanup effort has been calculated at the 65- and 95-percent confidence levels for a conservative excavation depth of 2 feet. The 95-percent confidence value for a cleanup criterion of 1 ppb TCDD is 728,800 cubic feet (26,990 cubic yards). If excavation in 6-inch intervals was performed, followed by sampling the bottom of the hole, it is estimated from the data that this value would be reduced to approximately 182,200 cubic feet (6,750 cubic yards).

EPA regulations to be finalized on November 8, 1988, will require that all material with a level higher than 1 ppb TCDD be treated with the best demonstrated available technology prior to land disposal (40 CFR Parts 268.31 and 268.41). This could affect the final choice of remedial action and the ultimate fate of the treated material. However, Dr. Renata Kimbrough of the Centers for Disease Control (CDC) has stated that the 1-ppb TCDD "level of concern" for soils is, perhaps, applicable only to residential areas where ingestion of contaminated soil by playing children is likely. Dr. Kimbrough showed that, for an industrial site such as JI--an HO storage site similar to NCBC--cleanup of the entire site is not necessary from a human health perspective. However, it was recommended that the areas exceeding 50 ppb be paved or made inaccessible by some other means (Kimbrough, 1986).

ES.2.2 Investigation of Areas B and C

EG&G Idaho's follow-on investigation involved collection and TCDD analysis of 740 soil samples from Area B and 133 samples from Area C. Eleven of the Area B samples were sediments from ditches that drain this area. To date, a data analysis of the type performed for the Area A samples has not been performed for the Area B and C samples. The data summary in Table ES-2 presents Area B and C data in comparison to similar data from Area A.

ES.3 OFFSITE DIOXIN CONTAMINATION SURVEYS

These surveys primarily involved collection of sediment and biological samples from the former HO storage site drainage system. The purpose of this limited program was twofold--to evaluate potential health impacts from exposure to TCDD-contaminated sediments for workers involved in drainage system renovation, and to evaluate potential impacts on people who may consume fish and crayfish caught in the drainage system by comparing TCDD levels in biological specimens to guidelines established by the U.S. Food and Drug Administration (FDA). Sediment and biota samples were collected on three different occasions from a number of sampling points in the drainage system and connecting streams at locations both on NCBC and off base, up to several miles from the installation boundary. In addition to the preceding program, potable groundwater samples

TABLE ES-2

Data Summary--Areas A, B, and C

TCDD Concentration Range (ppb)	Number of Samples[a]			
	Area A	Area B	Area C	Ditches[b]
<1.0	648	528	102	6
1-10	442	150	26	5
11-20	93	17	1	0
21-100	109	26	3	0
>100	139	8	1	0
Total	1331	729	133	11

[a]Does not include QA samples.

[b]Sediment samples from ditches in Area B.

were collected once from NCBC well heads to confirm that potable groundwater supplies in the NCBC area were not contaminated by TCDD.

The study reached the following conclusions:

- No TCDD was detected in potable water samples from two NCBC well heads, indicating that there may be no TCDD contamination of potable groundwater in the area.

- Detectable levels of TCDD in the sediments and biota of the NCBC HO storage site drainage system show that some TCDD-contaminated soils have been washed from the HO storage site. TCDD levels decrease significantly in both sediments and biota with greater distance from the storage site. The CDC 1-ppb level of concern was exceeded for only sediment samples collected from a ditch within the HO storage area. The FDA guideline of 25 to 50 ppT was exceeded only in fish/crayfish samples taken from locations close to the storage site. None of the off base samples, taken where people might actually catch fish or crayfish to eat, exceeded the FDA guideline.

- There would be no concerns about the health of individuals involved in renovation of the drainage system at the time of the surveys (1985-1986). This conclusion was based on the very low levels of TCDD contamination in drainage ditch sediments, combined with the fact that personnel would be working with wet materials not easily inhaled.

- Similarly, there would be no concerns regarding people consuming fish/crayfish caught in the drainage system. The low levels of TCDD contamination, combined with the scarcity of organisms, would make it virtually impossible for anyone to consume a TCDD dose of any significance.

This study supported associated conclusions of the inital HO monitoring program by ESL.

ES.4 GEOHYDROLOGIC SUMMARY TO ASSESS IMPACTS ON GROUNDWATER

Based on a literature study, the geohydrologic conditions at NCBC have been evaluated to assess the potential impacts on groundwater resulting from the contamination of surficial soils by storage and handling of HO. The results from this evaluation are used to determine the likelihood of TCDD being transported in the shallow groundwater and the possibility of contamination of deeper aquifers. A groundwater monitoring program is proposed in the report by Barraclough and Wade (1986); however, this proposed program, which has not been implemented to date, is not discussed herein.

The site is situated in the Gulf of Mexico Coastal Plain. The subsurface sediments are composed of quartz sand, clay, gravel, and silt. The permeable sands form aquifers, and the impermeable clays form aquicludes or confining beds. Horizontal permeabilities are much higher than vertical permeabilities. The water in the shallow aquifer at the site is soft and relatively unmineralized because of insoluble quartz sand and high recharge from rainfall. Low pH and high iron concentrations are caused by the low buffering capacity of the aquifer materials.

Contamination of the surficial water table aquifer is considered possible. Because of its shallow depth, it can saturate zones of contaminated soil at the site. However, the primary mode of contamination would be from contaminant leaching and infiltration due to heavy rainfall in the area and subsequent groundwater recharge. Rapid migration of contamination in the surficial aquifer is possible. Of course, the degree of contamination and contaminant migration would be limited by the low solubility of TCDD in water and its high sorption potential in soils. On the other hand, the possibility of deeper migration of TCDD is very remote because of the low solubility of TCDD, the depths to be traversed over which significant sorption by soils is likely, and the apparent upward movement of deep water-bearing zones that would inhibit down migration of contaminants.

1. INTRODUCTION

This document is the report on the U.S. Air Force (USAF) Installation Restoration Program (IRP) Remedial Investigation (RI) of the former Herbicide Orange (HO) storage site at the Naval Construction Battalion Center (NCBC), Gulfport, Mississippi. It represents a synthesis and reformatting of the entirety or portions of seven primary study documents and other related materials on the storage site and surrounding areas. The seven major documents included are the following:

1. Channell, R.E., and T.L. Stoddart, April 1984. Herbicide Orange Monitoring Program, Interim Report: January 1980-December 1982, ESL-TR-83-56, Engineering & Services Laboratory, Air Force Engineering & Services Center, Tyndall Air Force Base, Florida.

2. Rhodes, A.N., May 1985. Herbicide Orange Monitoring Program, Addendum I: January 1980-February 1985, ESL-TR-83-56, Engineering & Services Laboratory, Air Force Engineering & Services Center, Tyndall Air Force Base, Florida.

3. Markland, Col. Darryl T., December 18, 1985. Dioxin Contamination at Naval Construction Battalion Center (NCBC), Gulfport, MS, Consultative Letter 85-185EQ1001MBC, to Commanding Officer, NCBC, Gulfport, Mississippi.

4. Barraclough, J.T., and K.S. Wade, January 1986. Geohydrologic Summary and Proposed Monitoring Wells for Herbicide Residues at Eglin Air Force Base, Florida, and the Naval Construction Battalion Center, Mississippi, EG&G Idaho, Inc., Idaho Falls, Idaho.

5. Markland, Col. Darryl T., September 12, 1986. Dioxin Contamination Surveys, Naval Constuction Battalion Center (NCBC), Gulfport, MS, Consultative Letter 86-076EQ1001HBC, to Commanding Officer, NCBC, Gulfport, Mississippi.

6. Crockett, A.B., A. Propp, and T. Kimes, EG&G Idaho, Inc., Idaho Falls, Idaho, January 1987. Herbicide Orange Site Characterization Study, Naval Construction Battalion Center, Final Report, April 1984-September 1986, ESL-TR-86-21, Engineering & Services Laboratory, Air Force Engineering & Services Center, Tyndall Air Force Base, Florida.

7. Friedrich, C. E., EG&G Idaho, Inc., Idaho Falls, Idaho, May 23, 1988. Final NCBC Site Characterization Data - CEF-29-88, Letter to Captain C. R. Howell, HQ USAF/LEEVO, Bolling Air Force Base, Washington, DC.

The first two reports include the results of the initial monitoring programs conducted at NCBC. The first report reviews and provides interim results and conclusions for the Air Force Engineering & Services Laboratory (ESL) HO monitoring program at NCBC from 1980 through 1982. Results for soil samples from the storage site and for sediment samples and biological specimens from the NCBC drainage system are discussed. The second report, an addendum to the first, contains raw chemical analysis data for all samples collected during the ESL monitoring program and the earlier Air Force Occupational and Environmental Health Laboratory (OEHL) monitoring program at NCBC, for the period from 1977 through 1984. Raw data are reported for soil samples from the storage site and for surface water, sediment, and biota samples from the NCBC drainage system. No data analysis or conclusions are presented in Addendum I. In both the interim report and Addendum I, sample analyses were conducted for the HO components 2,4-dichlorophenoxy-acetic acid (2,4-D); 2,4,5-trichlorophenoxyacetic acid (2,4,5-T); and 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD).

The third and fifth documents are letter reports summarizing the results of offsite dioxin contamination surveys conducted by OEHL, which address monitoring for TCDD that might have washed off the old HO storage site. In these surveys, conducted in 1985 and 1986, samples of potable water from NCBC well heads and of sediments and biota from the NCBC drainage system were collected and analyzed for TCDD.

The fourth report presents an evaluation of the geohydrologic conditions at NCBC--in terms of a geohydrologic summary--to assess the potential impacts on the groundwater resulting from the contamination of surficial soils by storage and handling of HO. The results of this evaluation are used to determine the likelihood of TCDD being transported in the shallow groundwater. This report also proposed a groundwater monitoring program for the site; however, this program has not been implemented at NCBC to date.

The sixth and seventh documents, which are the most recent of the seven, report the results of a comprehensive soil characterization study of the former HO storage site. The first of these two reports presents a detailed analysis of the results of an investigation in which soil samples from a portion of the former storage site and associated drainage ditches were collected and analyzed for TCDD--to determine the quantities of contaminated soil potentially requiring remediation. Some deep soil samples also were analyzed for 2,4-D and 2,4,5-T. This report covers work performed between April 1984 and September 1986 and is the most detailed and comprehensive of the seven documents. The second of the two documents reports raw data for the TCDD analysis of soil samples collected from two additional areas at the storage site that had not been discovered until after the primary soil characterization report on the site (i.e., Report No. 6 listed above) was originally issued in October 1986. No data analysis or conclusions are presented in this document.

The seven previously-listed documents comprise the RI for the NCBC HO storage site and vicinity.

The following introductory discussion provides site background information and briefly discusses the nature and extent of contamination problems that led to the need for the aforementioned investigations. An overview of the RI program--including the purpose and scope of each of the site studies--also is presented, and the organization of the remainder of the report is outlined.

1.1 SITE BACKGROUND INFORMATION

1.1.1 NCBC Location and Description

NCBC is located in the northern part of Gulfport, Mississippi, in the extreme southeastern portion of the State in Harrison County, about 2 miles from the Gulf of Mexico (see Figures 1-1 and 1-2). It occupies a land area of several square miles. The elevation averages approximately 30 feet above sea level. Surface soils are primarily sand to sandy loam with minor clays. The groundwater table at the herbicide storage area ranges from approximately 3 to 10 feet below land surface.

The herbicide storage area--where approximately 850,000 gallons of HO were stored--comprises approximately 12 acres of flat land at NCBC (see Figure 1-3). The area is drained by a system of ditches and culverts graded to the west, discharging into a canal in the northwest corner of NCBC. The storage site surface

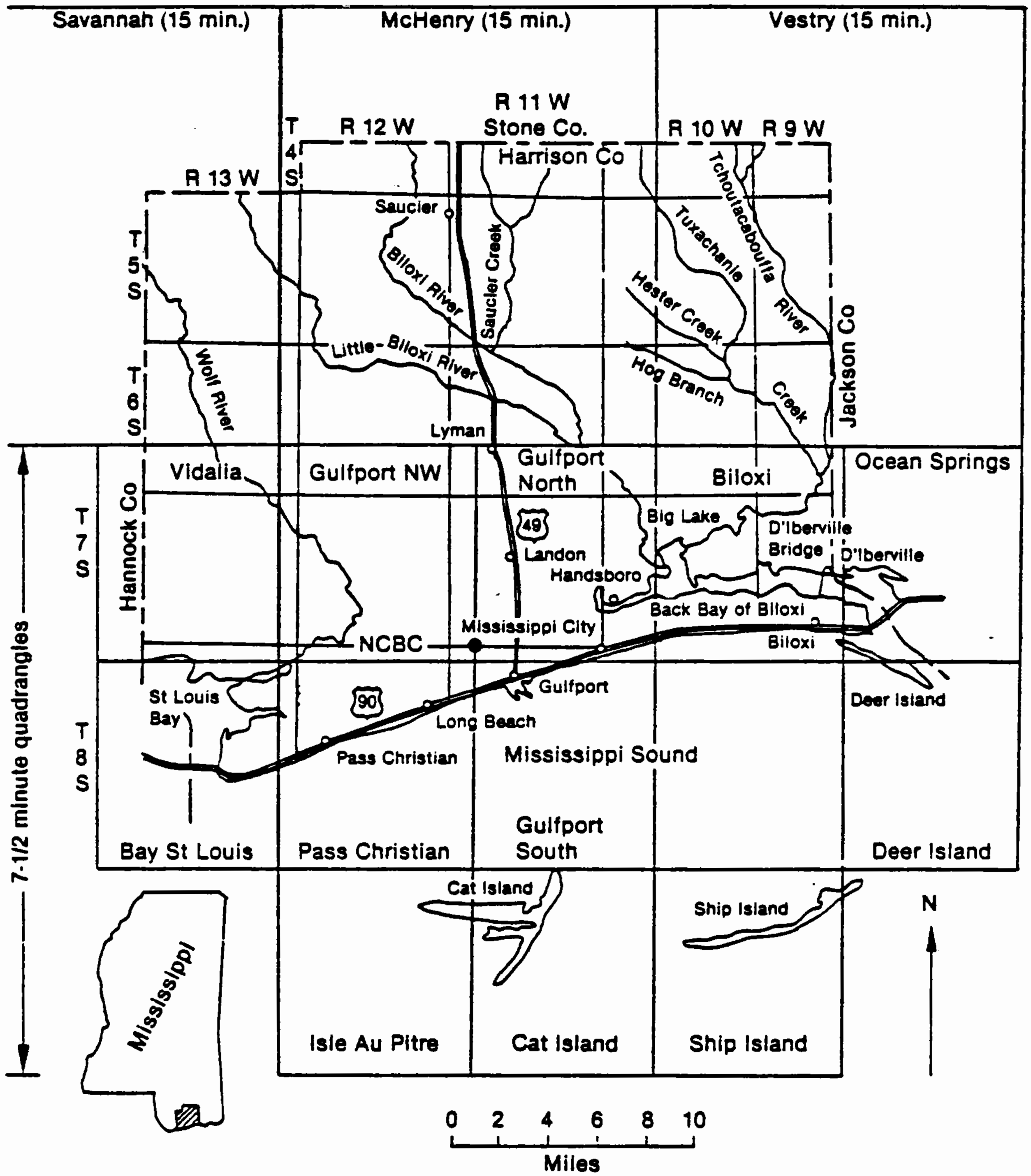
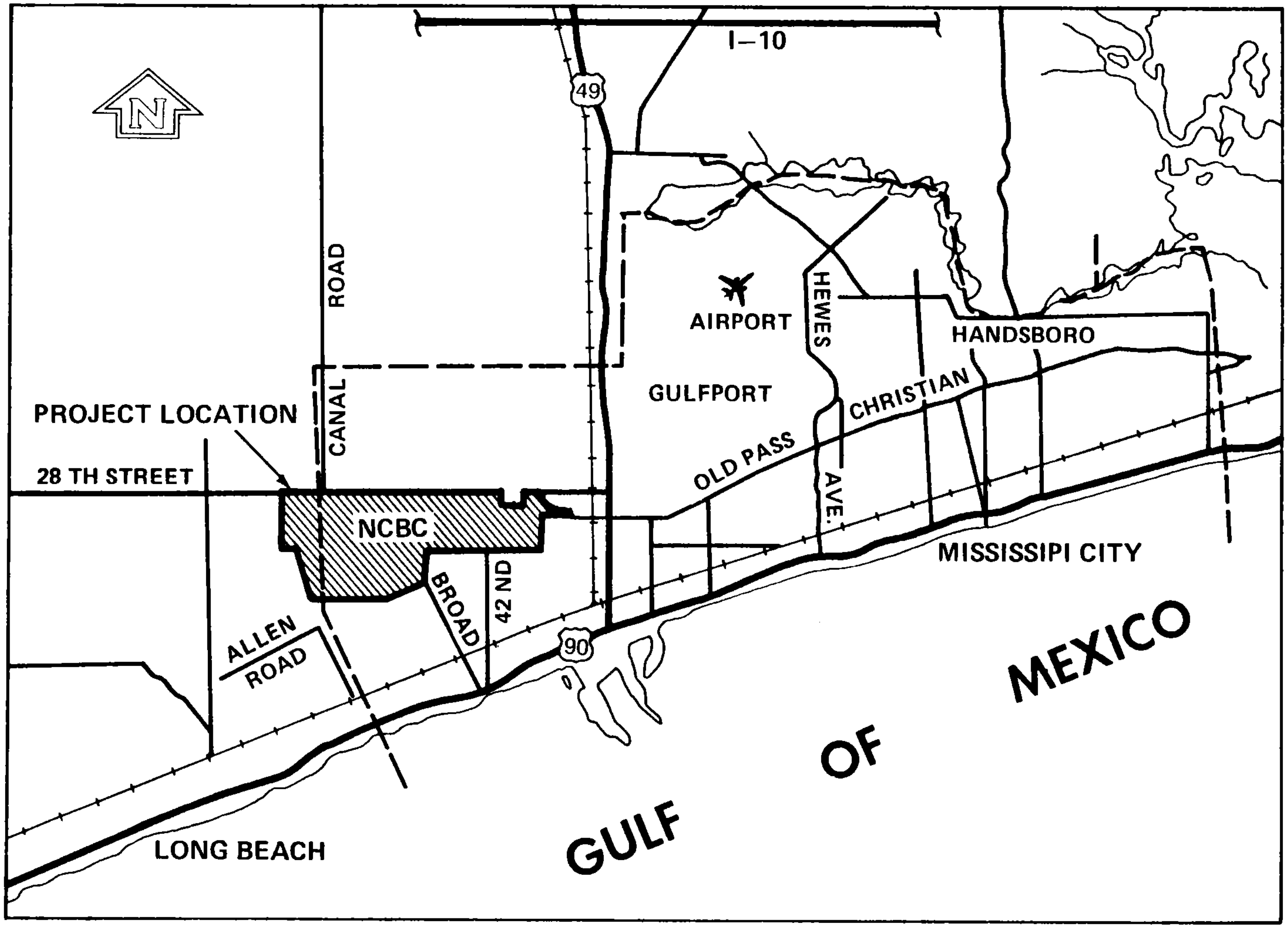


FIGURE 1-1
LOCATION MAP AND TOPOGRAPHIC QUADRANGLES, HARRISON COUNTY, MISSISSIPI

Source: Newcome *et al.*, 1968.



KEY :

GULFPORT CITY LIMITS

NOT TO SCALE

FIGURE 1-2
NCBC, GULFPORT, MISSISSIPI VICINITY MAP

Source: Channell and Stoddart, 1984.

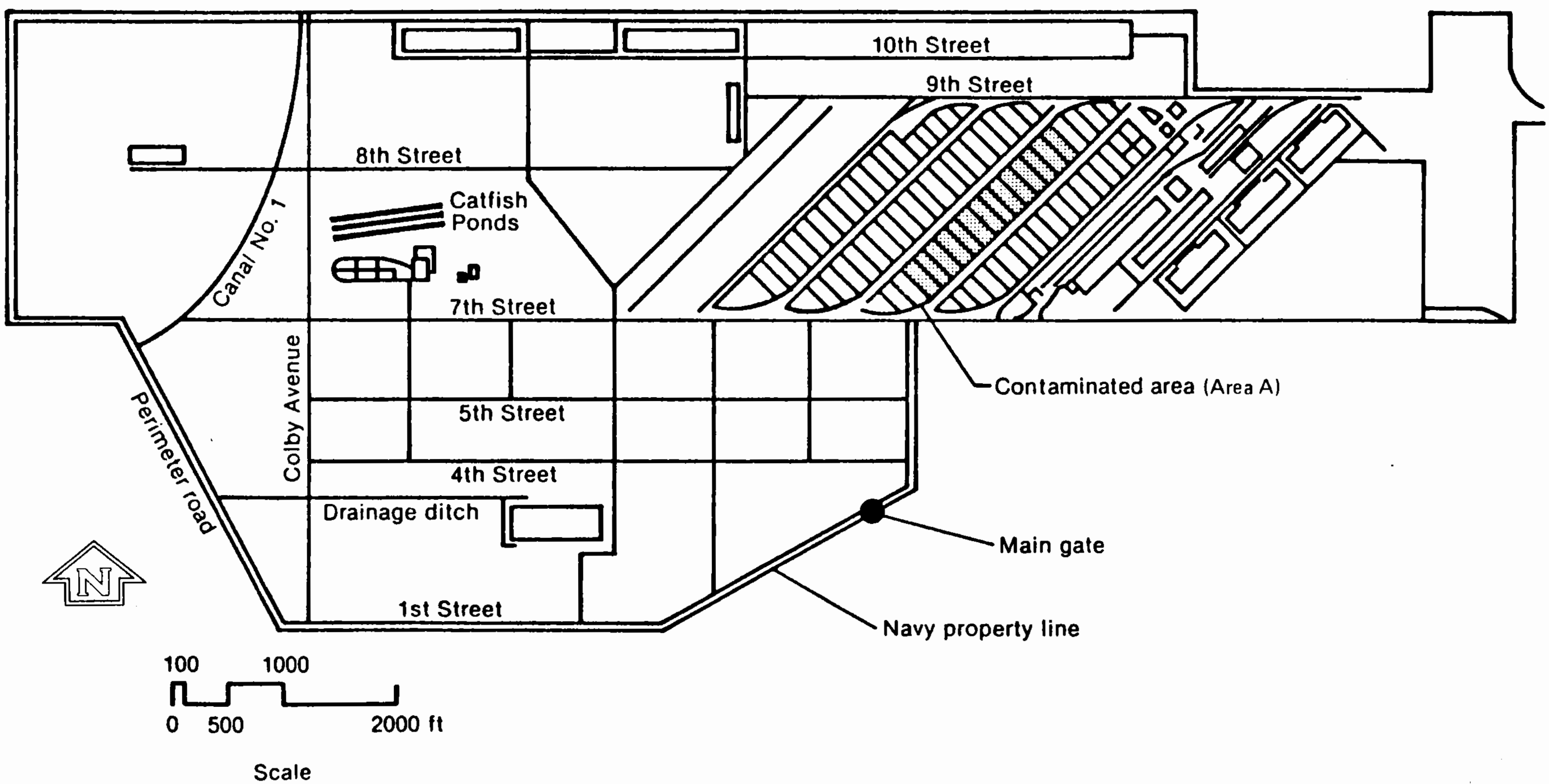


FIGURE 1-3
LOCATION OF HO STORAGE AREA AT NCBC

Source: Crockett et al., 1987.

was stabilized with a soil/Portland cement mixture about 30 years ago to provide a hardened surface for heavy equipment operation and storage. Over the years, additional fill material (shell, rock, and soil) was added to the storage area at locations of known spills, providing a cover over the cement-stabilized soil. This cover ranges from 0- to 6-inches thick.

Approximately 2 to 4 acres of the 12-acre site--now designated as Area A--were originally considered contaminated with HO and its associated TCDD (see Figure 1-4). During 1980, retention basins were constructed on this storage site to prevent the migration of contaminated soils offsite. However, in 1986, two additional areas designated Areas B and C (see Figures 1-5A, 1-5B, and 1-6)--located outside the "original" HO storage area (Area A)--were identified and verified as sites of additional drum storage.

Information on regional and site geology and related topics is presented in Section 2.2.2, which describes geohydrologic conditions at the site in association with an evaluation of potential impacts on groundwater.

1.1.2 History

HO was stored at NCBC from 1968 to 1977. In April 1970, the Secretaries of Agriculture; Health, Education, and Welfare; and the Interior jointly announced the suspension of certain uses of 2,4,5-T. This suspension resulted from published studies indicating that 2,4,5-T was a teratogen. Subsequent studies revealed that the teratogenic effects resulted from a toxic contaminant in the 2,4,5-T, identified as TCDD (dioxin). Subsequently, the U.S. Department of Defense (DoD) suspended the use of HO, which contained 2,4,5-T. At the time of the suspension, the USAF had an inventory of 1.37 million gallons of HO in South Vietnam and 850,000 gallons at NCBC. In September 1971, DoD directed that the HO in South Vietnam be returned to the United States and that the entire 2.22 million gallons be disposed of in an environmentally safe and efficient manner (Channell and Stoddart, 1984). The 1.37 million gallons were moved to Johnston Island (JI), Pacific Ocean, in April 1972.

The location of the storage area at NCBC is shown in Figure 1-3. Storage site Areas A, B, and C are shown in Figures 1-4, 1-5A, 1-5B, and 1-6, respectively. The storage area is described in Section 1.1.1. Currently, the "old" HO storage site is a restricted area and is not used.

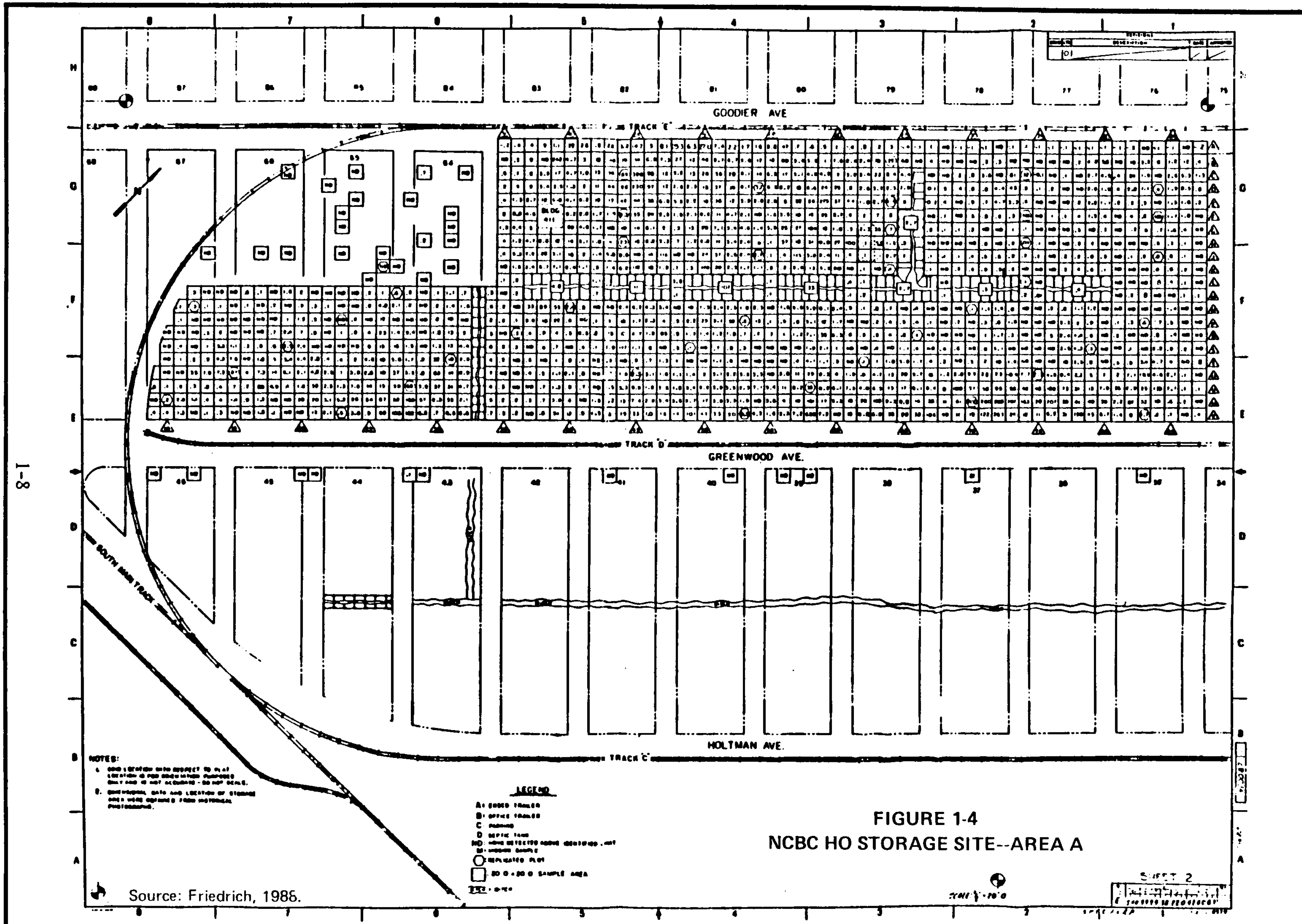


FIGURE 1-4
NCBC HO STORAGE SITE--AREA A

Source: Friedrich, 1986.

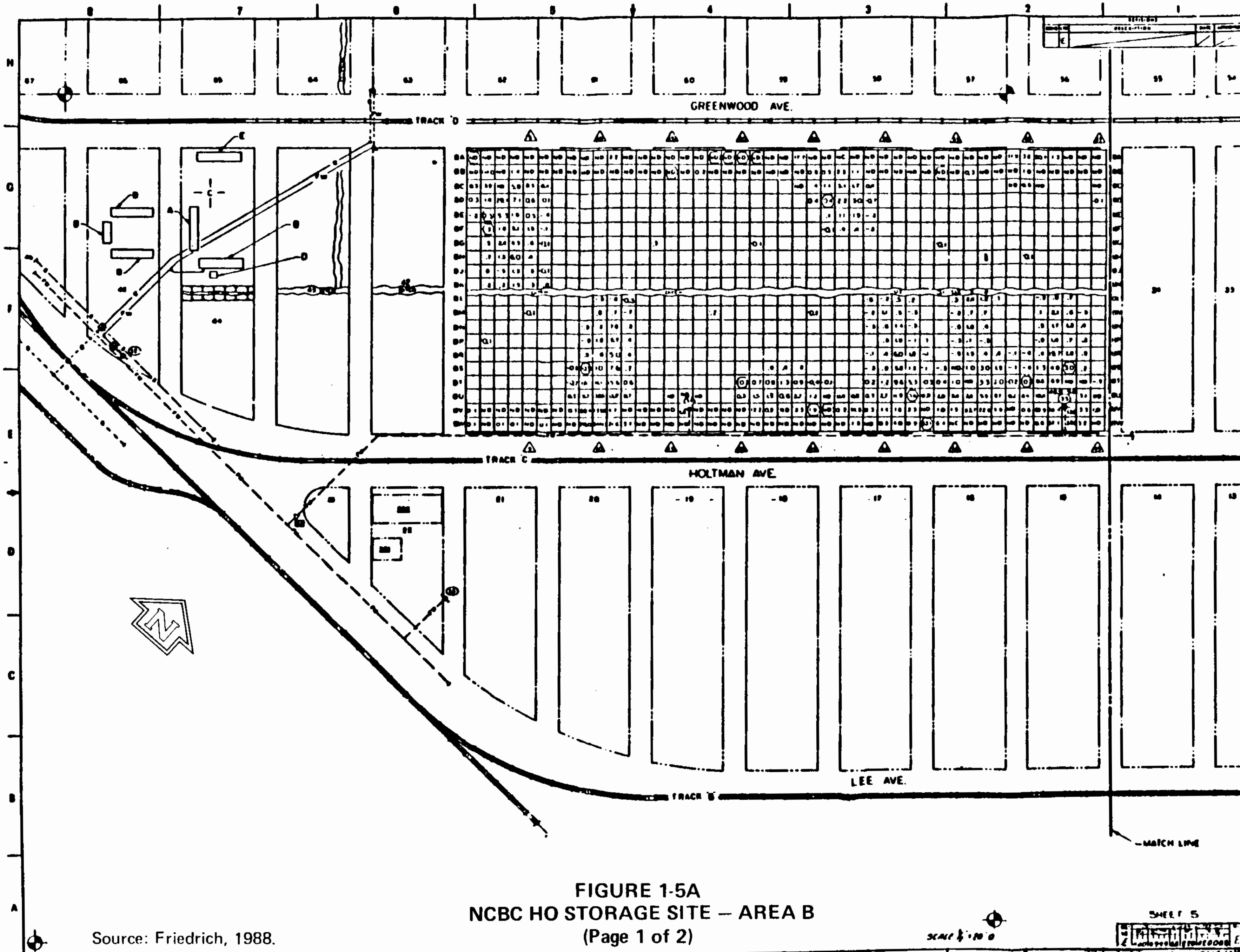


FIGURE 1-5A
NCBC HO STORAGE SITE – AREA B
(Page 1 of 2)

Source: Friedrich, 1988.

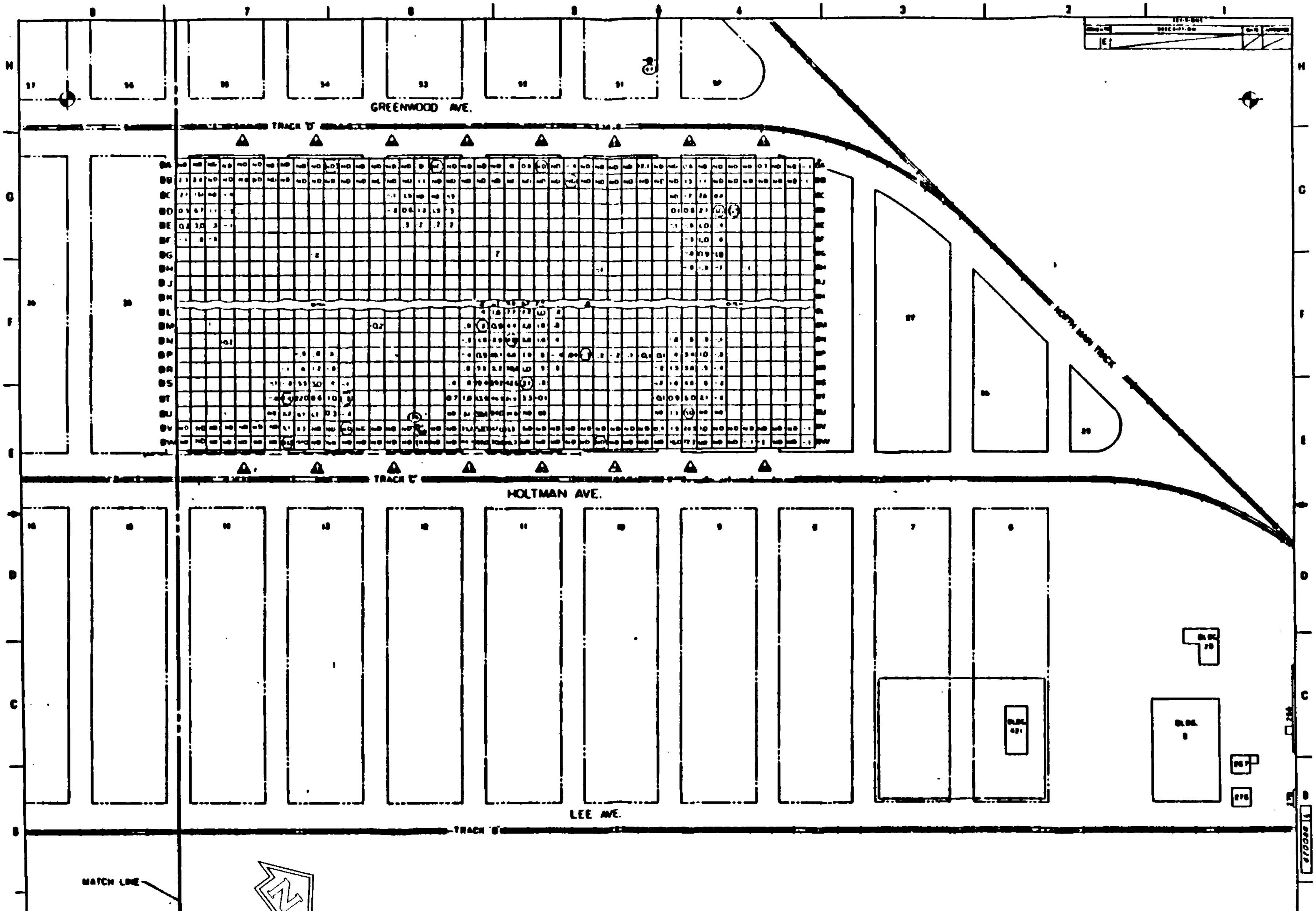


FIGURE 1-5B
NCBC STORAGE SITE – AREA B
(Page 2 of 2)

Source: Friedrich, 1988.

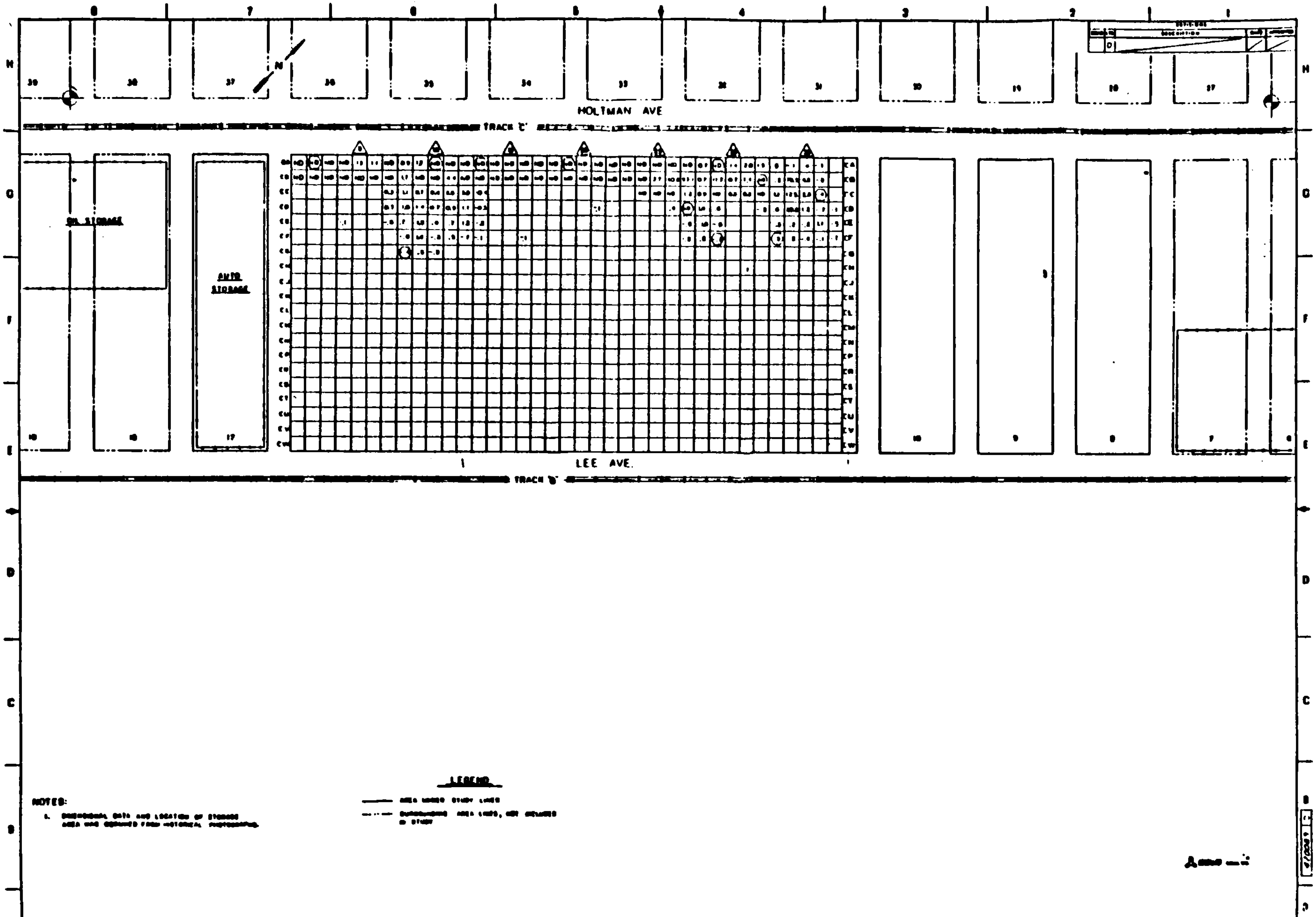


FIGURE 1–6
NCBC HO STORAGE SITE–AREA C

Source: Friedrich, 1988.

After various HO disposal techniques were evaluated, the USAF disposed of the NCBC stock--plus the 1.37 million gallons of HO from JI--by high-temperature incineration at sea during the summer of 1977 (Miller et al., 1980).

After incineration of the herbicide in 1977, the USAF instituted a storage site monitoring program (Channell and Stoddart, 1984).

1.2 NATURE AND EXTENT OF PROBLEM

During the period of storage of HO and in the process of handling HO at NCBC, some spillage and leakage occurred, resulting in contamination of the storage site. The quantities of materials spilled or leaked are unknown. Furthermore, contamination in surficial soils could be carried by surface runoff into storage site drainage ditches that could ultimately carry contaminants off base, although retention basins were constructed at Area A in 1980 in an attempt to prevent the offsite migration of TCDD-contaminated soils. Organisms living in and around the NCBC drainage system could be at the greatest risk of being impacted by such contaminant migration. There is also a possibility of shallow groundwater contamination at this site. Thus, there is a potential for environmental harm because of the toxic nature of HO (as discussed later) and the possible pathways of contaminant migration and exposure.

As discussed in Section 1.1.2, in April 1970 the Government ordered suspension of certain uses of 2,4,5-T because of the teratogenic effects of this compound, later found to be caused by a contaminant in the 2,4,5-T (i.e., TCDD). The average concentration of dioxin in the 850,000 gallons of HO stored at NCBC was about 2 parts per million (ppm); thus, the total amount of TCDD in the entire HO stock at NCBC is estimated at 16.9 pounds.

HO was developed as a tactical defoliant for use in Vietnam. It is a reddish-brown to tan liquid, soluble in diesel fuel and organic solvents, but insoluble in water. One gallon of HO theoretically contained 4.21 pounds of the active ingredient 2,4-D and 4.41 pounds of the active ingredient 2,4,5-T. HO was formulated to contain a 50-50 mixture (by weight) of the n-butyl esters of 2,4-D and 2,4,5-T. The percentages of the formulation typically were:

HO Component	Percentage
n-Butyl ester of 2,4-D	49.49
Free acid of 2,4-D	0.13
n-Butyl ester of 2,4,5-T	48.75
Free acid of 2,4,5-T	1.00
Inert ingredients (e.g., butyl alcohol and ester moieties)	0.63

After incineration of the herbicide in 1977, the USAF instituted a storage site monitoring program (Channell and Stoddart, 1984) to determine the extent and magnitude of contamination and of contamination degradation rates, potential for migration of residues, and managerial techniques of minimizing impacts. These include direct soil contamination at the storage site and surrounding areas; contamination of surface water, sediments, and aquatic organisms as a result of contaminant runoff from the storage area into the NCBC drainage system; and the potential for groundwater contamination. At NCBC, the major environmental and health concerns are human exposure to contaminated soils and sediments, contamination of aquatic organisms that may be consumed by humans, and potential human exposure to contaminated surface waters, sediments, and groundwater.

1.3 REMEDIAL INVESTIGATION SUMMARY

As discussed earlier, the RI of the former HO storage site and surrounding areas consisted of a number of individual sampling programs conducted under the overall direction of the USAF. These studies focused to varying degrees on the delineation of areas of contaminated soil, the potential for offsite transport of contamination by the NCBC drainage system, and the potential for groundwater contamination. The objectives and scope of each of these investigations are discussed in the following sections, and the details of the approach to sampling and analysis or other studies conducted in each are presented.

1.3.1 Purpose and Scope

1.3.1.1 Initial HO Monitoring Programs by OEHL and ESL. The USAF plan and U.S. Environmental Protection Agency (EPA) permits for the disposal of the HO by high-temperature incineration at sea committed the USAF to a follow-on storage site reclamation and environmental monitoring program. This program--the results of which were originally documented by Channell and Stoddart (1984) and Rhodes (1985)--had the following major objectives:

- Determination of the magnitude of HO contamination in and around the former HO storage site.
- Determination of the rate of natural degradation for the phenoxy herbicides (2,4-D and 2,4,5-T), their phenolic degradation products, and TCDD in soils of the storage site.
- Monitoring for potential movement of residues from the storage site into adjacent water, sediments, and biological organisms.
- Recommendation of managerial techniques for minimizing any impact of the herbicides and TCDD residues on the ecology and human populations near the storage site.

Immediately following at-sea incineration in 1977, the USAF OEHL initiated site monitoring studies of chemical residues in site soil associated with the former HO storage site at NCBC. The results of this study--conducted from August 1977 through August 1979--have been published (Young et al., 1979; Young et al., 1982) and also are reported by Rhodes (1985).

In 1980, the Air Force Engineering & Services Center (AFESC) ESL was designated the lead agency for the monitoring program. During the subsequent monitoring program, samples were collected on a semiannual basis at NCBC. Soil sampling was conducted during the period from September 1980 through November 1982; sediment and biological samples were collected from September 1980 through March 1984; and surface water was sampled in March 1984.

The limited initial soil monitoring programs conducted by OEHL and ESL led to the recommendation of a more detailed delineation of the areal and vertical extent of HO-derived contamination to establish boundaries for ultimate reclamation activities. This project was implemented by EG&G Idaho, Inc., under contract to ESL, as discussed in Section 1.3.1.2. The initial monitoring study also recommended additional monitoring of the drainage ditch system for TCDD. This was implemented in the offsite dioxin contamination surveys conducted by OEHL (see Section 1.3.1.3).

1.3.1.2 Comprehensive Soil Characterization Study. The purpose of this detailed soil characterization study--conducted by EG&G Idaho, Inc. (Crockett et al., 1987; Friedrich, 1988) during the period April 1984 through May 1988 under contract to

ESL--was to expand on the initial studies conducted by OEHL and ESL (Channell and Stoddart, 1984; Rhodes, 1985) by more precisely determining the horizontal and vertical extent of HO-derived TCDD in addition to the vertical extent of herbicides 2,4-D and 2,4,5-T at the former HO storage site. In addition to delineation of the areal and vertical extent of contamination, this study provides an estimate of the quantity of contaminated soil potentially requiring remediation.

Sampling was initially conducted--during April 1984 through September 1986--at the portion of the storage site now designated as Area A and in drainage ditches associated with this area. However, subsequent to the publication of the October 1986 version of the report on the subject investigation, two additional areas designated as Areas B and C--located outside the "original" HO storage area--were identified and verified as sites of additional drum storage. These were studied in a follow-on investigation by EG&G during which soil samples were collected from both sites; ditch sediment samples also were collected at Area B.

Crockett et al., (1987) report the results of the Area A investigation. They observed that an area of approximately 2 to 4 acres was considered contaminated with HO and TCDD, and that nearly all soil samples collected in the storage area during previous sampling programs (Young et al., 1979; Young et al., 1982; Young et al., 1983; Channell & Stoddart, 1984; Rhodes, 1985) had TCDD levels in excess of 1 part per billion (ppb) and ranged as high as 263 ppb. The overall scope of the subsequent comprehensive soils investigation included the following:

1. Development of a sampling protocol (procedures for sampling and analysis)
2. Site layout of the sampling plots and other sampling locations
3. Collection of field samples
4. Laboratory analysis of samples for HO components TCDD; 2,4-D; and 2,4,5-T
5. Validation of the laboratory results
6. Statistical analysis of laboratory data
7. Assessment of the extent of contamination.

Under this program, 1,767 samples of soil (some of which were sediments from drainage ditches associated with the site) and soil/cement were submitted to U.S. Testing Laboratories in New Jersey for analysis. Over 200 additional analyses were performed for a variety of quality assurance (QA) criteria.

The resultant data were compiled and analyzed for validation and to determine the statistical variability. Assessing the extent of contamination at various levels of confidence, based on the statistical analysis, will enable subsequent remedial action planning.

The follow-on investigation of Areas B and C included performance of steps 1 through 5 listed above (Williams, 1987). Under this follow-on program, a total of 873 sample analyses were performed, including 740 from Area B and 133 from Area C. Additional analyses of QA samples were performed. The data analysis performed by Crockett et al. (1987) on the Area A samples was not performed on the Area B and C samples, and only the raw results of the sample analyses have been reported to date (Friedrich, 1988).

1.3.1.3 Offsite Dioxin Contamination Surveys. As documented by Markland (1985; 1986), a number of brief investigations--involving collection and TCDD analysis of sediment, biological, and groundwater samples--were conducted by the USAF OEHL in offsite areas at NCBC.

In 1985, biological and sediment samples were collected from the NCBC drainage system that drains the former HO storage area. The purpose of this offsite dioxin contamination survey was to determine if appreciable quantities of TCDD were entering the drainage system. The immediate concerns were for welfare of personnel involved in renovation of the drainage system and for people consuming fish/crayfish caught in the drainage system. Although this initial study concluded that there are no significant adverse effects on the offsite environment and that there are no health concerns, continued surveillance was recommended due to the magnitude of TCDD concentrations that were detected.

During April 1986, biological and sediment samples again were collected from the storm drainage system. Also, during June 1986, sediment and biological samples were collected from the portion of the drainage system that drains plats 6 though 23 of the former HO storage area. This was done because it was determined by Captain Stoddart, HQ AFESC/RDVW, that these plots had been used to store HO and may have residual levels of TCDD contamination. This area includes a portion of what is now designated as Area C. Also, during June 1986, potable water samples were collected directly from three well heads at NCBC to determine if there was any TCDD contamination of potable groundwater at NCBC due to long-term storage of HO. It was pointed out by Markland (1986) that "all current scientific information indicated the virtual impossibility of TCDD being transported into the potable groundwater at the site," and that analysis of the samples collected would allow the definitive statement to be made that no TCDD contamination was present in potable groundwater at NCBC.

1.3.1.4 Geohydrologic Summary to Assess Impacts on Groundwater. The purpose of this investigation (Barraclough and Wade, 1986) was to use existing data to describe the hydrogeologic conditions at NCBC, and then to evaluate this information to assess the potential impacts on the groundwater resulting from the contamination of surficial soils by storage and handling of HO. The results of this evaluation are used to determine the likelihood of TCDD being transported in the shallow groundwater. The report also proposed a groundwater monitoring program for the site, although this monitoring program has not been implemented at NCBC to date.

1.3.2 Overview of Site Investigation Programs

This section presents an overview/summary of the field investigation programs conducted at NCBC. Also included is a discussion of the approach used in conducting the geohydrologic evaluation of the site. Where available, more detailed information on individual program methodologies is presented in Appendix A, including information on sampling procedures and chemical analysis methods and associated quality assurance/quality control (QA/QC) procedures. The three sections below correspond to the major components of the site investigation:

- Hydrogeologic investigation (including soils, geology, and groundwater)
- Surface water and sediments investigation
- Biota investigation (i.e., aquatic organisms).

1.3.2.1 Hydrogeologic Investigation. The hydrogeologic investigation of NCBC included the evaluation of soils contamination in field investigations and of geology and/or groundwater in an offsite dioxin contamination survey conducted by OEHL and a literature study of site hydrogeologic conditions.

1.3.2.1.1 Soils. As discussed following, sampling and analysis of soils from the former HO storage site and surrounding areas were conducted as part of the initial HO monitoring programs by OEHL and ESL (Channell and Stoddart, 1984; Rhodes, 1985) and the soil characterization study conducted by EG&G Idaho, Inc., under contract to ESL (Crockett et al., 1987; Friedrich, 1988).

1.3.2.1.1.1 Initial HO Monitoring Programs by OEHL and ESL. In these preliminary investigations, surface soil samples were collected throughout the former storage facility area and were analyzed for TCDD, 2,4,5-T, and 2,4-D. No depth profile studies were conducted by ESL at NCBC, because previous OEHL data (Young et al., 1978; Young et al., 1979) had established that the "hardpan" at NCBC is relatively impervious to water and, presumably, to TCDD.

The OEHL procedure for collecting surface soil samples consisted of collecting a 3-inch cube, 6 inches from the site marker pins. At each sampling, soil was taken from a different "point of the compass," with reference to the marker pin, to ensure a fresh and undisturbed sample. The inherent weakness of this sample protocol was that the concentrations of the chemical varied significantly within the spill perimeter. Although this protocol establishes the level and extent of contamination at a specified location, it is useless in evaluating the rate of natural degradation.

ESL employed a surface soil sampling procedure similar to that used by OEHL. However, the ESL sampling protocol used a single sampling plot, 1 foot square by 3 inches deep, located 6 inches from the marker pin, which appears to be in the most contaminated area. This same sampling plot was resampled on all subsequent sampling dates. The soil was removed, sieved to remove rocks and debris, homogenized, sampled, remixed, and returned to the plot. The main disadvantage of this sampling protocol was the fresh exposure of contaminated soil to sunlight, resulting in a bias caused by accelerated photodecomposition of the dioxin compared to that of undisturbed soil. Five sampling sites were selected at each location to follow the rate of natural degradation. In cases where only the level and extent of contamination were to be determined, the OEHL protocol for soil sample collection was used.

Information on chemical analysis and QA/QC procedures employed in the ESL program is presented in Appendix A.

1.3.2.1.1.2 Comprehensive Soil Characterization Study. In the EG&G Idaho, Inc., study at Area A and vicinity (Crockett et al., 1987), a field protocol was prepared that addressed objectives, review of background data, sampling plans, site safety and decontamination, sample data reporting, QA, and analytical procedures. [Note: Procedures used in the follow-on study of Areas B and C (Friedrich, 1988) have not been reported.] The protocol was reviewed by the USAF and, informally, by EPA personnel. Comments were incorporated, and a final protocol was completed in October 1984. This section summarizes information contained in the protocol and includes field modifications. A USAF representative was present during sampling and approved all modifications. Procedures for sample collection, sample handling, chemical analysis, and laboratory QA are discussed in Appendix A. Field safety procedures are summarized in Appendix B.

1.3.2.1.1.2.1 Surface Sampling Design (Area A and Vicinity). Data from previous studies at NCBC (Young et al., 1983; Channell and Stoddart, 1984; Rhodes, 1985) were found to be inadequate to design a rigorous, statistically based characterization study. Previous results indicated the "hot spot" nature of the contamination that would be expected from leaking drums. Most of the soil samples containing TCDD in excess of 1 ppb were collected within the former storage area. Therefore, most of the sampling was concentrated in that area, and a reduced sampling intensity was used for the surrounding area.

In designing the sampling plan, two different approaches were considered. Relatively large areas could be repeatedly sampled to provide a mean value (and standard deviation) that is compared against some cleanup criteria. This procedure has been used by EPA when dealing with contaminated oils spread fairly evenly over large areas. Because contamination on NCBC is due to small spills, cleanup, theoretically, could be conducted on small plots. The alternate procedure was to divide the large area into many small areas and make a decision based on the results of a single analysis. An advantage of the latter approach is that data from many small areas can be combined to produce a means for evaluating larger areas, as was done by EPA.

However, making decisions based on one sample is generally unacceptable if data do not exist on the uncertainty associated with the value. To determine the uncertainty within sampling plots, every thirtieth sampling plot was sampled an additional four times. The four additional field replicate samples would be used to determine a mean and standard deviation and establish confidence intervals about the mean. These results would be used to estimate confidence limits for the other sampling plots. For example, to ensure with a 90-percent probability that all plots in excess of 10 ppb are cleaned up, it might be necessary to clean up all plots exceeding 5 ppb. The number of field samples at NCBC was based on an arbitrary decision to allocate one surface soil sample for every 400 ft^2. It was decided that 20-foot-square plots would be used. Plots of this size are probably about as small as can be reasonably cleaned up with heavy equipment. The final surface sampling design is shown in Figure 1-7.

The sampling design within the fenced storage area is systematic, with no designed-in randomness. A systematic grid was selected over random designs because of the relative ease of locating plots, sampling costs, the assumption that a random design would not improve the usefulness of the data (Young et al., 1983), and the need for 100-percent coverage of the fenced portion of the former storage area. In addition, remedial action based on a systematic grid should be easier to conduct. The use of a systematic grid for collecting the five soil subsamples and four replicate samples can be criticized for a lack of randomness. However, it can be argued that the distribution of contamination within a sampling plot is random; therefore, a random sampling design is not necessary. This sampling design was arrived at after a review of EPA Region VII's recommended procedures (draft*), other reports (Rhodes, 1985; Harris, 1983), and consultation with a statistician** familiar with TCDD data.

To verify data indicating very little contamination in excess of 1 ppb outside the fence, 100 additional sample plots were allocated for characterizing the surrounding area. The storage area grid shown in Figure 1-7 was extended, and plots were randomly selected from within an area bounded by the railroad tracks, roads, and along the south side of Greenwood Avenue.

At each sampling plot, a composite sample composed of five subsamples was collected on an "X" pattern (four corners and a center aliquot). The center subsample was collected 6 inches from the center stake and with the corners of the

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*U.S. Environmental Protection Agency Region VII. Field Procedure and Techniques for Use in Dioxin Site Investigations, Draft.

**Personal Communication, Robert Kinninson.

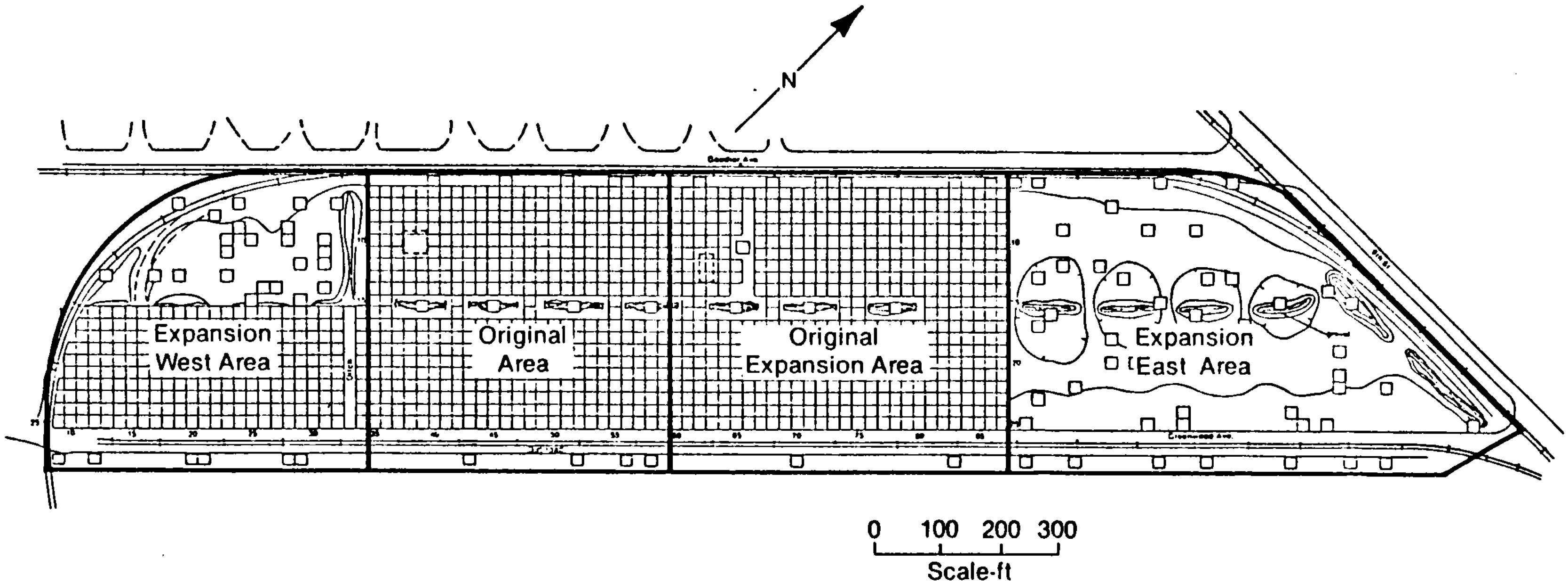


FIGURE 1-7
HO STUDY AREAS
(AREA A AND VICINITY)
COMPREHENSIVE SOIL CHARACTERIZATION STUDY BY EG&G IDAHO, INC.

Source: Crockett et al., 1987.

"X" at the ends of diagonals, 9.5 feet from the plot center. The purpose of collecting a composite sample was to obtain a more representative sample (and thus a more accurate estimate of TCDD contamination) from the sampling plot. Surface soils ranged from 0- to 6-inches thick.

To ensure data quality and utility, additional samples were collected and submitted to the analytical laboratory, including replicates, splits, blanks, rinsates, and standards. Replicate sampling, as previously discussed, involves collecting a normal sample, and then collecting four more samples (at every thirtieth plot) by shifting the pattern 3 feet in four directions parallel to grid lines. These samples were essential for determining confidence limits about sample plot means. Split samples involved collecting a composite sample every fortieth plot, dividing it into two jars, and sending each to a separate analytical laboratory. Blank samples at the rate of one in 40 were also collected and submitted for analysis. All blanks came from one large homogeneous sample containing soil and shells. Every twentieth sample was a standard or known sample. This QA program was designed to determine the accuracy and precision of the laboratories and the total uncertainty associated with sampling and to permit detection of cross-contamination between samples. Because of the lack of timely analytical results, it was not possible to provide QA data to field personnel during sampling as was planned.

All surface soil samples were analyzed for TCDD at a target detection limit of 0.1 ppb.

1.3.2.1.1.2.2 <u>Near-Surface and Subsurface Sampling Designs (Area A and Vicinity)</u>. Near-surface soil samples from the upper 12 inches of soil were collected to determine the vertical extent of contamination in "hot spot" areas for remedial action. Subsurface samples to a depth of 5 feet were collected to determine the maximum vertical migration of 2,4-D; 2,4,5-T; and TCDD. Sampling sites were determined in the field based on a limited quantity of analytical results from surface soil samples. Those sites with the highest concentrations of TCDD at the surface were chosen for subsurface sampling; sites with the next highest concentration were chosen for near-surface sampling.

Near-surface samples were collected from 35 sites at the following intervals--surface soil, soil/cement, 0 to 3 inches, and 3 to 7 inches below soil/cement. Sites were selected based on limited analytical results available.

Samples were collected near the plot center. The previously described field QA program regarding splits, blanks, rinsates, and standards also applies to near-surface sampling. All samples were analyzed for TCDD at a target detection limit (DL) of 0.1 ppb.

Subsurface soil samples were collected from 15 locations at the following depth intervals--surface to soil/cement, soil cement, 0 to 3 inches, 3 to 7 inches, and 8 to 12 inches below soil/cement, and at 1-foot intervals to 5 feet. Sampling sites were selected next to the most contaminated sites indicated by analytical results available at that time. The field QA program is as previously described. Samples were prioritized for analysis. Samples below 30 inches were held, pending results of the shallow samples. All subsurface samples were analyzed for 2,4-D; 2,4,5-T; and TCDD. The DL specified for TCDD varied from 0.1 ppb to 0.01 ppb based on the estimated concentration in the sample and depth of collection. The DL for 2,4-D and 2,4,5-T ranged from 20 to 5,000 ppb.

1.3.2.1.2 Geology and Groundwater. As discussed below, sampling and analysis of groundwater were conducted as part of the offsite dioxin contamination surveys by OEHL (Markland, 1986). Also, site geohydrologic conditions and groundwater contamination potential were evaluated by Barraclough and Wade (1986).

1.3.2.1.2.1 Offsite Dioxin Contamination Survey. As part of this project, potable water samples were collected from three well heads at NCBC during June 23-24, 1986. Analysis of these samples for TCDD was performed by Radian Corporation.

1.3.2.1.2.2 Geohydrologic Summary to Assess Impacts on Groundwater. Barraclough and Wade (1986) of EG&G Idaho, Inc., performed an evaluation of geohydrologic conditions at NCBC to assess the potential impacts on the groundwater resulting from the contamination of surficial soils by the storage and handling of HO. A literature survey was performed to collect relevant data on climatology, regional and site geology, water quality, and geohydrology for NCBC and surrounding areas. This information was evaluated to achieve the project objectives and to develop a groundwater monitoring program for the site. Because this monitoring program has not been implemented to date, it is not discussed in this report.

1.3.2.2 Surface Water and Sediments Investigation. Surface water and/or sediments of the NCBC drainage system associated with the former HO storage site were investigated as part of the initial HO monitoring program by ESL (Channell and Stoddart, 1984; Rhodes, 1985); comprehensive soil characterization study by EG&G Idaho, Inc. (Crockett et al., 1987; Friedrich, 1988); and offsite dioxin contamination surveys by OEHL (Markland, 1985; 1986).

1.3.2.2.1 Initial HO Monitoring Program by ESL. ESL collected samples in March 1984 to examine offsite TCDD migration in surface water. Samples were collected from the storm drains at NCBC and in other sections of the drainage system for a total of 14 locations (see Figure 1-8). Samples were analyzed for TCDD as discussed in the following paragraphs.

Due to the low solubility of TCDD in water (octanol/water partitioning coefficient of 1.4×10^{-6}), 10 liters of water were needed per sample. Samples were collected in 13-liter, hexane-rinsed and oven-dried glass bottles. The bottles were filled with water by either submerging the mouth of the bottle below the water surface or bailing water into the bottle with glass jars. After filling, the bottles were sealed with aluminum foil-wrapped butyl rubber stoppers. The stoppers were wired in place, and the samples were stored in a walk-in refrigerator (37°F) until shipment to the laboratory. Samples were shipped to Brehm Laboratory, Wright State University (WSU), unrefrigerated, by overnight air freight.

Water samples were analyzed one of two ways, depending on the amount of suspended sediment in a sample. Clean samples (less than 10 grams suspended sediment per sample*) were analyzed without filtering. Turbid samples (more than 10 grams suspended sediment per sample) were first filtered to remove the sediment. Two analyses then were run on the sample--one on the sediment and the other on the water. The decision to filter was at the discretion of Brehm Laboratory.

Sediment samples collected in association with biological samples were collected beginning in September 1980 through March 1984 to determine whether TCDD was migrating offsite. The 14 sampling locations are shown in Figure 1-8. These samples were collected according to the OEHL sampling protocol. Samples were analyzed for TCDD (see Appendix A). OEHL established that the primary

*Ten grams was the minimum sample size needed to perform soil and sediment samples.

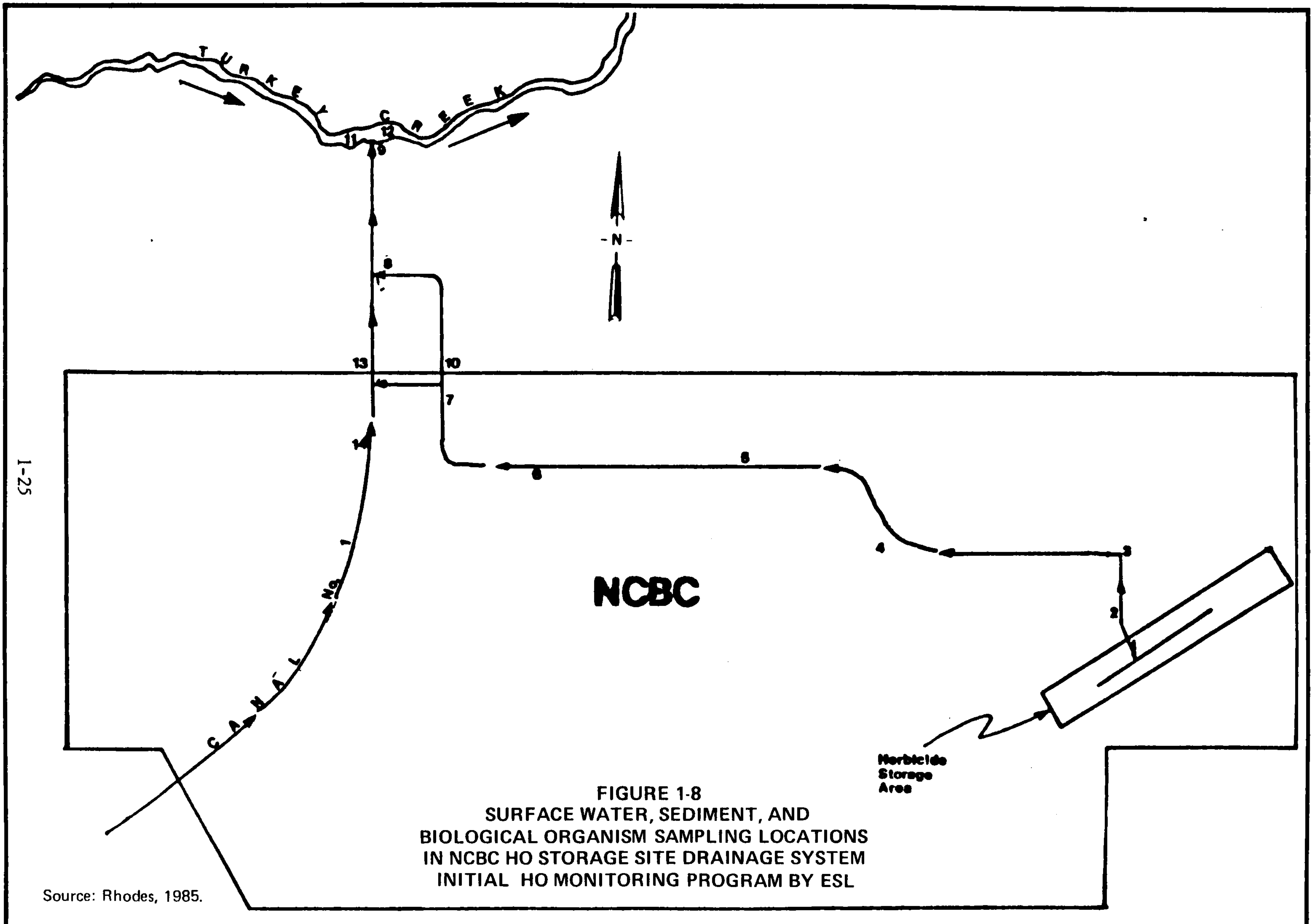


FIGURE 1-8
SURFACE WATER, SEDIMENT, AND
BIOLOGICAL ORGANISM SAMPLING LOCATIONS
IN NCBC HO STORAGE SITE DRAINAGE SYSTEM
INITIAL HO MONITORING PROGRAM BY ESL

Source: Rhodes, 1985.

mode of dioxin movement was through the erosion of contaminated soil into the rainwater drainage system (Young et al., 1978; Young et al., 1979). Biological species could become contaminated by direct exposure to contaminated sediments. This route of contamination was previously postulated by Young (1974).

1.3.2.2.2 Comprehensive Soil Characterization Study. As a part of the study of Area A (Crockett et al., 1987), 11 samples were collected from the sediment in the bottom of all ditch segments at Area A and vicinity (see Figure 1-7) to determine if TCDD contamination entered the local drainage system. Five aliquots were collected from each ditch segment and were sieved, mixed, and spooned into jars; samples were collected using a shovel and new spoons. Nondisposable equipment was decontaminated between each sample. The samples were analyzed for TCDD. Analytical and laboratory QA procedures are discussed in Appendix A.

In addition, during the follow-on study of Areas B and C (Friedrich, 1988), 11 sediment samples were collected from ditches in Area B and analyzed for TCDD.

1.3.2.2.3 Offsite Dioxin Contamination Surveys. During the initial sampling event in 1985, sediment samples were taken from 17 sampling points in the NCBC drainage system (see Figure 1-8). (NOTE: Not all sampling locations are shown in Figure 1-8.) The first site was within the old HO storage site, and the last site was in Turkey Creek, several miles downstream of its confluence with the base drainage system. In addition to collecting sediment samples at each of 17 sites, three separate sediment samples were collected at each of five sites (10 and 18 to 21) as stream transects to confirm the validity of the "normal" method of collecting only one sample at each location. All sediment samples were analyzed for TCDD.

During the sampling survey period of April 14-16, 1986, sediment samples were collected from several of the locations used previously by both OEHL and ESL--including locations 2 through 4, 6 through 12, and 15 through 17. These samples and a blank, duplicate, and matrix spike were analyzed for TCDD.

During the June 23-24, 1986, sampling survey, sediment samples were collected at two locations from the portion of the storm drainage system that drains plats 6 through 23 of the former HO storage site. The reason for this is discussed in Section 1.3.1.3. These samples and a blank and duplicate were analyzed for TCDD.

1.3.2.3 Biota Investigation. Sampling and analysis of biological organisms from the HO storage site drainage system were conducted as a part of the initial HO monitoring program by ESL (Channell and Stoddart, 1984; Rhodes, 1985) and the offsite dioxin contamination surveys by OEHL (Markland, 1985; 1986).

1.3.2.3.1 Initial HO Monitoring Program by ESL. In association with sediment sampling (see Section 1.3.2.2.1), biological samples were also collected from the NCBC storage site drainage system (see sampling locations in Figure 1-8) to assess offsite TCDD migration and contamination of biological species. These samples were collected according to OEHL sampling protocols.

1.3.2.3.2 Offsite Dioxin Contamination Surveys. During the 1985 sampling event, biological sampling was attempted at the 17 locations sampled for sediments (see Section 1.3.2.2.3). However, due to the scarcity of aquatic life in the drainage system, insufficient volume for analysis was collected at Sites 1, 5, 7, 8, and 10. Some of the sampling locations are shown in Figure 1-8. Samples were analyzed for TCDD.

During the sampling survey period of April 14-16, 1986, additional biological samples (including fish, crayfish, insects, and frogs) were collected from the drainage system at previously used sites--2 through 4, 6 through 12, and 15 through 17--and analyzed for TCDD. At that time, sediment samples also were collected at these sites (see Section 1.3.2.2.3). Two blank samples were also analyzed.

During the June 23-24, 1986, sampling survey, biological samples (fish, crayfish, and insects) were collected from the portion of the storm drainage system that drains plats 6 through 23 of the former HO storage area. The reason for this is discussed in Section 1.3.1.3. Samples from the two locations at which sediments were collected were analyzed for TCDD. One blank sample also was analyzed.

1.4 OVERVIEW OF REPORT

The remaining sections of this report present the following information:

- A discussion of the RI findings for each of the major components of the investigation:
  - Hydrogeologic investigation (Section 2)
  - Surface water and sediments investigation (Section 3)
  - Biota investigation (Section 4)

- Conclusions of each of the RI studies (Section 5)
- References (Section 6).

Also included are appendices that provide additional information relevant to investigation methodologies and findings, as well as supporting data.

2. HYDROGEOLOGIC INVESTIGATION RESULTS

Included in the hydrogeologic investigation were studies of soil contamination and of geology and groundwater.

2.1 SOILS

2.1.1 Initial HO Monitoring Program by OEHL and ESL

Data from soil sampling/analysis conducted from September 1980 through April 1982 are discussed by Channell and Stoddart (1984). That discussion is presented in this section. A listing of analytical results is presented in Appendix C.

Soil sampling points at the former HO storage site and ranges of detected concentrations are identified in Figure 2-1. A summary of average herbicide and TCDD concentrations is presented in Table 2-1. As a result of localized spills from leaking drums, TCDD concentrations are variable and range from 0.2 to 263 ppb. No depth-of-penetration studies were conducted past the artificial hardpan. Data collected by OEHL before 1979 (Young et al., 1978; Young et al., 1979) suggest that penetration of HO and TCDD past the current stabilized zone would be negligible.

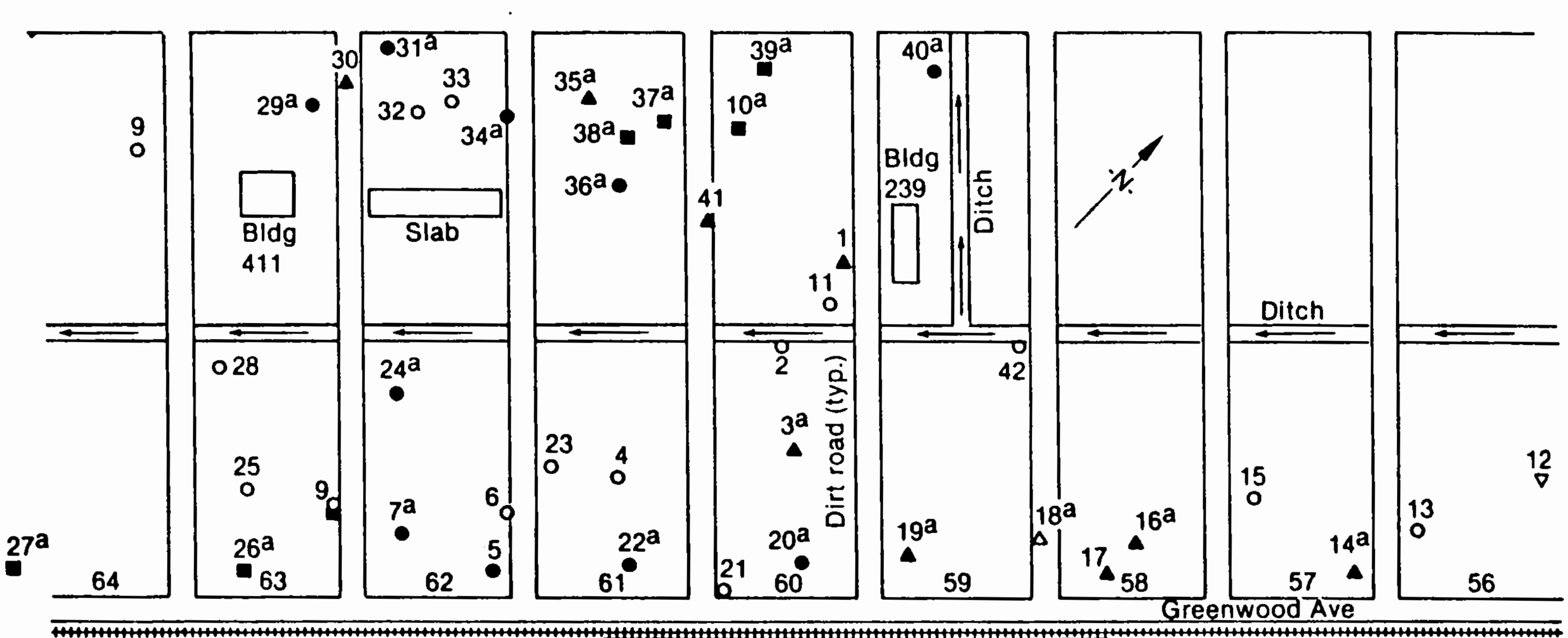
Percent reduction calculations shown in Table 2-2 indicate that concentrations of the phenoxy herbicides have decreased approximately 60 percent over the 6-month time period between November 1981 and April 1982. Environmental factors influencing herbicide reduction include soil matrix, wind velocity, precipitation, temperature, ultraviolet radiation, and volatility of the herbicide component.

All soil sampling results for the initial HO monitoring program, through November 1982, are presented by Rhodes (1985). These data are provided in Appendix C.

2.1.2 Comprehensive Soil Characterization Study

2.1.2.1 Investigation of Area A and Vicinity

2.1.2.1.1 Analytical Results by Sample Type. This section presents the results obtained from the analysis of the NCBC soil samples collected from Area A of the former HO storage site and surrounding areas. In addition to an overall summary,



TCDD concentration in parts per billion	
○ No data	● 1 to 10
□ <0.01 ND	■ 10 to 100
△ 0.01 to 0.1	▲ 100 to 500
▽ 0.1 to 1	

⟶ SURFACE WATER FLOW IN DITCH

a - Samples collected in 1977-78 and analyzed by the University of Utah; all other samples collected in 1980-82 and analyzed by Wright State University and California Analytical Laboratory

Source: Channell and Stoddart, 1984; Rhodes, 1985; Crockett et al., 1987.

FIGURE 2-1
MAP OF FORMER HO STORAGE SITES AT NCBC SHOWING THE AVERAGE TCDD CONCENTRATION RANGE FOR EACH SAMPLING LOCATION

TABLE 2-1

Summary of Average Values
for HO Residues at NCBC

Spill Site	Laboratory	2,4,-D (ppm) Lab Average	2,4,5-T (ppm) Lab Average	TCDD (ppb) Lab Average
1	CAL[a]	301±326	394±475	194±32 (4)[b]
	WSU[c]			144±22 (5)
	WSU/CAL[d]			166±36 (9)
5	CAL	465+191	1820+255	1.3±1.6 (2)
	WSU			2.2±0.6 (3)
	WSU/CAL			1.8±1.1 (5)
12	CAL	0.7±0.6	0.4±0.5	<0.09±0.02 (3)
	WSU			0.2±0.3 (5)
	WSU/CAL			0.2±0.2 (8)
17	CAL	2999±2368	2968±1036	207±80 (4)
	WSU			263±113 (5)
	WSU/CAL			238±98 (9)
41	CAL	1703±1595	1343±657	138±42 (4)
	WSU			157±73 (5)
	WSU/CAL			148±59 (9)

SOURCE: Channell and Stoddart, 1984.

[a]CAL = California Analytical Laboratories.

[b]( ) = The number of samples analyzed.

[c]WSU = Wright State University (Brehm Laboratory).

[d]WSU/CAL references split samples.

TABLE 2-2

Percent Reduction of Herbicide Levels at NCBC (1981-1982)[a]

Site No.	Date	Concentration 2,4-D (ppm)	Concentration 2,4,5-T (ppm)	Concentration Total Herbicide (ppm)	Date	Concentration 2,4-D (ppm)	Concentration 2,4,5-T (ppm)	Concentration Total Herbicide (ppm)	Percent Reduction[b]
1	Nov 81	130	200	330	April 82	22	74	96	78
5	Nov 81	600	2000	2600	April 82	330	1640	1970	24
12	Nov 81	<0.01	<0.01	<0.01	April 82	<1	<1	<1	NC[c]
17	Nov 81	5000	3700	8700	April 82	796	2770	3566	59
41	Nov 81	3050	1850	4900	April 82	110	570	680	86

SOURCE: Channell and Stoddart, 1984.

[a]For samples collected from depth of 0 to 3 inches at soil surface.

[b]Average percent reduction calculated as 61 percent for time period indicated.

[c]NC = not calculated.

the results for each type of sample (duplicates, splits, field blanks, etc.) are presented separately.

2.1.2.1.1.1 Field Soil Sample Analyses. The results of the analyses of the NCBC field soil samples, including the analytical results for the herbicides, are listed in Appendix C. This summary contains TCDD results on 1,766 field soil samples, which exclude rinsate samples and field performance audit (PA) samples. To prepare the summary, the TCDD results have been reviewed and assigned a validation status, as shown in Table 2-3. In addition, all maximum possible concentrations (MPC), explained following, have been interpreted as reporting levels or positive concentrations, as appropriate. As shown in Table 2-3, the term reporting level (RL) was adopted for use in Appendix C as a general term to cover both DL's and MPC's to avoid confusion, because the terms DL and MPC have specific meanings according to the analytical protocol. A DL is reported for samples in which no unlabeled TCDD was detected. An MPC is reported for samples where interference is observed for both ions with mass 320 and 322 or when unacceptable 320/322 and/or 257/322 ion ratios prevented identification of unlabeled TCDD as a sample component.

MPC's with a 257/322 ion ratio outside the prescribed window have been interpreted as actual concentrations if there was a nonzero peak area for ion mass 257. This interpretation is consistent with current EPA practice. Conversely, MPC's with a zero peak area for ion mass 257 have been interpreted as an RL, and MPC's with a nonzero peak area for ion mass 257 but an unacceptable 320/322 ion ratio have been interpreted as either a probable concentration or an RL, depending on how far outside the acceptance window the ratio was.

Only the average of duplicate results is presented in Appendix A. When more than one result was available for a sample because of reruns, only the valid one is presented. If more than one valid result was available, the highest value has been presented in the appendix, because this would provide the best indication of the maximum contamination of any location.

The TCDD results in the summary list have been presented to two places past the decimal point (i.e., to the hundredths place). No significance should be placed on a zero in the hundredths place; the analytical results are usually not that accurate. The zeros were added during preparation of Appendix C for data

TABLE 2-3

Legend for NCBC Final Sample Summary

Symbol	Explanation
Status	Validation status for the sample TCDD result; refers only to the TCDD result. Validation categories are defined below.
V	Valid; sample result is valid; all validation criteria have been met.
P	Probable; sample results interpreted as a probable concentration; not all validation criteria have been met, but the discrepancies are minor.
I	Invalid; sample result is invalid; there are major departures from the requirements of the validation criteria. No statement can be made about the results.
M	Missing; sample results are missing; the sample was either not received by the laboratory or could not be analyzed by the laboratory.
RL	Reporting limit; this term is used for the TCDD results instead of detection limit (DL) or maximum possible concentration (MPC) because the latter terms have specific definitions according to the analytical protocol. The RL is a term applied after the interpretation of the results; in some cases, it will be numerically equal to a true DL, and in other cases, it will be numerically equal to an MPC.

SOURCE: Crockett et al., 1987.

manipulation and data presentation purposes only. A maximum of two significant figures should be attributed to the analytical results because of possible analytical errors.

As shown in Table 2-4, 1,473 out of the total 1,766 samples were determined to be valid. The valid samples represented 83.4 percent, which is above the 80-percent level required by the analytical protocol.

2.1.2.1.1.2 Method Blank Analyses. A total of 94 method blank analyses were performed during the NCBC sample analysis program. This total includes 14 method blank analyses performed during rerun of various field soil samples, because the original results failed to meet specific QA requirements of the analytical protocol. In 93 of the method blanks, no TCDD was found, indicating that all reagents and glassware used were free of contaminants and interference. The remaining method blank was reported with a positive TCDD value of 0.08 ppb. This level of contamination was not considered to be significant, particularly because the majority of the samples associated with this method blank were reported with positive TCDD values of 0.3 ppb or greater.

2.1.2.1.1.3 Matrix Spike Analyses. A total of 102 matrix spike analyses were performed during the NCBC sample analysis program. Included in this total are 15 matrix spike analyses performed during rerun of various field soil samples, because the original results failed to meet specific QA requirements of the analytical protocol. The matrix spike samples were prepared using aliquots of clean (uncontaminated) NCBC matrix material that were subsequently spiked with native (unlabeled) TCDD. Spiking was performed either at the 1.0-ppb level in 10-gram matrix aliquots or at the 0.2-ppb level in 50-gram matrix aliquots. Five of the matrix spikes were performed at the 0.2-ppb level in 50-gram sample aliquots. The remaining matrix spikes were performed at the 1.0-ppb level in 10-gram sample aliquots. As stated previously, the purpose of these analyses was to measure the accuracy of the analytical procedure.

Out of the total 102 matrix spike analyses reported, 81 (79 percent) were reported as positive TCDD concentrations. In addition, 19 results (19 percent) were reported as MPC's because the 257/322 mass ratio was outside the prescribed window. However, in keeping with current EPA practice, this condition has been relaxed, and these results have been interpreted as actual TCDD concentrations

TABLE 2-4

NCBC TCDD Results Status Summary

Status Category	Number of Results	Percent of Total
Missing	5	0.3
Invalid	109	6.2
Probable	179	10.2
Valid	1473	83.4
Total	1766[a]	100.0

SOURCE: Crockett et al., 1987.

[a]The total does not include results for rinsate, field blank, or PA samples.

because each had a nonzero peak area at ion mass 257. Two results were outliers, where an outlier is defined as a result for which the spike recovery is either less than 60 percent or greater than 140 percent. The percentage of outliers was 2.0. One of the outliers is an MPC considered as an actual concentration. The spike recovery for this analysis was 53 percent. The second outlier is an MPC for which the 320/322 mass ratio is unacceptable and the 257 mass peak is zero. In this case, the MPC was considered as a DL, which means that the reported concentration was 0.0 ppb for 0.0 percent spike recovery.

The average percent spike recovery for the 100 acceptable (within tolerance) matrix spike results was 103 percent, with a standard deviation of 14 percent and a recovery that ranged from 80 to 140 percent.

Because the average percent recovery is close to the theoretical value and the standard deviation is well within the guidelines of the protocol, the results of the matrix spike analyses indicated that there was no significant analytical interference or bias due to the matrix.

2.1.2.1.1.4 Duplicate Analyses. Table 2-5 lists the results of the duplicate analyses performed during the NCBC sample analysis program. A total of 90 duplicate pairs were reported. Included in the list are results for 17 samples that were rerun. These samples may be either one or both members of the original duplicate pair. All reruns have been reported separately. Where only one member of the pair was rerun, the rerun results have been compared with the other member of the original pair. If both members of the duplicate pair were rerun, the two reruns have been compared with each other.

For duplicate analyses, MPC's where the 257/322 ratio was outside the prescribed window have been considered as actual concentrations. Conversely, MPC's with unacceptable 320/322 ratios have been considered as DL's. This interpretation is consistent with the situation discussed previously for matrix spikes. The MPC values in each category have been accordingly identified in Table 2-5.

Of the 90 pairs of duplicate results, 16 are outliers [i.e., 16 pairs of results have a relative percent difference (RPD) of greater than 50 percent]. The percentage of outliers is 18. Thus, the results of the duplicate analyses meet the protocol guidelines regarding the percentage of outliers based on the guideline for data completeness (i.e., acceptability of 80 percent or greater of the data).

TABLE 2-5

NCBC Duplicate Analysis Summary[a]

Sample Number	TCDD (ppb) Reported Concentration	TCDD (ppb) Detection Limit	Relative Percent Difference
NC-0590.01000	0.0	0.03[b]	0.0
NC-0590.01000D[c]	0.0	0.10[b]	
NC-0635.01000	0.1	--[d]	200[e]
NC-0635.01000D	0.0	1.90[b]	
NC-0642.02004	0.0	95.85[b]	0.0
NC-0642.02004D	0.0	91.23[b]	
NC-0742.01000	15.5	--	35
NC-0742.01000D	10.9	--	
NC-0774.51000	0.0	0.11[b]	0.0
NC-0774.51000D	0.0	0.03[b]	
NC-0776.01000	0.0	0.02[b]	0.0
NC-0776.01000D	0.0	0.06[b]	
NC-0841.01000	2.0	--	4.9
NC-0841.01000D	2.1	--	
NC-0857.01000	14.9	--	0.67
NC-0857.01000D	15.0	--	
NC-0884.51000	0.0	0.34[f]	13
NC-0884.51000D	0.3	--	
NC-0939.01000	6.6	--	24
NC-0939.01000D	0.0	5.21[f]	
NC-0953.01000	4.8	--	46
NC-0953.01000D	3.0	--	
NC-0977.01000	0.0	0.20[b]	0.0
NC-0977.01000D	0.0	0.24[b]	
NC-0992.51000	0.0	0.10	0.0
NC-0992.51000D	0.0	0.1	
NC-1031.01001	0.0	0.10	0.0
NC-1031.01001D	0.0	0.10	

TABLE 2-5 (cont'd)

Sample Number	TCDD (ppb) Reported Concentration	Detection Limit	Relative Percent Difference
NC-1062.01000	2.0	--	5.1
NC-1062.01000D	1.9		
NC-1080.01000	0.4	--	5.1
NC-1080.01000D	0.38	--	
NC-1086.01000	1.g	--	0.0
NC-1086.01000D	1.8	--	
NC-1146.01000	5.6	--	28
NC-1146.01000D	7.4	--	
NC-1229.01000	0.2	--	0.0
NC-1229.01000D	0.2	--	
NC-1238.01000	9.4	--	4.2
NC-1238.01000D	9.8	--	
NC-1255.01000	0.1	--	11
NC-1255.01000D	0.0	0.09[f]	
NC-1259.01000	11.5	35	
NC-1259.01000D	8.1		
NC-1285.01000	0.0	0.26[f]	26
NC-1285.01000D	0.2	--	
NC-1353.01000	2.2	--	13
NC-1353.01000D	2.5	--	
NC-1374.01000	0.0	0.23[f]	130[e]
NC-1374.01000D	0.0	0.05[f]	
NC-1374.01000R[g]	0.0	0.02	0.0
NC-1374.01000DR	0.0	0.02	
NC-1385.61000	0.0	0.59[f]	38
NC-1385.61000D	0.4	--	
NC-1444.01000	5.2	18	

TABLE 2-5 (cont'd)

Sample Number	TCDD (ppb) Reported Concentration	Detection Limit	Relative Percent Difference
NC-1444.01000D	0.0	6.23[f]	
NC-1568.01000	0.0	0.10	0.0
NC-1568.01000D	0.0	0.10	
NC-1568.01000R	0.0	0.11[b]	200[e]
NC-1568.01000DR	0.1	--	
NC-1620.01000	2.0	--	0.0
NC-1620.01000D	2.0	--	
NC-1626.01000	1.0	--	200[e]
NC-1626.01000D	0.0	1.41[b]	
NC-1632.01000	0.7	--	15
NC-1632.01000D	0.6	--	
NC-1685.01000	0.0	0.18[b]	200[e]
NC-1685.01000D	0.3	--	
NC-1713.01000	0.0	0.05[f]	200[e]
NC-1713.01000D	0.0	0.06[b]	
NC-1713.01000R	0.1	--	50
NC-1713.01000DR	0.0	0.06[f]	
NC-1754.01000	8.3	--	1.2
NC-1754.01000D	8.2	--	
NC-1763.01000	0.8	--	12
NC-1763.01000D	0.9		
NC-1780.01000	0.0	0.06[b]	0.0
NC-1780.01000D	0.0	0.08[b]	
NC-17A7.01000	0.0	0.10	0.0
NC-17A7.01000D	0.0	0.09	
NC-1823.51000	0.0	0.06[b]	0.0
NC-1823.51000D	0.0	0.09[b]	

TABLE 2-5 (cont'd)

Sample Number	TCDD (ppb) Reported Concentration	Detection Limit	Relative Percent Difference
NC-1868.01000	0.0	0.04[b]	0.0
NC-1868.01000D	0.0	0.20	
NC-1884.01000	1.5	--	24
NC-1884.01000D	0.0	1.18[f]	
NC-1884.01000R	1.4		13
NC-1884.01000DR	1.6	--	
NC-1914.01000	0.0	1.99[f]	200[e]
NC-1914.01000D	0.0	2.13[b]	
NC-1917.01000	0.0	0.33[b]	200[e]
NC-1917.01000D	0.5		
NC-1923.01000	0.1		200[e]
NC-1923.010000	0.0	0.13[b]	
NC-1975.01000	0.0	0.13[b]	0.0
NC-1975.010000	0.0	0.14[b]	
NC-1985.01000	1.1		200[e]
NC-1985.01000D	0.0	0.10	
NC-202B.01000	1.5	--	14
NC-2028.01000D	1.3	--	
NC-2041.01000	0.4	--	29
NC-2041.01000D	0.3	--	
NC-2054.01000	0.0	0.20[b]	0.0
NC-2054.01000D	0.0	0.13[b]	
NC-20A7.61000	0.0	0.10	0.0
NC-20A7.61000D	0.0	0.10	
NC-2158.01000	4.4	--	6.3
NC-2158.01000D	0.0	4.13[f]	
NC-2182.01000	0.9	--	5.4

TABLE 2-5 (cont'd)

Sample Number	TCDD (ppb) Reported Concentration	Detection Limit	Relative Percent Difference
NC-2182.01000D	0.0	0.95[f]	
NC-2268.01000	1.2	--	8.7
NC-2268.01000D	1.1	--	
NC-2271.01000	24.5	--	12
NC-2271.01000D	27.5	--	
NC-2271.01000R	14.9	--	6.9
NC-2271.01000DR	13.9	--	
NC-2277.01000	9.4	--	2.2
NC-2277.01000D	9.2	--	
NC-2277.01000R	7.5	--	2.6
NC-2277.01000DR	7.7	--	
NC-2318.01000	0.0	7.5[b]	200[e]
NC-2318.01000D	6.1		
NC-2318.01000R	4.9	--	22
NC-2318.01000D	6.1	--	
NC-2328.03008	0.15		150[e]
NC-2328.03008D	0.02	--	
NC-2329.01000	5.0	--	3.9
NC-2329.01000D	5.2	--	
NC-2329.01000R	3.9	--	5.3
NC-2329.01000DR	3.7	--	
NC-2358.41000	37.6		12
NC-2358.41000D	0.0	33.5[f]	
NC-2365.01000	17.3		23
NC-2365.01000D	13.8		
NC-2369.03000	15.8	--	1.3
NC-2377.02004	0.20	--	62[e]

TABLE 2-5 (cont'd)

	TCDD (ppb)		
Sample Number	Reported Concentration	Detection Limit	Relative Percent Difference
NC-2377.02004D	0.38		
NC-2378.04000	1.1		15
NC-2378.04000D	0.95	--	
NC-2418.01000	0.0	0.78[b]	0.0
NC-2418.01000D	0.0	0.60[b]	
NC-2431.04000	154.0		48
NC-2440.21000	1.4	--	25
NC-2440.21000D	1.8	--	
NC-2462.02004	34.4		13
NC-2462.02004D	39.3	--	
NC-2482.01000	86.6	--	1.2
NC-2482.01000D	85.6	--	
NC-2516.01000	0.0	0.20[b]	0.0
NC-2516.01000D	0.0	0.20[b]	
NC-2528.03004	0.22	--	8.7
NC-2528.03004D	0.24	--	
NC-2541.01000	0.9	--	40
NC-2541.01000D	0.6	--	
NC-2550.02001	12.9	--	20
NC-2550.02001D	15.8		
NC-2555.01000	0.0	1.92[f]	26
NC-2555.01000D	2.5		
NC-2555.01000R	1.7	--	6.1
NC-2555.01000DR	1.6	--	
NC-2564.02000	35.5	--	18
NC-2564.02000D	42.5	--	
NC-2575.01000	10.7	--	3.7

TABLE 2-5 (cont'd)

Sample Number	TCDD (ppb) Reported Concentration	Detection Limit	Relative Percent Difference
NC-2575.01000D	11.1	--	
NC-2587.01000	0.0	0.38[f]	200[e]
NC-2587.01000D	0.0	1.07[b]	
NC-2870.01000	31.0	--	2.9
NC-2870.01000D	31.9	--	
NC-6030.81000	0.0	0.15[b]	0.0
NC-6030.81000D	0.0	0.09[b]	
NC-6041.81000	0.0	0.09[b]	200[e]
NC-6041.81000D	0.1	--	
NC-7008.01000	0.0	0.12[b]	0.0
NC-7008.01000D	0.0	9.06[b]	
NC-7025.01000	0.0	4.70[f]	2.1
NC-7025.01000D	4.8	--	
NC-8018.81000	0.19	--	71[e]
NC-8018.81000D	0.09	--	

SOURCE: Crockett et al., 1987.

[a]Total pairs of results: 90, including 17 individual reruns; average relative percent difference: 40 percent; standard deviation: 67 percent; number of outliers: 16; percent outliers: 18.

[b]MPC considered as a DL.

[c]D = duplicate.

[d]— = not applicable.

[e]Outlier = pair of results with RPD >50 percent.

[f]MPC considered as a positive result.

[g]R = rerun.

The overall average RPD for the duplicate analyses is 40 percent, with a standard deviation of 67 percent. The large standard deviation of 67 percent is due to the large RPD of the majority of the outliers. The average RPD meets the protocol guidelines for accuracy. However, the large standard deviation means that the protocol goal for precision, which is a relative standard deviation (RSD) of 20 percent or less, was not met.

Of the 16 pairs of duplicate results that are outliers, 10 pairs have reported low-level TCDD concentrations with all values 0.5 ppb or less. This group of outliers is of only minor significance because of the low levels of TCDD contamination involved. Specifically, it is anticipated that the low levels of TCDD contamination represented by these samples would be well below any proposed action level required by any site remedial action activity contemplated in the future. Therefore, spread in the results obtained at these concentrations, as reflected in their large contribution to the standard deviation associated with the average RPD levels, is of no practical concern.

Five of the six remaining outlier pairs each include one result that is an MCP and has been interpreted as a DL because the 320/322 ion ratio was unacceptable. Three of these five pairs of results would each have acceptable RPD's if the MPC's were interpreted as actual concentrations. Because reanalysis of these samples, which was not performed because it was not required by the analytical protocol, would most probably have provided data with an acceptable 320/322 ion ratio and, therefore, have dramatically reduced the RPD for each pair of results, the large contribution of these outliers to the standard deviation associated with the average RPD is also of no practical significance.

In support of this conclusion, consider the case of sample NC-2318.01000, which was reanalyzed because of QA problems with the first analysis. In the first analysis, an MPC was interpreted as a DL because of an unacceptable 320/322 ion ratio, which led to an RPD of 200 percent when compared to the duplicate analysis. Reanalysis of this sample produced a result that was an actual concentration of TCDD and led to an RPD of 22 percent when compared to the same duplicate analysis. This case is typical of the results that would be anticipated if all of these MPC outliers had been reanalyzed.

To provide an indication of the significant contribution of the outliers to the average RPD and the associated standard deviation, the average RPD for the duplicate results is reduced to 11 percent, with a standard deviation of 13 percent if the outliers are eliminated. The RSD still exceeds the protocol goal of 20 percent or less, which means that the goal for precision has still not been achieved. The standard deviation measures the dispersion of clustering of the results around the average value (precision) and reflects the range of the RPD values. For the duplicate analyses, the clustering of the RPD values around the average does not meet the guidelines of the protocol. That is, there is more spread in the RPD values than would be ideal. This spread indicates that there is more scatter in the analytical results than anticipated. However, an inspection of the results of the duplicate analyses shows that, with the exception of the outliers, each pair of results is consistent and meets the accuracy guidelines of the protocol. Therefore, the fact that the within-tolerance duplicate results do not meet the protocol goal for precision is of no practical significance. The lack of significance of most of the outliers has already been noted previously.

2.1.2.1.1.5 Surrogate Standard Analyses. Table 2-6 summarizes the results of the surrogate standard analyses performed during the NCBC sample analysis program. Each surrogate spike was performed at a level equivalent to 1.0 ppb in a 10-gram sample aliquot. As stated previously, the purpose of these analyses was to indicate the accuracy of the analytical procedure at the 1.0-ppb level.

A total of 2,543 results were reported. Of this number, 51 are outliers, representing 2 percent. An outlier is defined by the protocol as a result for which the percent surrogate accuracy is either less than 60 percent or greater than 140 percent. The average surrogate accuracy for the within-tolerance results is 100 percent, with a standard deviation of 19 percent.

The results of the surrogate standard analyses show that there are no significant analytical problems in quantifying results at the 1.0-ppb level. These results meet the protocol guidelines for accuracy and precision, which are ± 40 percent for surrogate accuracy and an RSD of 20 percent or less for precision.

2.1.2.1.1.6 Field Blank Analyses. As indicated previously in Table A-3 (Appendix A), 53 field blank samples were submitted to the analytical laboratory during the NCBC sample analysis program. The status of these samples and the results of the

TABLE 2-6

NCBC Surrogate Accuracy Summary

Parameter	Value
Total results reported	2543[a]
Total number of outliers[b]	51
Percent outliers	2.0
Surrogate accuracy for within-tolerance results	
Average	100%
Standard Deviation	19%

SOURCE: Crockett et al., 1987.

[a]This total includes all results reported, including duplicates, method blanks, matrix spikes, PA samples, rinsate samples, and reruns.

[b]Outlier = result for which percent surrogate accuracy is either <60 percent or >140 percent.

field blank analyses performed during the analysis program are listed in Table 2-7. Of the 53 samples submitted to the analytical laboratory, six were used as sources of material for the matrix spike analyses and four are listed as missing, meaning that the sample either was not received by the laboratory or for some reason could not be analyzed by the laboratory. These two categories of field blank samples are appropriately identified in the table. Table 2-7 lists 55 analytical results for the remaining 43 field blank samples, including 10 reruns and two duplicate results.

Of the 55 reported results, six were outliers, defined as a field blank with a reported positive TCDD value of greater than 0.1 ppb. Two of the outliers were due to MPC's considered as positive results, as discussed previously for the matrix spike analyses. The percentage of outliers was 11 percent. The outliers are appropriately identified in the table. Four of the field blanks with outlier results were reanalyzed as part of the reruns performed during the project. In each case, the rerun result showed the field blank to be free of TCDD contamination. The other two field blanks with outlier results were not reanalyzed because of project schedule restraints. The field sample results associated with these two field blanks were invalidated.

An additional six field blanks, for 11 percent out the 55 results reported, were reported with positive TCDD levels ranging from 0.04 to 0.1 ppb. The low level of suspected contamination indicated by these results did not warrant reanalyzing the respective field blanks.

Overall, the results of the field blank analyses indicate that significant contamination of the samples during sampling and analysis did not occur.

2.1.2.1.1.7 <u>Field PA Sample Analyses</u>. For the NCBC site, the QA laboratory prepared three different series of PA samples from the same batch of clean (uncontaminated) NCBC matrix material. Replicate analysis in triplicate by the QA laboratory established the true TCDD value for each series of these PA samples. The experimentally determined true value for each series of PA samples and the associated standard deviation for the replicate analyses are shown in Table 2-8.

Tables 2-9, 2-10, and 2-11 list the results of the field PA sample analyses performed during the NCBC sample analysis program. A total of 82 PA samples were submitted to the analytical laboratory for analysis during the NCBC sampling

TABLE 2-7

NCBC Field Blank Analysis Summary[a]

	TCDD (ppb)	
Sample Number	Reported Concentration	Detection Limit
NC-6001.81000	MS[b]	--[c]
NC-6002.81000	MS	--
NC-6003.81000	MS	--
NC-6004.81000	MS	--
NC-6005.81000	MS	--
NC-6006.81000	MS	--
NC-6007.81000	Missing[d]	--
NC-6008.81000	0.0	0.1
NC-6009.81000	0.6[e]	--
NC-6009.81000R[f]	0.0	0.1
NC-6010.81000	0.0	0.26[g]
NC-6011.81000	3.5[e]	--
NC-6011.81000R	0.0	0.1
NC-6012.81000	0.0	0.5
NC-6013.81000	0.0	0.3
NC-6013.81000R	0.0	0.3
NC-6014.81000	0.0	0.3
NC-6015.81000	0.0	0.1
NC-6016.81000	0.0	0.1
NC-6017.81000	0.0	0.2
NC-6018.81000	0.09	--
NC-6019.81000	0.0	0.2
NC-6019.81000R	0.0	0.2
NC-6020.81000	0.0	0.16[g]
NC-6020.B1000R	0.0	0.1
NC-6021.81000	0.0	0.12[g]
NC-6022.81000	0.0	0.1
NC-6023.81000	0.0	0.17[e,h]

TABLE 2-7 (cont'd)

Sample Number	TCDD (ppb) Reported Concentration	TCDD (ppb) Detection Limit
NC-6023.81000R	0.0	0.09[g]
NC-6024.81000	0.0	0.1
NC-6025.81000	0.0	0.2
NC-6025.81000R	0.0	0.1[g]
NC-6026.81000	0.0	0.08[g]
NC-6027.81000	0.0	0.1
NC-6028.81000	0.4[e]	--
NC-6028.81000R	0.0	0.1
NC-6029.81000	0.0	0.02[g]
NC-6030.81000	0.0	0.15[g]
NC-6030.81000R	0.0	0.1
NC-6030.81000D[i]	0.0	0.9[g]
NC-6031.81000	Missing	--
NC-6032.81000	0.0	0.1
NC-6033.81000	Missing	--
NC-6034.81000	0.0	0.03[g]
NC-6035.81000	0.0	0.01[g]
NC-6035.81000R	0.0	0.01
NC-6036.81000	0.0	0.6
NC-6037.81000	0.0	0.05
NC-6038.81000	0.0	0.05
NC-6039.81000	0.0	0.18[g]
NC-6040.81000	0.0	0.04[g]
NC-6041.81000	0.0	0.09[g]
NC-6041.81000D	0.1	--
NC-6042.81000	0.0	0.06[g]
NC-6043.81000	0.0	0.1

TABLE 2-7 (cont'd)

Sample Number	TCDD (ppb) Reported Concentration	Detection Limit
NC-6044.81000	0.0	0.09
NC-6045.81000	Missing	--
NC-6046.82000	0.0	0.33[e,h]
NC-6047.82000	0.0	0.9
NC-6048.82000	0.2[e]	--
NC-6049.82000	0.1	--
NC-6050.83000	0.04	--
NC-6051.83000	0.05	--
NC-6052.83000	0.05	--
NC-6638.81000	0.0	0.04[g]

SOURCE: Crockett et al., 1987.

[a]Total results reported: 55, including 10 reruns and two duplicates; number of outliers: six; percent outliers:

[b]MS = sample used as a source of material for matrix spike analyses.

[c]— = not applicable.

[d]Missing = sample results are missing; the sample was either not received by the laboratory or for some reason could not be analyzed by the laboratory.

[e]Outlier = a positive result with a value >0.1 ppb.

[f]R = rerun.

[g]MPC considered as a DL.

[h]MPC considered as a positive result.

[i]D = duplicate.

TABLE 2-8

NCBC Performance Audit Samples: QA Laboratory Results

TCDD (ppb)	
True Concentration	Standard Deviation
0.080	0.00
0.85	0.042
8.34	0.64

SOURCE: Crockett *et al.*, 1987.

TABLE 2-9

NCBC Performance Sample Analysis Summary[a] (Series 1)

Sample Number	TCDD (ppb) Reported Concentration	Detection Limit	Relative Percent Error[b]
NC-8004.81000	0.0	0.11[c]	38
NC-8007.81000	Missing[d]		
NC-8011.81000	0.9[e]	--[f]	1000[e,g]
NC-8011.81000R[h]	0.1	--	25
NC-8013.81000	0.0	0.05	-38
NC-8013.81000R	0.2	--	650[g]
NC-8018.81000	0.19	--	140[g]
NC-8018.81000D[i]	0.09	--	13
NC-8019.81000	0.8[e]	--	900[e,g]
NC-8019.81000R	0.1	--	25
NC-8021.81000	0.0	0.14[c]	75[g]
NC-8021.81000R	0.1	--	25
NC-8022.81000	0.0	0.1[c]	25
NC-8038.81000	0.0	0.1	25
NC-8039.81000	0.0	0.1[c]	25
NC-8043.81000	0.5[e]	--	530[e,g]
NC-8043.81000R	0.1	--	25
NC-8046.81000	0.4[e]	--	400[e,g]
NC-8047.81000	0.1	--	25
NC-8049.81000	0.0	0.06[c]	-25
NC-8050.81000	0.3[e]	--	280[e,g]
NC-8050.81000R	0.6[e]	--	650[e,g]
NC-8051.81000	4.8[e]	--	5900[e,g]
NC-8051.81000R	0.1	--	25
NC-8052.81000	Missing		
NC-8054.81000	0.0	0.05[c]	-38
NC-8056.81000	0.0	0.06[c]	-25
NC-8061.81000	0.9[e]	--	1000[e,g]

TABLE 2-9 (cont'd)

Sample Number	TCDD (ppb) Reported Concentration	Detection Limit	Relative Percent Error[b]
NC-8061.81000R	0.1	--	25
NC-8062.81000	0.1	--	25
NC-8067.81000	0.0	0.1[c]	25
NC-8067.81000R	0.1	--	25
NC-8068.81000	0.0	0.07[c]	-13
NC-8070.81000	0.0	0.1[c]	25
NC-8072.81000	0.11	--	38
NC-8074.81000	0.2	--	150g
NC-8074.81000R	0.2	--	150g
NC-8078.81000	0.0	0.06[c]	-25

SOURCE: Crockett et al., 1987.

[a]Total results reported: 36, including 10 reruns and one duplicate; number of missing results: two; average reported TCDD concentration: 0.11 ppb; standard deviation: 0.043 ppb; average RPE: 33 percent; standard deviation: 53 percent; bias: 38 percent; number of outliers: 13; percent outliers: 36.

[b]RPE versus the true value for the PA samples; true value: 0.080 ppb.

[c]MPC considered as a positive result.

[d]Missing = sample results are missing; the sample was either not received by the laboratory or for some reason could not be analyzed by the laboratory.

[e]Result not included in calculation of averages.

[f]-- = not applicable.

[g]Outlier = result with a RPE >50 percent.

[h]R = rerun.

[i]D = duplicate.

TABLE 2-10

NCBC Performance Sample Analysis Summary[a] (Series 2)

Sample Number	TCDD (ppb) Reported Concentration	Detection Limit	Relative Percent Error[b]
NC-8002.81000	1.0	--[c]	18
NC-8003.81000	0.3	--	-65[d]
NC-8003.81000R[e]	0.7	--	-18
NC-8008.81000	0.9	--	5.9
NC-8012.81000	0.9	--	5.9
NC-8014.81000	1.1	--	29
NC-8015.81000	0.0	0.99[f]	16
NC-8017.81000	0.8	--	-5.9
NC-8025.81000	Missing		
NC-8026.81000	0.71	--	-16
NC-8027.81000	0.92	--	8.2
NC-8028.81000	0.7	--	-18
NC-8028.81000R	0.78	--	-8.2
NC-8029.81000	1.0	--	18
NC-8030.81000	0.85	--	0.0
NC-8031.81000	0.65	--	-24
NC-8032.81000	0.78	--	-8.2
NC-8033.81000	0.86	--	1.2
NC-8034.81000	0.85	--	0.0
NC-8035.81000	0.82	--	-3.5
NC-8036.81000	1.5	--	76[d]
NC-8037.81000	0.93	--	9.4
NC-8052.81000	Missing		
NC-8065.81000	0.8	--	-5.9
NC-8076.81000	1.1	--	29
NC-8077.81000	0.0	0.79[f]	-7.1
NC-8079.81000	1.0	--	18
NC-8080.81000	Missing		

TABLE 2-10 (cont'd)

Sample Number	TCDD (ppb) Reported Concentration	Detection Limit	Relative Percent Error[b]
NC-8082.81000	0.8	--	-5.9

SOURCE: Crockett et al., 1987.

[a]Total results reported: 26, including two reruns; number of missing results: three; average reported TCDD concentration: 0.87 ppb; standard deviation: 0.21 ppb; average RPE: 2.0 percent; standard deviation: 24 percent; bias: 2.4 percent; number of outliers: two; percent outliers: 8.0.

[b]RPE versus the true value for the PA samples; true value: 0.85 ppb.

[c]-- = not applicable.

[d]Outlier = result with an RPE >50 percent.

[e]R = rerun.

[f]MPC considered as a positive result.

[g]Missing = sample results are missing; the sample was either not received by the laboratory or for some reason could not be analyzed by the laboratory.

TABLE 2-11

NCBC Performance Sample Analysis Summary[a] (Series 3)

Sample Number	TCDD (ppb) Reported Concentration	Detection Limit	Relative Percent Error[b]
NC-8005.81000	13.3	--[c]	59[d]
NC-8005.81000R[e]	9.4	--	13
NC-8006.81000	0.0	10.8[f]	29
NC-8009.81000	9.3	--	12
NC-8010.81000	6.4	--	-23
NC-8016.81000	7.8	--	-6.5
NC-8020.81000	8.5	--	1.9
NC-8023.81000	8.4	--	0.72
NC-8023.81000R	7.8	--	-6.5
NC-8024.81000	7.4	--	-11
NC-8040.81000	0.0	8.18[f]	-1.9
NC-8041.81000	11.6	--	39
NC-8042.81000	0.0	7.79[f]	-6.6
NC-8044.81000	8.4	--	0.72
NC-8045.81000	7.8	--	-6.5
NC-8048.81000	QA		
NC-8053.81000	0.0	10.7[f]	28
NC-8055.81000	6.6	--	-21
NC-8055.81000R	7.9	--	-5.3
NC-8057.81000	7.5	--	-10
NC-8057.81000R	6.7	--	-20
NC-8058.81000	Missing		
NC-8059.81000	0.0	8.63[f]	3.5
NC-8060.81000	7.4	--	-11
NC-8063.81000	8.1	--	-2.9
NC-8064.81000	0.0	8.49[f]	1.8
NC-8066.81000	8.1	--	-2.9
NC-8069.81000	7.5	--	-10

TABLE 2-11 (cont'd)

Sample Number	TCDD (ppb) Reported Concentration	TCDD (ppb) Detection Limit	Relative Percent Error[b]
NC-80071.81000	6.7	--	-2.9
NC-80073.81000	8.1	--	-2.9
NC-80075.81000	7.2	--	-14
NC-80081.81000	8.4	--	0.72

SOURCE: Crockett et al., 1987.

[a]Total results reported: 30, including four reruns; number of missing results: one; average reported TCDD concentration: 8.4 ppb; standard deviation: 1.5 ppb; average RPE: 0.83 percent; standard deviation: 18 percent; bias: 0.84 percent; number of outliers: one; percent outliers: 3.3.

[b]RPE versus the true value for the PA samples; true value: 8.34 ppb.

[c]-- = not applicable.

[d]Outlier = result with an RPE >50 percent.

[e]R = rerun.

[f]MPC considered as a positive result.

[g]QA = sample submitted as an unknown to the QA laboratory.

[h]Missing = sample results are missing; the sample was either not received by the laboratory or for some reason could not be analyzed by the laboratory.

program. These tables also identify the MPC's. In all cases, the MPC's have been considered as positive results. The situation is similar to that noted previously for matrix spikes (Section 2.1.2.1.1.3). In addition, in each of these three tables, various samples have been identified as missing. This notation, as explained in the footnotes to each table, means that results for the sample in question are missing; the samples either were not received by the laboratory or for some reason could not be analyzed by the laboratory (e.g., the sample container had been broken in transit).

Furthermore, in each of the three tables, several analytical laboratory PA sample results have been identified as outliers, where an outlier is defined by the analytical protocol as a result with a relative percent error (RPE) compared to the true concentration of greater than ± 50 percent. In accordance with the analytical protocol, if a sample extraction batch contained a PA sample with a reported TCDD concentration so that the RPE was out of tolerance, then all samples in the extraction batch, including the PA sample, were reanalyzed. If reanalysis still failed to produce an acceptable RPE for the PA sample, then the analytical results for each of the samples in the extraction batch were invalidated.

Table 2-9 lists the analytical results for PA samples with a true TCDD concentration of 0.080 ppb. A total of 36 results are reported in the table, including the results for 10 samples reanalyzed (rerun) because of various QA considerations of the data validation process. Also listed in the table is the result of one duplicate analysis. The rerun and duplicate results are identified in the table. In addition, two samples are listed as missing, as already explained. The missing samples are also listed in the table, but have not been included as part of the total results. As noted, the true concentration for this series of PA samples was 0.080 ppb, which was below the 0.1-ppb DL required for the majority of the analyses. To prevent biasing the laboratory results, no attempt was made to identify to the analytical laboratory that any of the PA samples had a concentration of less than 0.1 ppb. In this regard, two of the results in Table 2-9 are reported as nondetected with an associated DL. For each of these results, the DL has been considered equivalent to a concentration to perform the statistical analysis of the analytical results.

Of the 36 results, 13 are outliers, representing 36 percent. Eight of the outliers have RPE's greater than 250 percent. Because these latter results are considered extreme outliers, they were excluded when calculating both the average reported TCDD concentration and the average RPE. Both the outliers and the extreme outliers are identified in Table 2-9. The results for this series of PA samples fail to meet the analytical protocol guidelines regarding the percentage of outliers based upon the protocol guideline for data completeness (i.e., acceptability of 80 percent or greater of the data).

The average RPE for this series of PA samples is 33 percent, with a standard deviation of 53 percent. The average RPE meets the protocol guideline for accuracy. Of the 10 reruns reported, six resulted in RPE's within tolerance, compared to the original results that had unacceptable RPE's. For two of the reruns, the RPE for the rerun was the same as for the original result. For the remaining two reanalyses, the RPE for the rerun was significantly larger in magnitude than for the original result.

For this series of PA samples, as shown in Table 2-9, the average reported TCDD concentration is 0.11 ppb, with a standard deviation of 0.043 ppb. Based on this standard deviation, the results for the analyses of this series of PA samples do not meet the protocol guidelines for precision. As with other categories of analyses, the protocol guideline for precision in this case is a relative standard deviation of 20 percent or less. Comparing the average reported TCDD concentration to the true concentration indicates an apparent bias between the analytical laboratory and the QA laboratory of 38 percent, which exceeds the protocol guideline of $\pm$10 percent.

In summary, the analytical results for this series of PA samples, as listed in Table 2-9, meet the protocol guideline for accuracy, but do not meet the guidelines for percent outliers, precision, or bias. The high precentage of outliers, low precision, and the large apparent bias can all be attributed to the significant scatter evident in the analytical results. Possible sources of this scatter will be discussed later, following discussion of the results for the other two series of PA samples. The problems with this series of PA samples are due to the low true concentration of the samples, which is at the extreme limits of the analytical protocol as adapted for a DL of 0.1 ppb. The scatter implies that analytical errors are more significant for low-level samples, around 0.1 ppb, than for samples at the 1.0-ppb level and higher. However, because any projected cleanup of the NCBC site would probably be based on a criterion of 1.0 ppb or greater, the error in such low-level samples would not have a significant impact on cleanup. To illustrate the dramatic decrease in analytical errors with increasing concentration, the analytical laboratory results for the other two series of PA samples, which had higher true TCDD concentrations, show significantly less scatter, resulting in better precision and lower bias. The other two series of PA samples will be discussed in the following paragraphs.

Table 2-10 lists the analytical results for the series of PA samples with a true TCDD concentration of 0.85 ppb. A total of 26 results are reported in the table, including the results for two samples that were reanalyzed (rerun) because of various QA considerations of the data validation process. The rerun results are identified in the table. In addition, three samples are listed as missing, as explained previously. The missing samples are identified in Table 2-10, but they have not been included in the total results.

Of the 26 results, two are outliers, representing 8 percent. Thus, the results for this series of PA samples meet the analytical protocol guideline for outliers. The average RPE is 2 percent, with a standard deviation of 24 percent. The average RPE is well within the analytical protocol guideline for accuracy. In addition, the average reported TCDD concentration is 0.87 ppb, with a standard deviation of 0.21 ppb. Based on this standard deviation, the results did not meet the previously discussed protocol guideline for precision. Finally, comparing the average reported TCDD concentration to the true concentration indicates an apparent bias between the analytical laboratory and the QA laboratory of 2.4 percent, which is well within the protocol guideline.

In summary, the analytical results for this series of PA samples, as listed in Table 2-10, meet the protocol guidelines for accuracy, percent outliers, and bias, but do not meet the guideline for precision. For both the duplicate sample analyses and the results for the first series of PA samples, the failure to meet the goal for precision is due to the scatter in the analytical laboratory results. This failure is not considered significant for the same reasons discussed previously for the duplicate sample analyses (Section 2.1.2.1.1.4).

Table 2-11 lists the analytical results for the series of PA samples having a true TCDD concentration of 8.34 ppb. A total of 30 results are reported in the table, including the results for four samples that were rerun. One sample has been listed as missing, as explained previously, and another sample was submitted to the QA laboratory rather than being submitted to the analytical laboratory. These samples have not been included in the total results.

Of the 30 results, one is an outlier, representing 3.3 percent. Thus, the results for this series of PA samples meet the analytical protocol guideline regarding the percentage of outliers. The average RPE is 0.83 percent, with a standard deviation of 18 percent. The average RPE is well within the analytical protocol guideline for accuracy. In addition, the average reported TCDD concentration is 8.4 ppb, with a standard deviation of 1.5 ppb. On the basis of this standard deviation, the results meet the analytical protocol guideline for precision. Finally, comparing the average reported TCDD concentration to the true concentration indicates a bias between the two laboratories of 0.84 percent, which is well within the analytical protocol guideline.

In summary, the analytical results for this last series of PA samples, as listed in Table 2-11, meet the protocol guidelines for accuracy, precision, bias, and percent outliers.

As stated previously, one sample from this last series of PA samples was submitted to the QA laboratory. The specific sample, identification number NC-8048.81000, was submitted as an unknown to serve as a check on the performance of the QA laboratory. The QA laboratory reported a TCDD concentration in the sample of 7.34 ppb, giving an RPE in comparison with the previously established true concentration of 12 percent. This result provides additional confirmation of the previous results of the QA laboratory.

Throughout the analysis program, the analytical laboratory did not extract and analyze the NCBC samples strictly according to the sequence in which they were submitted. As a result, one batch of samples extracted by the laboratory in the latter stages of the analysis program contained four different PA samples, and one of the PA samples was analyzed in duplicate. For this particular extraction batch, the result for the PA sample analyzed in duplicate was an outlier, with an RPE greater than 50 percent. However, the results for the duplicate of this PA sample, as well as the results for the other three PA samples, were all within tolerance, with RPE's of less than 50 percent. Thus, for this extraction batch, the outlier PA sample result was ignored, and the sample results for the extraction batch were validated based on the presence in the batch of four PA sample results with RPE's within tolerance.

There is no obvious cause for discrepancies or apparent bias between the analytical laboratory and the QA laboratory. The same analytical protocol, including extraction procedures, was used by both laboratories so there would be no differences resulting from procedural variations. No errors or discrepancies were found in the various calibrations and calculations of either laboratory. Furthermore, the instruments used by both laboratories were from the same manufacturer, so there was no possibility of differences because of different makes of instruments. Finally, neither laboratory reported instrument problems that could have led to discrepancies in results between the two laboratories.

Therefore, the apparent bias between the two laboratories, as well as the low precision previously noted during the discussion of the PA samples, has been attributed to significant scatter in the analytical laboratory results for certain levels of TCDD concentrations. This scatter is evidenced not only by the extreme range in the results, also reflected in the large standard deviations calculated, but also by the wide variations in the results upon reanalysis of samples. Such scatter in the results is probably because numerous personnel and several different instruments, working in multiple shifts, were employed in preparing and analyzing these samples. This scatter in results has contributed significantly to both the lack of precision and the apparent biases noted at lower levels of TCDD concentration. Scatter decreases dramatically as the TCDD levels increase. As anticipated, the analytical results show that reductions in the scatter produce concomitant improvements in the precision and reductions in the apparent bias.

2.1.2.1.1.8 Performance Evaluation (PE) Sample Analyses. The analytical laboratory analyzed two sets of PE samples, provided by the QA laboratory, during the analysis program. The results from the first set were inconclusive because the results reported by the analytical laboratory did not agree with the values previously determined by the QA laboratory. The analytical laboratory reported TCDD levels in several of the samples that were significantly higher than the values determined by replicate analysis in triplicate by the QA laboratory. For these results, the RPE's were about 200 percent. One of the sample extracts was obtained from the analytical laboratory and analyzed by the QA laboratory. The QA laboratory results confirmed the analytical laboratory results. Conversely, the

QA laboratory confirmed its previous analyses by reanalyzing one of its original sample extracts. Because of the requirements of the analytical schedule, the analytical laboratory did not at the same time analyze one of the sample extracts from the QA laboratory. It was decided that, in this case, the additional analytical effort was not warranted because it would have provided no conclusive additional information and would also have increased the chances of loss or contamination of the QA laboratory sample extract, all of which were maintained for reference purposes throughout the project. The same analytical protocol had been used by both laboratories, and no discrepancies in any of the calibrations or calculations were revealed. Thus, no apparent reason for the discrepancies between the laboratories could be determined for this set of PE samples. The confirmatory results obtained by the QA laboratory for the extract provided by the analytical laboratory indicated that the results for this set of PE samples were at least consistent. However, the results were anomalous because they did not agree with the true values determined by the QA laboratory.

Because the problems with the first set of PE samples could not be resolved, a second set of samples was immediately submitted to the analytical laboratory. This set consisted of six samples that included two sets of duplicates and a blank. Table 2-12 summarizes the results of the analysis of this set of samples. The average RPE for the six samples is -7.8 percent, with a standard deviation of 7.3 percent. Furthermore, the average RPD for the two pairs of duplicates in the set is 12 percent, with a standard deviation of 2.4 percent. These results show very good agreement between the QA laboratory and the analytical laboratory and indicate that there is no significant bias between the two laboratories for these samples.

To further confirm its previous analysis of the various PE samples, the QA laboratory analyzed a separate set while the analytical laboratory was analyzing the second set of PE samples. The QA laboratory results reconfirmed the previous results obtained by that laboratory.

2.1.2.1.1.9 Split-Sample Analyses. The results of the split-sample analyses performed during the NCBC sample analysis program are summarized in Table 2-13. Forty-five pairs of results were reported, including five reruns and two duplicate analyses by the analytical laboratory and one missing sample. Twelve are outlier pairs, representing 27 percent, out of a total of 45 pairs. To

TABLE 2-12

NCBC Performance Evaluation Sample Analysis Summary

Sample Designation	TCDD (0.080 ppb) True Concentration[a]	TCDD (0.080 ppb) Reported Concentration	Reported Results Relative Percent Difference[b]	Reported Results Relative Percent Error[c]
PE-2	0.0	0.0		0.0
PE-1	0.083	0.08	13	-3.6
PE-6	0.083	0.07		-16
PE-3	15.09	13.8	10	-8.5
PE-4	15.09	13.8	10	-8.5
PE-5	25.78	25.3		-1.9
Average:			12	-7.8
Standard Deviation:			2.4	7.3

SOURCE: Crockett et al., 1987.

[a]True value for the PE samples as determined by the QA laboratory.

[b]RPD calculated between results for PE samples having the same true value.

[c]RPE calculated against the true value for the PE sample.

TABLE 2-13

NCBC Split-Sample Analysis Summary[a]

Sample Number	TCDD (ppb) Reported Concentration	Detection Limit	Relative Percent Difference[b]
NC-0639.63001	259.0	--[c]	64[d]
NC-0639.73001	504.8	--	
NC-0763.61000	0.0	22.1[e]	71[d]
NC-0763.71000	10.5		
NC-0763.61000R[f]	12.7	--	19
NC-0763.71000	10.5	--	
NC-0796.61000	0.0	0.20	0.0
NC-0796.71000	0.0	0.11	--
NC-0853.61000	6.7	--	1.5
NC-0853.71000	6.8	--	
NC-0944.61000	41.5	--	0.97
NC-0944.71000	41.1	--	
NC-0944.61000	0.0	0.40[g]	0.0
NC-0984.71000	0.0	0.45[g]	
NC-1073.61000	0.0	0.27[e]	200[d]
NC-1073.71000	0.0	0.18[g]	
NC-1163.61000	49.5	--	30
NC-1163.71000	36.7	--	
NC-1163.6100R			
NC-1163.71000			
NC-1163.61000R	35.0	--	18
NC-1163.71000	36.7	--	
NC-1254.61000	1.3	--	31
NC-1254.71000	0.95		
NC-1254.61000R	0.9	--	5.4
NC-1254.71000	0.95	--	
NC-1343.61000	5.8	--	8.3
NC-1343.71000	6.3	--	

TABLE 2-13 (cont'd)

Sample Number	TCDD (ppb) Reported Concentration	Detection Limit	Relative Percent Difference[b]
NC-1385.61000	0.0	0.59[e]	21
NC-1385.71000	0.48	--	
NC-1385.61000D[h]	0.4	--	18
NC-1385.71000	0.48	--	
NC-13A6.61000	0.0	0.10	0.0
NC-13A6.71000	0.0	0.19	
NC-1474.61000	0.0	0.05[g]	0.0
NC-1474.71000	0.0	0.14	
NC-1718.61000	0.0	0.24[g]	0.0
NC-1718.71000	0.0	0.24[g]	
NC-1718.61000R	0.3	--	200[d]
NC-1718.71000	0.0	0.24[f]	
NC-1758.61000	5.9	--	31
NC-1758.71000	4.3	--	
NC-1821.61000	0.0	0.47[g]	0.0
NC-1821.71000	0.0	0.31[g]	
NC-1861.61000	0.0	0.2	0.0
NC-1861.71000	0.0	0.25	
NC-1924.61000	0.0	0.50[g]	0.0
NC-1924.71000	0.0	0.43[g]	
NC-1924.61000R	0.8	--	200[d]
NC-1924.71000	0.0	0.43[g]	
NC-1964.61000	0.0	0.37[e]	24
NC-1964.71000	0.0	0.47[e]	
NC-2027.61000	16.4	--	69[d]
NC-2027.71000	8.0		
NC-2030.63001	0.41	--	200[d]

TABLE 2-13 (cont'd)

Sample Number	TCDD (ppb) Reported Concentration	Detection Limit	Relative Percent Difference[b]
NC-2030.73001	0.0	0.10[g]	
NC-2067.61000	0.0	0.15[g]	0.0
NC-2067.71000	0.0	0.16[g]	
NC-20A7.61000	0.0	0.10	0.0
NC-20A7.71000	0.0	0.06	
NC-20A7.61000D	0.0	0.1	0.0
NC-20A7.71000	0.0	0.06	
NC-2130.61000	31.9	--	0.31
NC-2170.61000	0.0	0.47[e]	14
NC-2170.71000	0.41		
NC-2273.61000	Missing	--	
NC-2336.61000	0.0	0.60	0.0
NC-2336.71000	0.0	0.25[g]	
NC-2376.61000	179.0	--	45
NC-2376.71000	113.6	--	
NC-2377.62001	1.20	--	49
NC-2377.72001	1.98		
NC-2381.64000	0.22	--	67[d]
NC-2381.74000	0.11	--	
NC-2420.62001	3.30	--	170[d]
NC-2420.72001	0.24		
NC-2439.61000	3.9	--	9.8
NC-2439.71000	4.3	--	
NC-2479.61000	40.1	--	5.6
NC-2479.71000	42.4	--	
NC-2527.63001	0.0	307.00[e]	69[d]
NC-2527.73001	151.3	--	

TABLE 2-13 (cont'd)

Sample Number	TCDD (ppb) Reported Concentration	Detection Limit	Relative Percent Difference[b]
NC-2542.61000	1.5	--	40
NC-2542.71000	1.0	--	
NC-2544.62001	8.7	--	200[d]
NC-2544.72001	0.0	0.03[g]	
NC-2549.62000	0.0	226.5[e]	81[d]
NC-2549.72000	533.9	--	
NC-2582.61000	8.0	--	2.5
NC-2582.71000	8.2	--	

SOURCE: Crockett et al., 1987.

[a]Total result pairs reported: 45, including five individual reruns by the analytical lab, two duplicates, and one missing sample; average RPD = 44 percent; standard deviation: 65 percent; number of outliers: 12; percent outliers: 27.

[b]Sample Identification Code: NC-___.6___= analytical laboratory sample; NC-___.7___= QA laboratory sample.

[c]-- = not applicable.

[d]Outlier = pair of results with an RPD >50 percent.

[e]MPC considered as a positive result.

[f]R = rerun.

[g]MPC considered as a DL.

[h]D = duplicate.

compare the results of the split-sample analyses, MPC's have been considered in the same way as those encountered during analysis of the results of matrix spikes (Section 2.1.2.1.1.3). MPC's with unacceptable 320/322 ratios have been considered as DL's. The results of the split-sample analyses fail to meet the analytical protocol guideline for the outliers based on the guideline for data completeness.

The average RPD is 44 percent, with a standard deviation of 65 percent. The average RPD meets the analytical protocol guideline for accuracy. However, the large standard deviation means that the protocol goal for precision was not met. As with other categories of analyses, the protocol guideline for precision in this case is a relative standard deviation of 20 percent or less. The pairs of results listed in the table show significant differences between the results reported by the analytical laboratory and the QA laboratory. However, as is further evident from the results, there is also significant scatter in the data so that no clear-cut trends can be identified. The scatter in the results is also reflected by both the large standard deviation associated with the average RPD and the large number of outlier pairs. The differences between the two laboratories can be attributed to the significant scatter in the results and do not necessarily imply bias between the two laboratories. The lack of bias has been confirmed based on the conclusions reached during the preceding discussions regarding the results of both the PA and the PE samples.

The failure to meet the protocol guideline for outliers is of no practical significance because many of the outliers are either low-level samples with TCDD concentrations below 1.0 ppb or higher-level samples with TCDD concentrations of around 20 ppb or higher. In the former case, the TCDD levels are below any anticipated action level that might be required by future site remedial action. In the latter case, the TCDD levels are probably higher than any action level that might be required. Thus, cleanup of contamination of these levels would be required in any event.

The failure to meet the guideline for precision is a reflection of the scatter in the data. Such failure is not of practical significance because much of the scatter results from the outliers.

In addition to the potential causes of scatter noted previously during discussion of the PA sample analyses (Section 2.1.2.1.1.7), another possible cause for the scatter in the results for the split samples is the heterogeneous nature of the NCBC sample matrix, which may have resulted in sample splits that were not equivalent.

2.1.2.1.1.10 Rinsate Sample Analyses. Six rinsate samples were collected during the NCBC sampling program. Rinsate samples were only collected during subsurface drilling operations because other samples were collected using disposable equipment. Trichloroethane rinse samples were collected after the split-spoon sampler had been cleaned, as previously described. Four of the six rinses show low levels of contamination, while the other two show levels of 61 and 1.2 ppb, respectively. These results indicate that decontamination of the split spoon was incomplete.

The sampling protocol was designed to minimize the possibility of cross-contaminating the sample by use of a contaminated tool. After the split spoon sampler was removed from the hole and carefully opened, the top 3 inches of the core were cut off and removed. The outer layer of soil (approximately 1-inch thick) was then scraped off to expose the interior of the core. A new spoon was used to scoop the center of the core out of the sampler, leaving behind the layer of soil (approximately 1-inch thick) exposed to the other half of the split spoon. If this procedure had not been followed, samples collected with a contaminated split spoon could have been contaminated, although probably at insignificant levels (the dilution factor for 1 gram of soil contamination in a 1,500-gram sample is 1,500). However, any cross-contamination from the sampler should have been eliminated by removing soil directly below the previous sampling interval and soil that contacted the walls of the tool. Thus, the rinsate sample indicates the potential for contamination, not that contamination actually occurred. These data do not invalidate the subsurface sampling results. Because samples were not collected in strict numerical sequence, it is not possible to determine what samples were collected using the contaminated spoons. The rinsate sample numbers relate to the rinse following the sampling of a location (i.e., sample 2030-93040 is the rinse of the spoon used to collect sample 2030-03040).

2.1.2.1.2 Surface Sampling Results. The results of the surface sampling task are presented in this section. The overall site is presented first, and then the site is divided into the following four areas--the original area (Rows 5-28, Columns 35-59), the original expansion area (Rows 5-28, Columns 60-87), the expansion west area (Rows 6-28, Columns 9-34), and the expansion east area (Rows 5-28, Columns 88-127). The relationship of the areas is shown in Figure 1-7, Section 1.

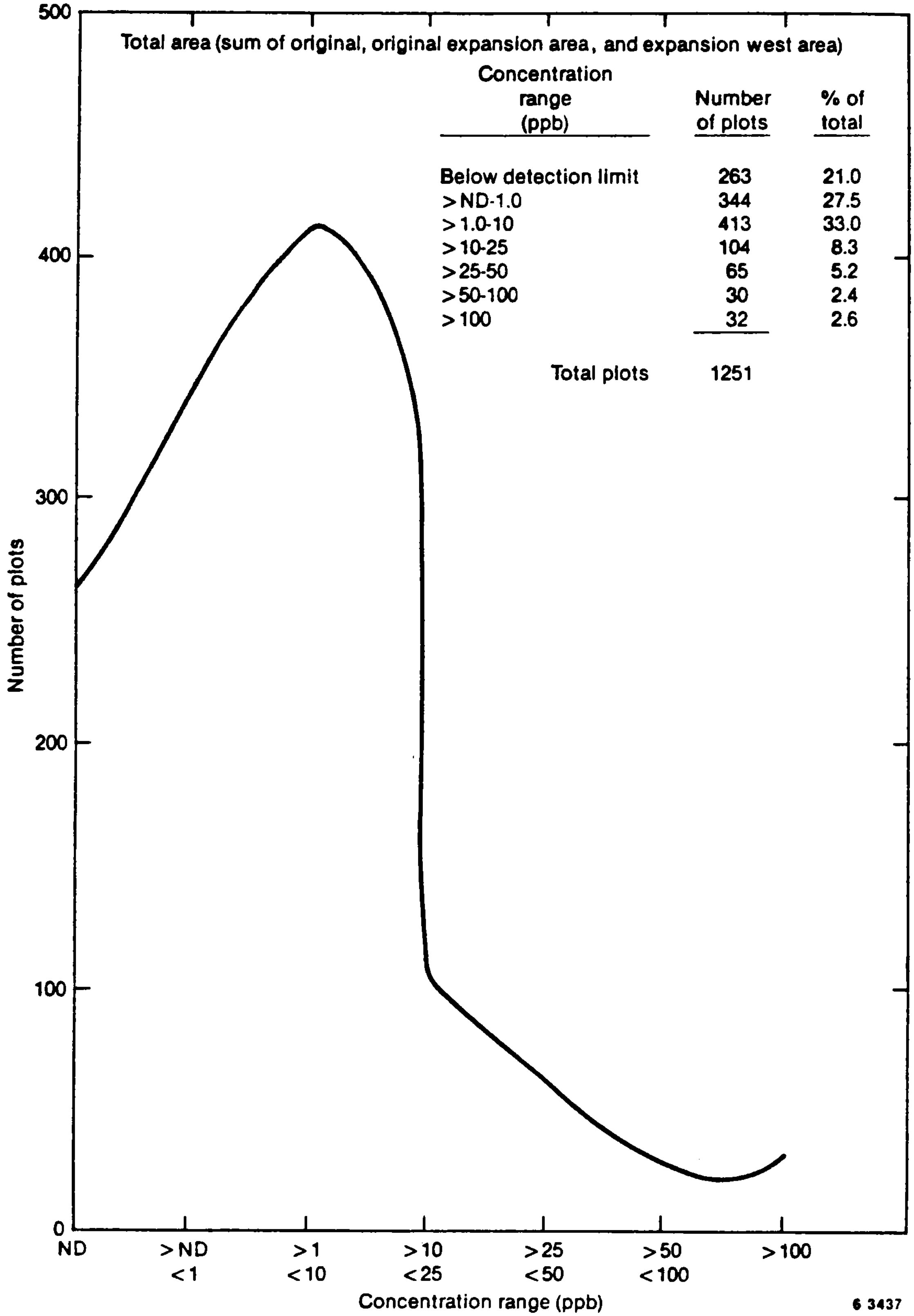
2.1.2.1.2.1 Overall Site. TCDD concentrations for all 1,300 plots are shown in Figure 2-2. Surface TCDD concentrations in the overall site range from less than a DL of 0.01 to a high of 650 ppb. Of the 1,300 plots, 83 percent had TCDD concentrations less than 10 ppb, and 51 percent had TCDD concentrations less than 1 ppb (Figure 2-3). The major contamination occurs in areas where drums either were stored or handled. The area along Greenwood Avenue (Rows 23-25, Columns 10-85) was drum storage. The area around Building 411 (Rows 6-14, Columns 35-53) was for dedrumming operations, and the area around the concrete slab (Rows 6-13, Columns 60-64) was used to crush empty drums. There are additional random hot spots where leakage obviously occurred outside these areas, but these are isolated and less than 100-ppb TCDD concentration.

The drainage of the overall site is inward toward the drainage ditches in the middle of the site. The three major areas identified previously all show that leakage drained toward the ditches with further confirmation from the ditch samples, which are TCDD contaminated to a maximum of 107 ppb in these areas. The contamination in the ditches decreased downstream until reaching the filter system installed at Row 6, Column 66, preventing contamination spread offsite.

The horizontal extent of TCDD contamination in surface soils has been delineated on the overall site, including the expansion areas. The random samples taken offsite indicate no contamination except in Row 28, Column 10, with a TCDD concentration of 31 ppb. EG&G Idaho, Inc., has advised AFESC/RDVW of this finding and suggested additional sampling in this area. The effort is currently under consideration.

2.1.2.1.2.2 Original Area. TCDD concentrations for all plots in the original area are shown in Figure 2-4. Figures 2-5 through 2-11 present the plots of TCDD concentration using the concentration intervals less than DL, DL to >1 ppb, >1-10 ppb, >10.25 ppb, >25.50 ppb, and >50-100 ppb. Plots containing replicated analyses are represented by the arithmetic mean of the replicated values.

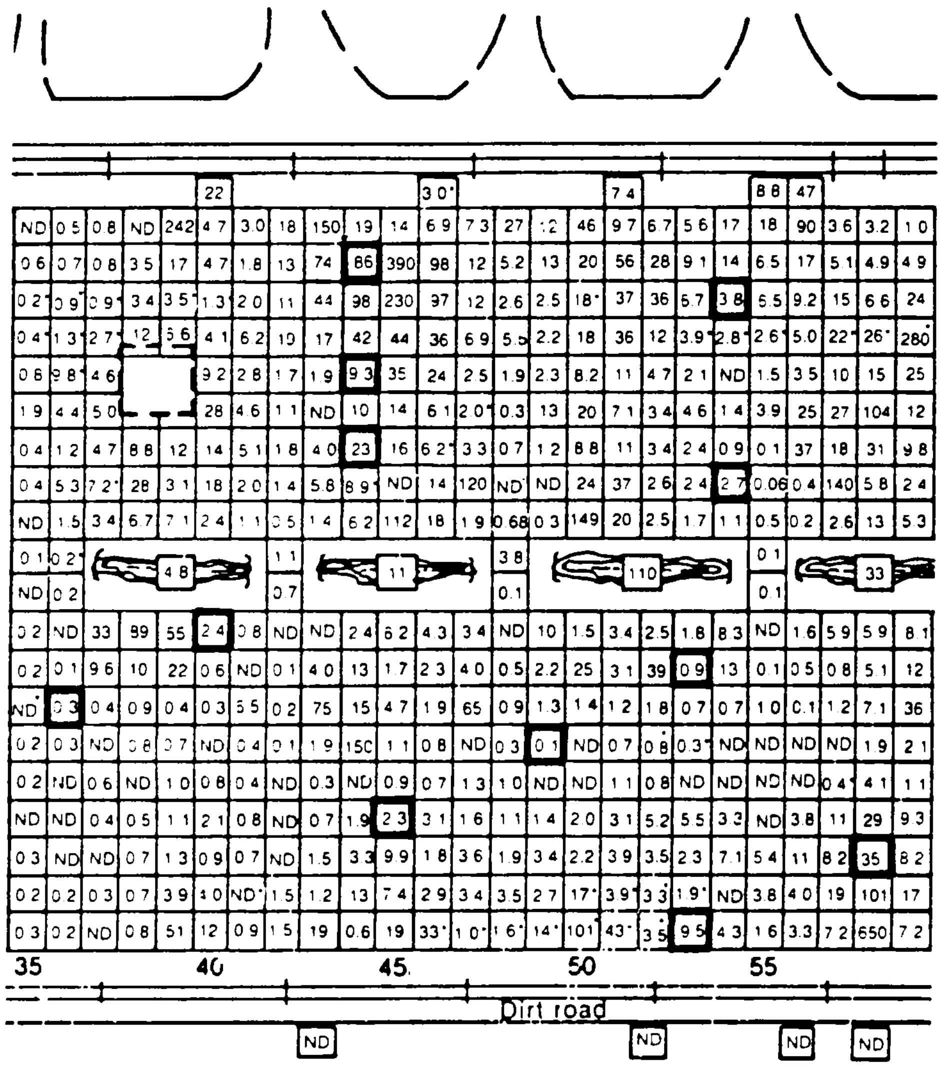
Surface TCDD concentrations in the original area using arithmetic means for replicated plots range from less than a DL of 0.01 to a high of 650 ppb. The 10 highest values are 650, 390, 280, 240, 230, 150 (three plots), 140, and 120 ppb. In



Concentration range (ppb)	Number of plots	% of total
Below detection limit	263	21.0
>ND-1.0	344	27.5
>1.0-10	413	33.0
>10-25	104	8.3
>25-50	65	5.2
>50-100	30	2.4
>100	32	2.6
Total plots	1251	

FIGURE 2-3
STORAGE SITE (EXCLUDING RANDOMS) CONCENTRATION RANGE DISTRIBUTION OF SURFACE SOIL PLOTS

Source: Crockett et al., 1987.



ND-indicates none detected above detection limit identified in Appendix A

☐ Indicated replicated plot, value given is arithmetic mean of all replicates

. Indicates result may be invalid due to quality assurance variances

FIGURE 2-4
ORIGINAL AREA--TCDD CONCENTRATIONS IN COMPOSITED SURFACE SOILS

Source: Crockett et al., 1987.

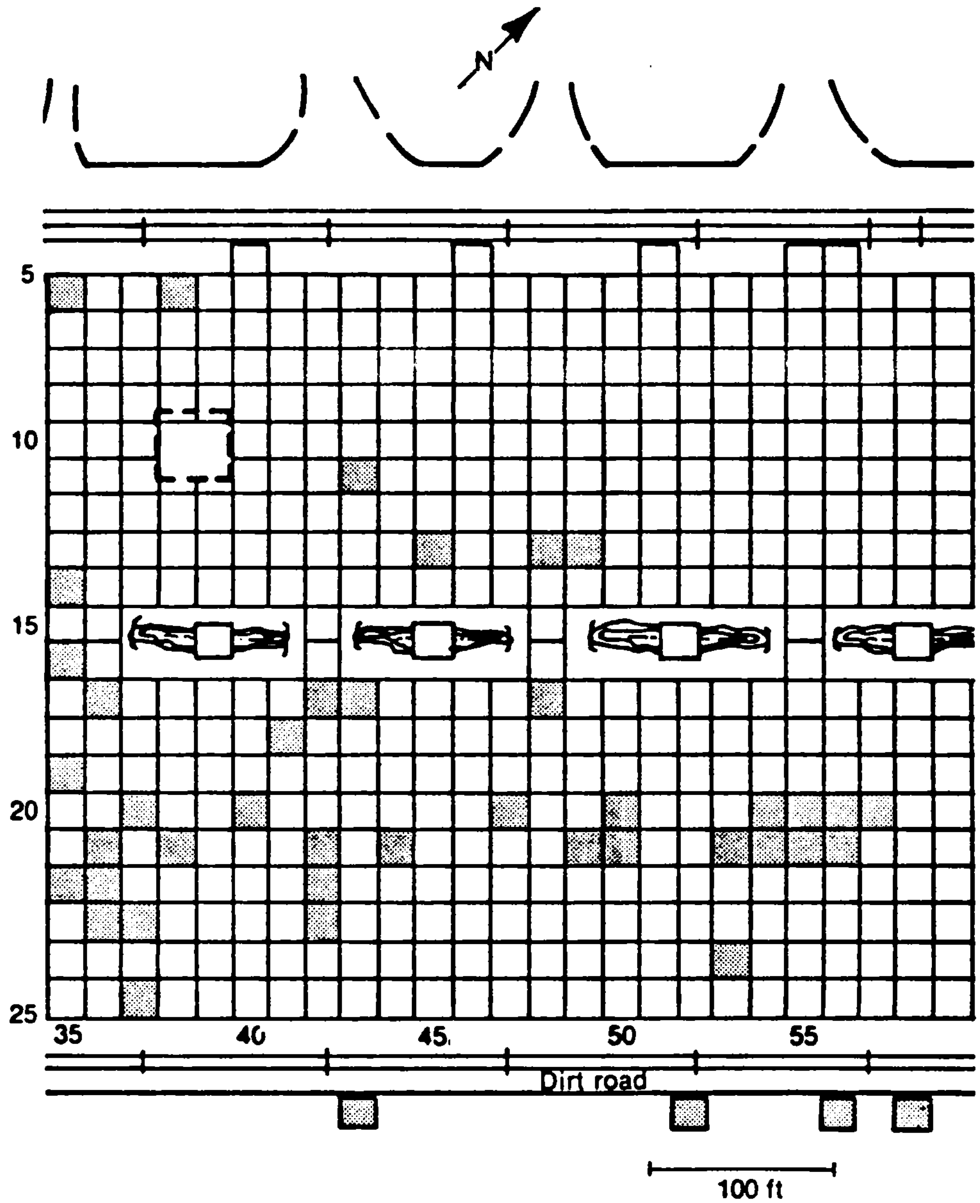


FIGURE 2-5
ORIGINAL AREA--TCDD CONCENTRATIONS IN
COMPOSITED SURFACE SOILS, LESS THAN DETECTION LIMIT

Source: Crockett et al., 1987.

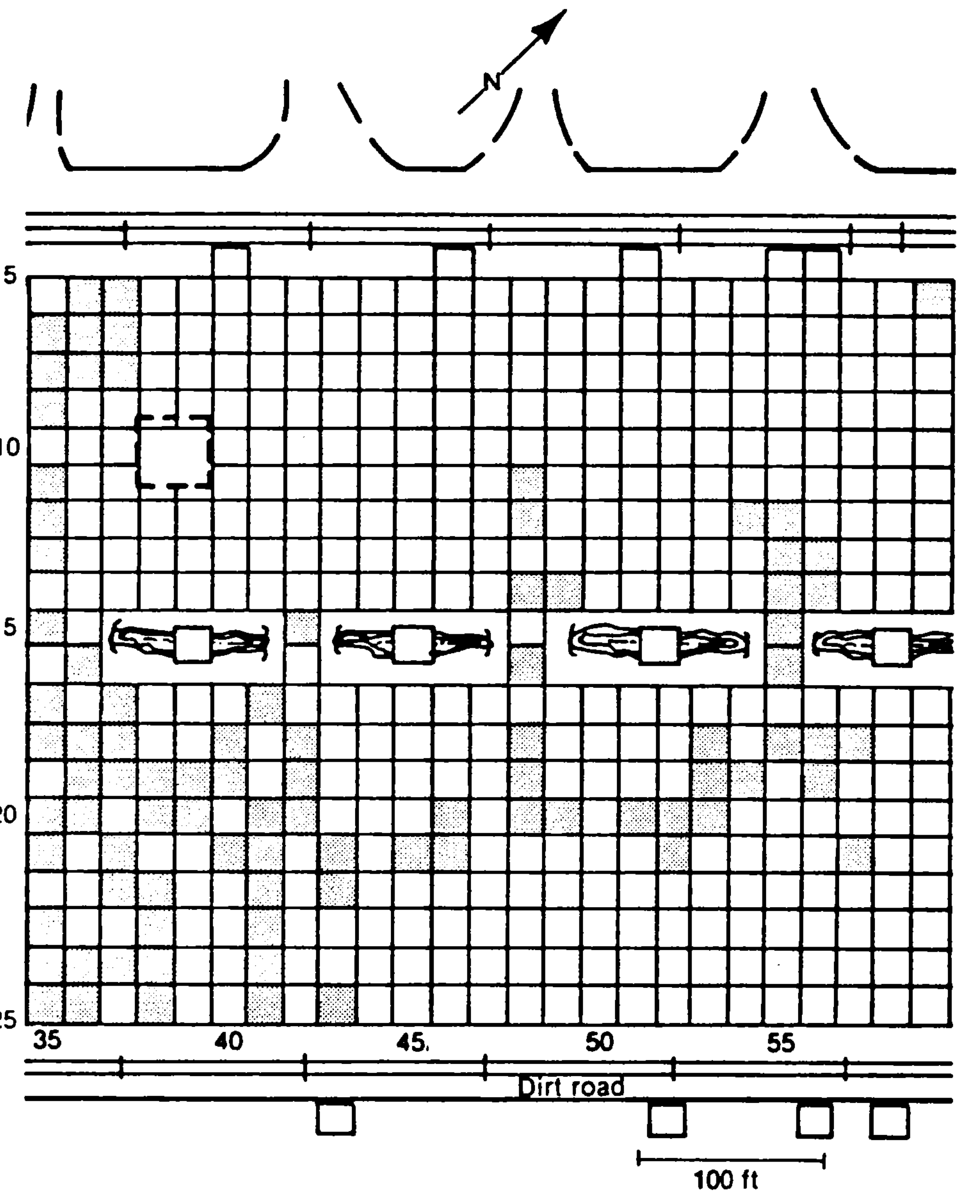


FIGURE 2-6
ORIGINAL AREA--TCDD CONCENTRATIONS IN COMPOSITED SURFACE SOILS,
>DETECTION LIMIT THROUGH 1.0 ppb

Source: Crockett et al., 1987.

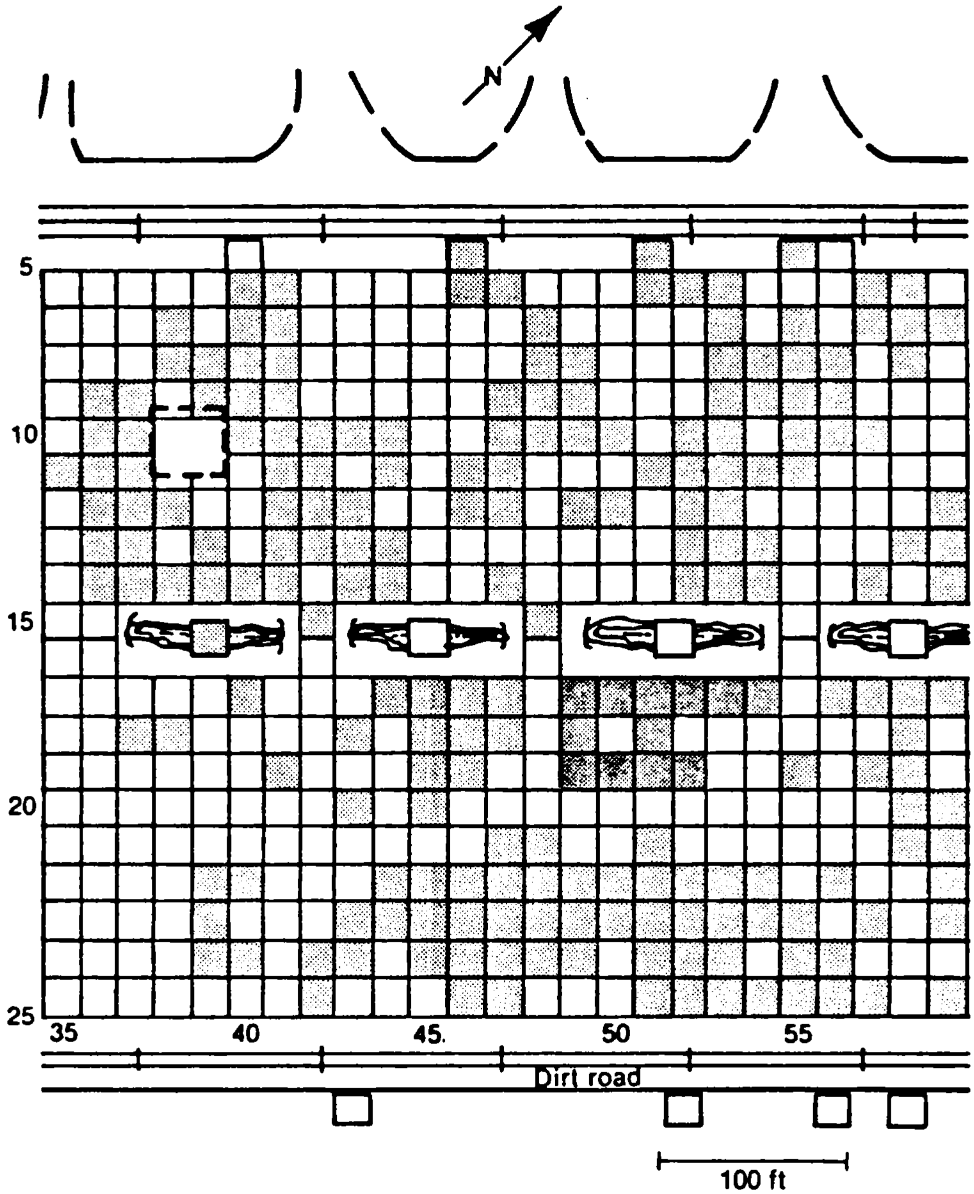


FIGURE 2-7
ORIGINAL AREA--TCDD CONCENTRATIONS IN COMPOSITED SURFACE SOILS, >1.0 ppb THROUGH 10 ppb

Source: Crockett et al., 1987.

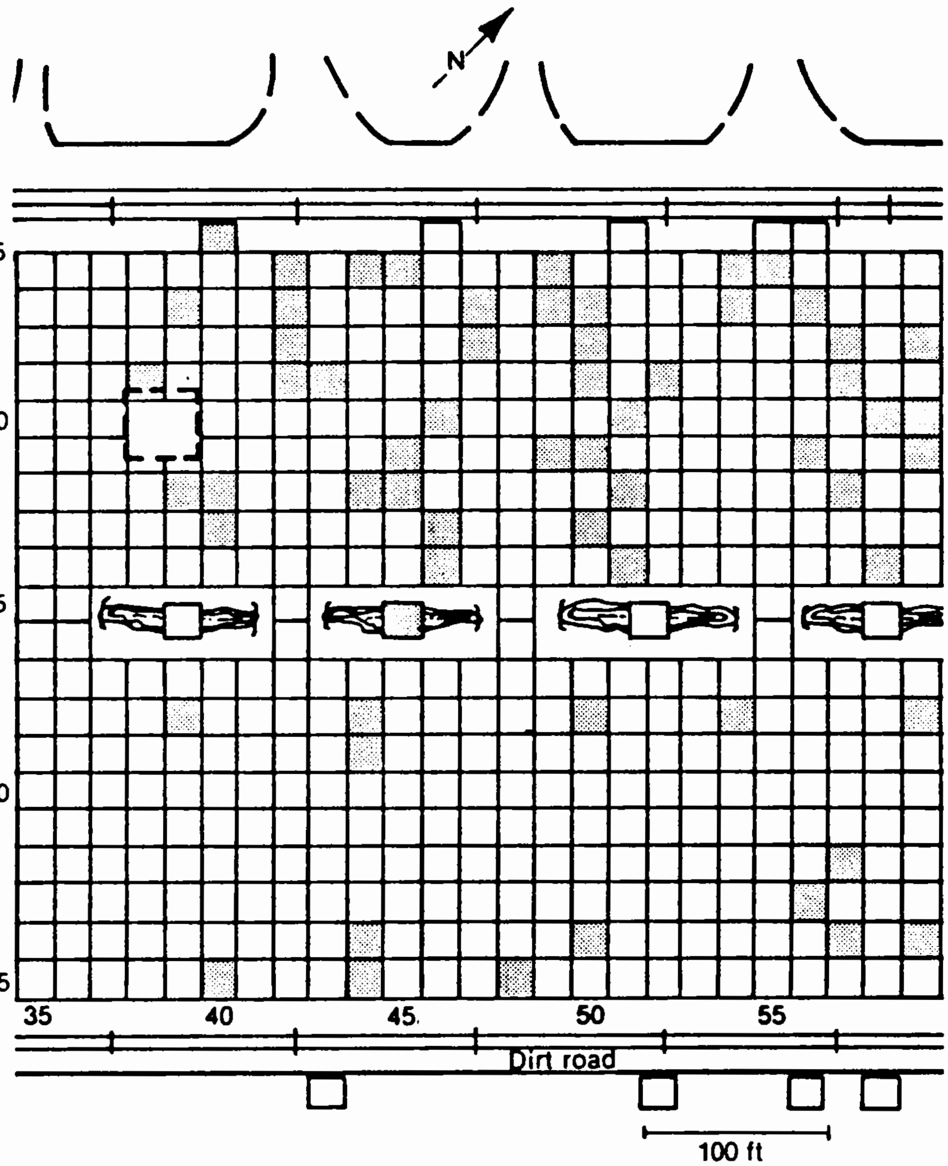


FIGURE 2-8
ORIGINAL AREA--TCDD CONCENTRATIONS IN COMPOSITED SURFACE SOILS, >10 ppb THROUGH 25 ppb

Source: Crockett et al., 1987.

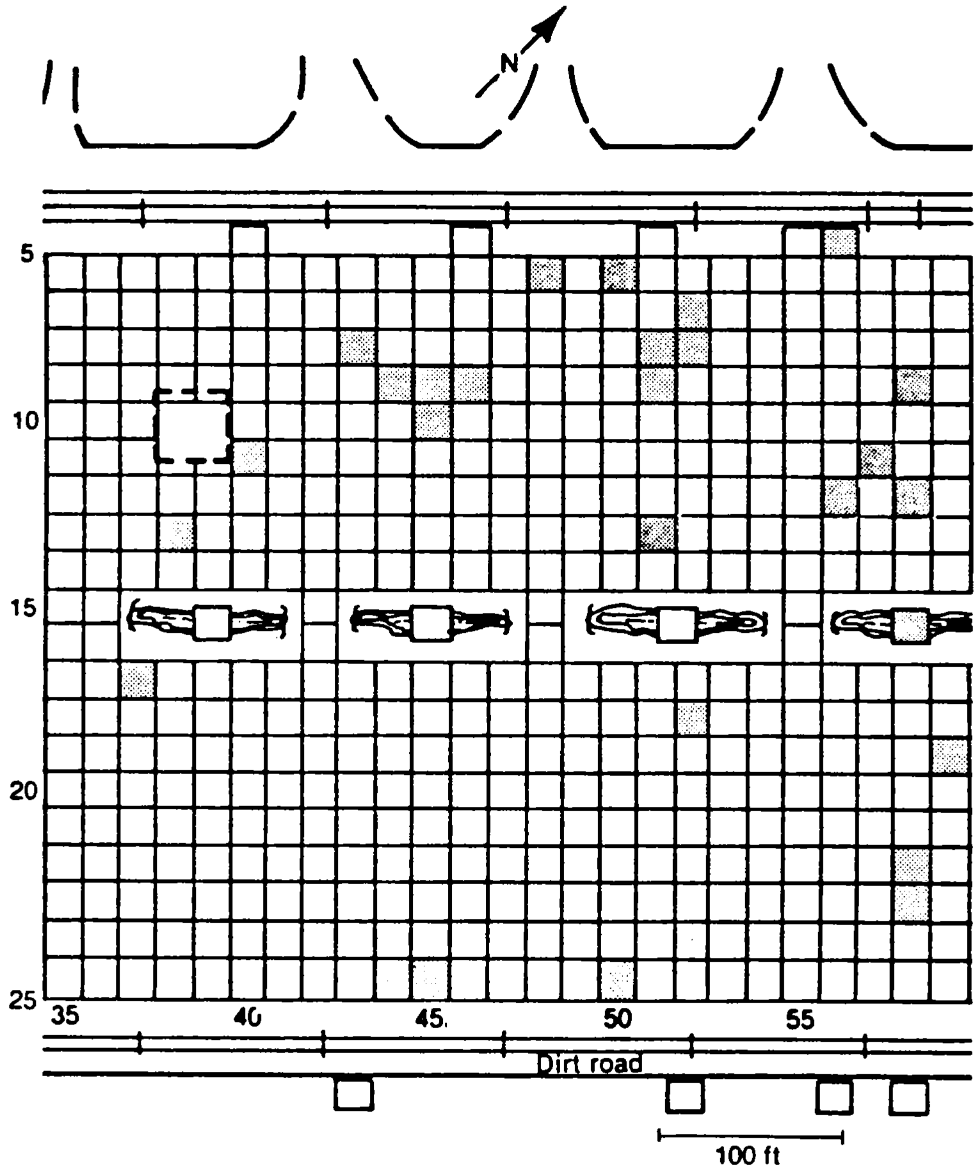


FIGURE 2-9
ORIGINAL AREA--TCDD CONCENTRATIONS IN COMPOSITED SURFACE SOILS, >25 ppb THROUGH 50 ppb

Source: Crockett et al., 1987.

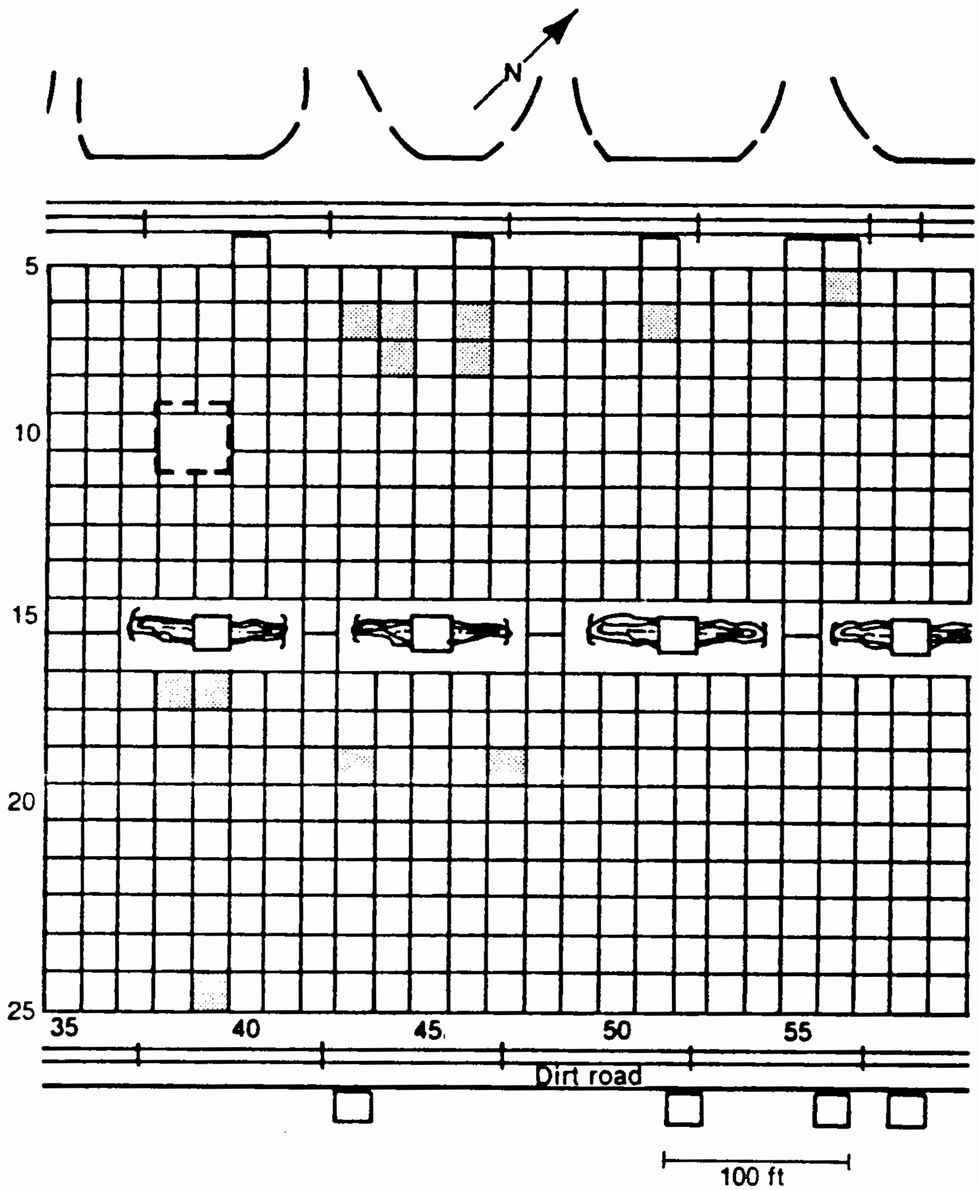


FIGURE 2-10
ORIGINAL AREA--TCDD CONCENTRATIONS IN COMPOSITED SURFACE SOILS, >50 THROUGH 100 ppb

Source: Crockett et al., 1987.

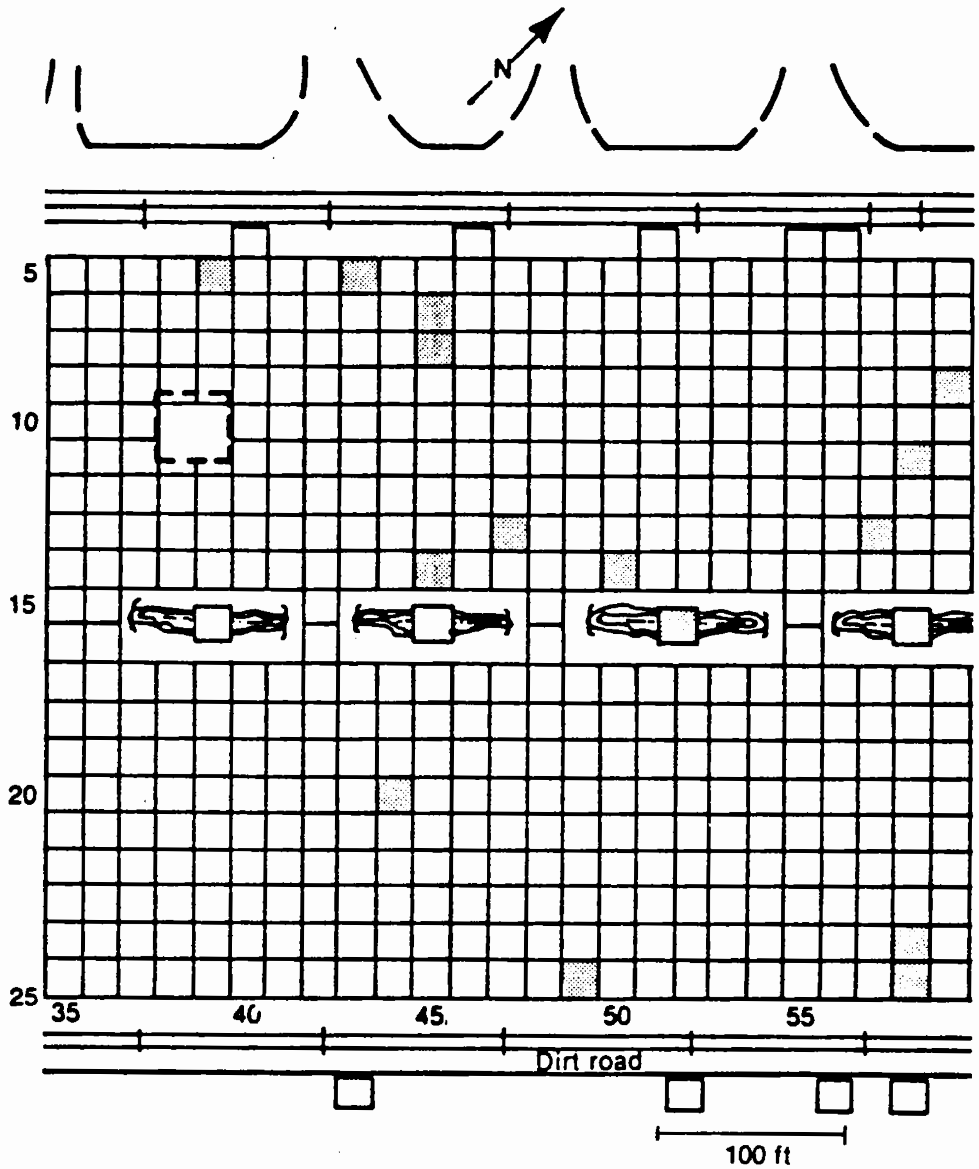


FIGURE 2-11
ORIGINAL AREA--TCDD CONCENTRATIONS IN COMPOSITED SURFACE SOILS, >100 ppb

Source: Crockett et al., 1987.

general, the spatial distribution of TCDD appears random as would be expected from leaking drums and spills. The frequency distribution of the plots for the various TCDD concentration intervals is given in Figure 2-3. As shown in Figure 2-3, the TCDD concentrations in over 75 percent of the plots in the original area are less than 10 ppb.

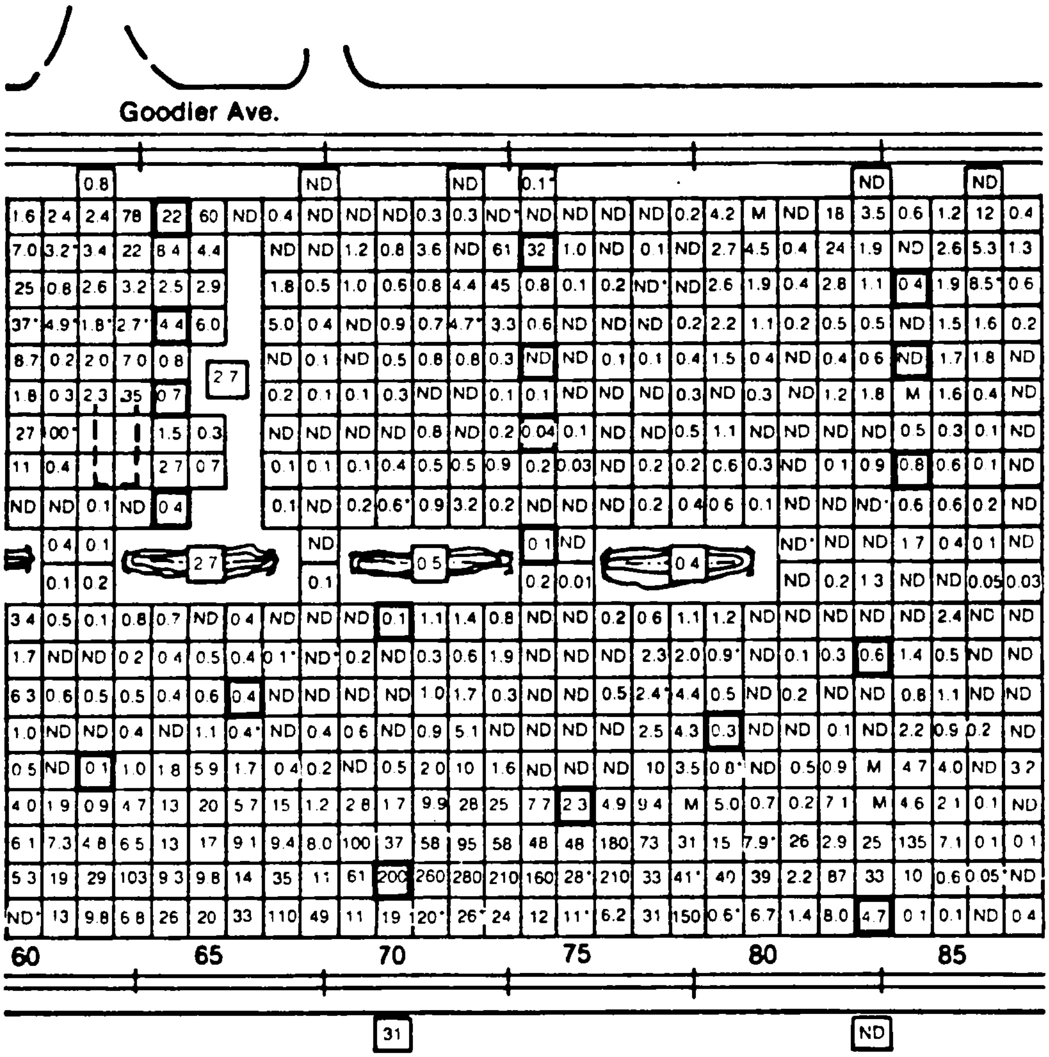
2.1.2.1.2.3 Original Expansion Area. The original expansion area includes 56 plots. TCDD concentrations in composited surface soils for all plots are shown in Figure 2-12. Figures 2-13 through 2-19 present the plots with TCDD concentrations within the intervals as stated previously. Plots containing replicate analyses are represented by the arithmetic mean of the replicated values.

Surface TCDD concentrations in the original expansion area range from less than a DL of 0.01 ppb to 280 ppb. Thirteen plots, all located in the southeastern portion of the original expansion area, exceed 100 ppb (Figure 2-19). In particular, the area comprising Row 24, Columns 70 through 74, and Row 25, Columns 71 and 72, has been impacted by a significant spill. A composite sample of surface soils collected southeast of Greenwood Avenue and the railroad tracks (approximately 50 feet) from the spill area had a TCDD concentration of 31 ppb (see Figure 2-12).

2.1.2.1.2.4 Expansion West Area. Two hundred seventy plots were sampled in the expansion west area. TCDD concentrations in composited surface soils are shown in Figure 2-20. TCDD concentrations in replicated plots are represented by the arithmetic means of all replicates. TCDD concentrations in the expansion west area ranged from nondetectable to 182 ppb. Only 3 of 25 plots in the northwestern portion of the area had detectable levels of TCDD. The highest TCDD concentrations appear to be in the southeastern portion of the area, particularly in Rows 23, 24, and 25; Columns 25 through 29.

Figures 2-21 through 2-27 present the plots with TCDD concentrations within the intervals listed in Figure 2-3. TCDD concentrations in over 86 percent of all plots in the expansion west area are less than 10 ppb. Almost 60 percent of the plots has concentrations less than 1 ppb. In general, the expansion west area has lower overall TCDD concentrations than both the original area and the original expansion area.

2.1.2.1.2.5 Expansion East Area. The expansion east area is next to the original expansion area to the northeast of the fenced-in area. To determine the presence,



ND-indicates none detected above detection limit identified in Appendix A

M-indicates missing sample

☐ Indicates replicated plot, value given is arithmetic mean of all replicates

• Indicates result may be invalid due to quality assurance variances

FIGURE 2-12
ORIGINAL EXPANSION AREA--TCDD CONCENTRATIONS IN COMPOSITED SURFACE SOILS

Source: Crockett et al., 1987.

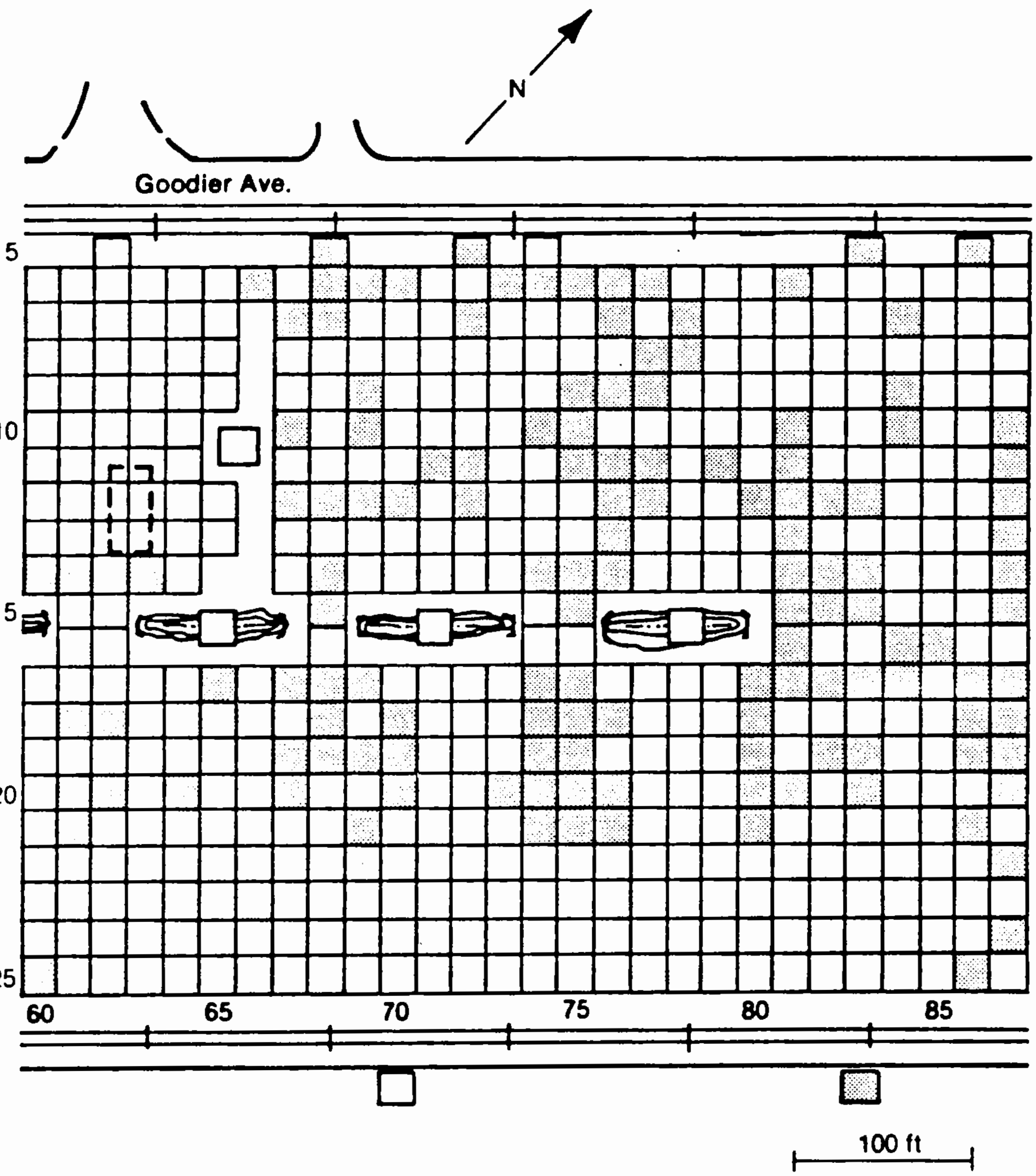


FIGURE 2-13
ORIGINAL EXPANSION AREA--TCDD CONCENTRATIONS
IN COMPOSITED SURFACE SOILS,< DETECTION LIMIT

Source: Crockett et al., 1987.

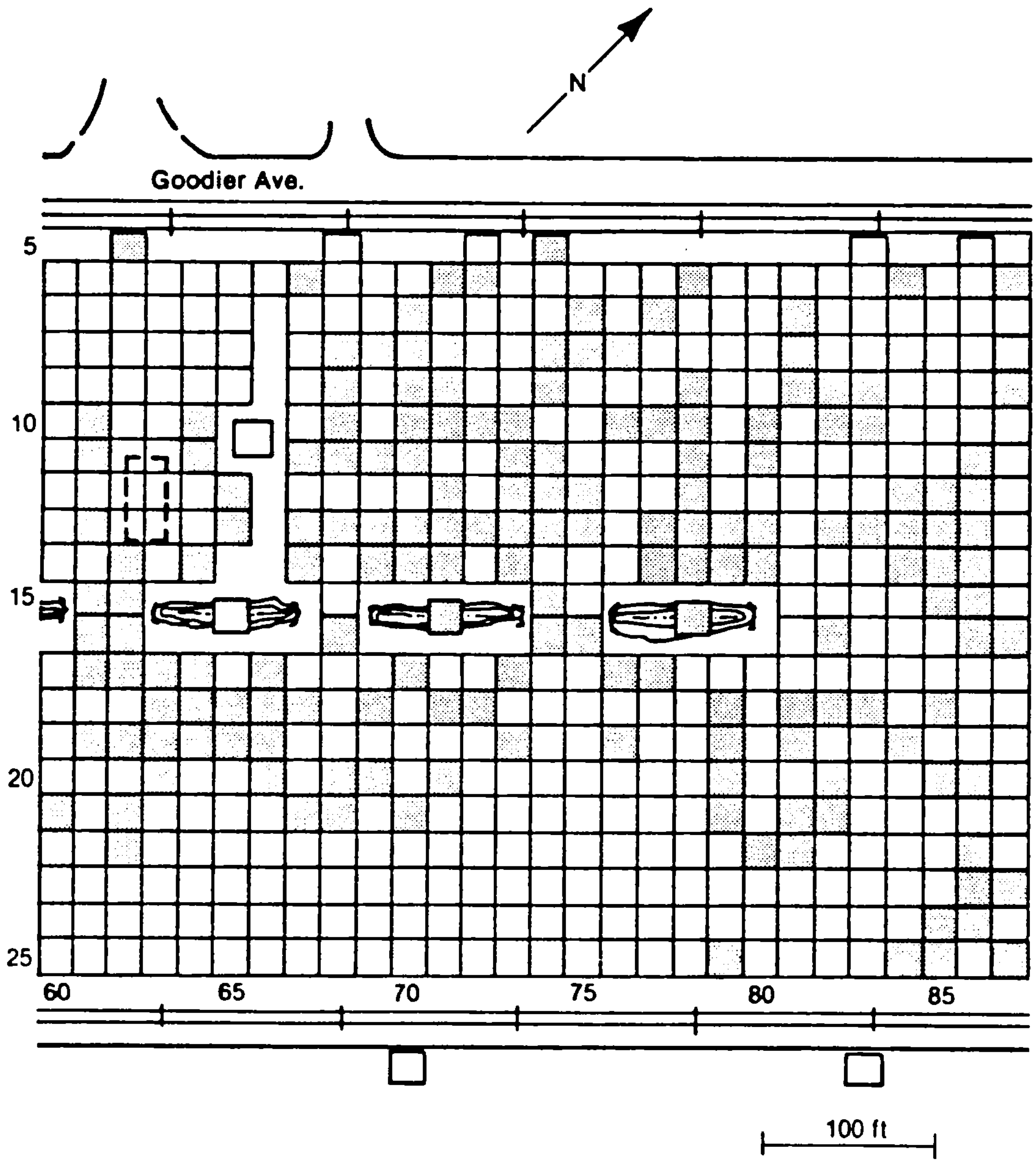


FIGURE 2-14
ORIGINAL EXPANSION AREA--TCDD CONCENTRATIONS
IN COMPOSITED SURFACE SOILS,> DETECTION LIMIT THROUGH 1.0 ppb

Source: Crockett et al., 1987.

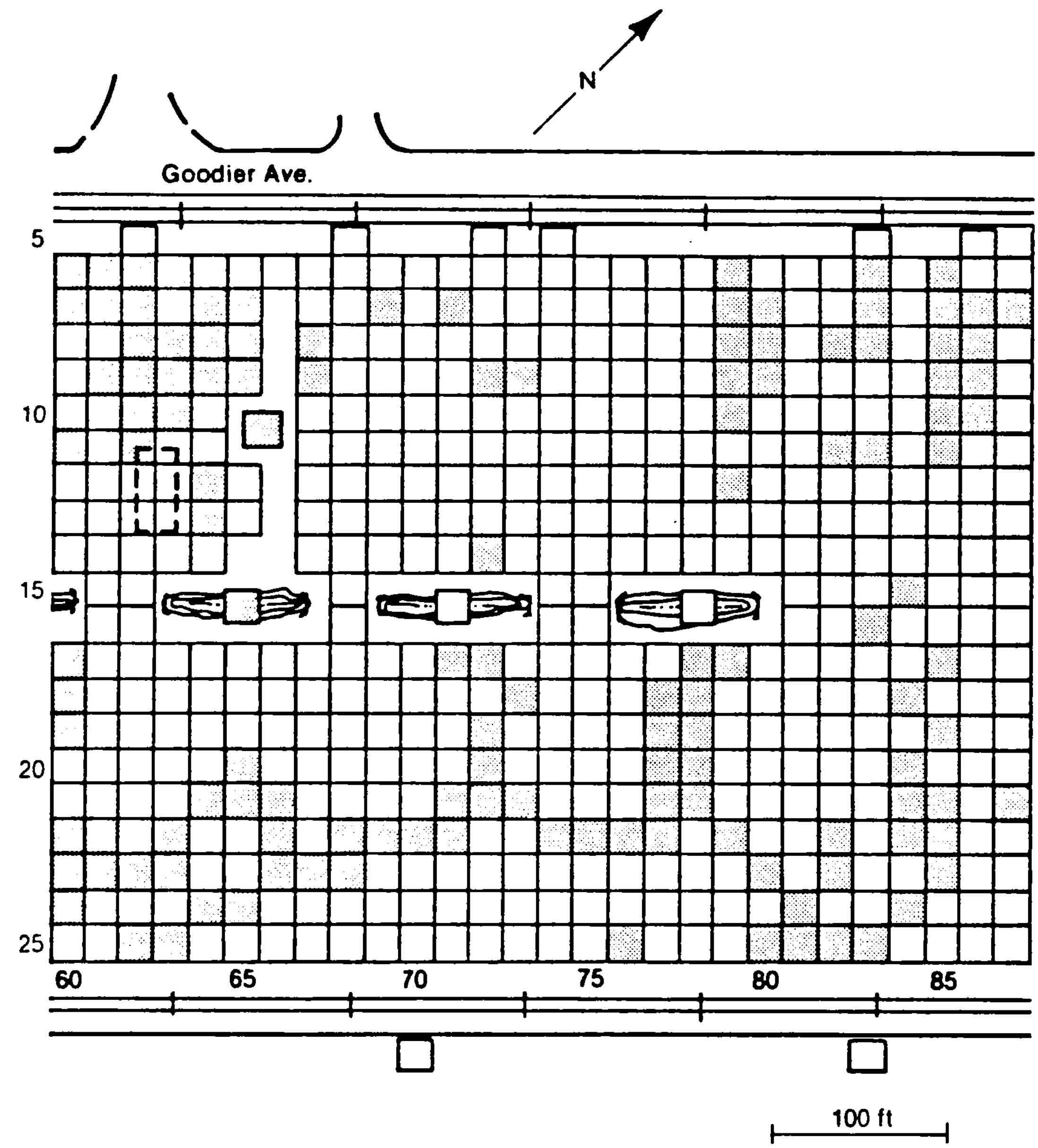


FIGURE 2-15
ORIGINAL EXPANSION AREA -- TCDD CONCENTRATIONS IN COMPOSITED SURFACE SOILS, > 1.0 ppb THROUGH 10 ppb

Source: Crockett et al., 1987.

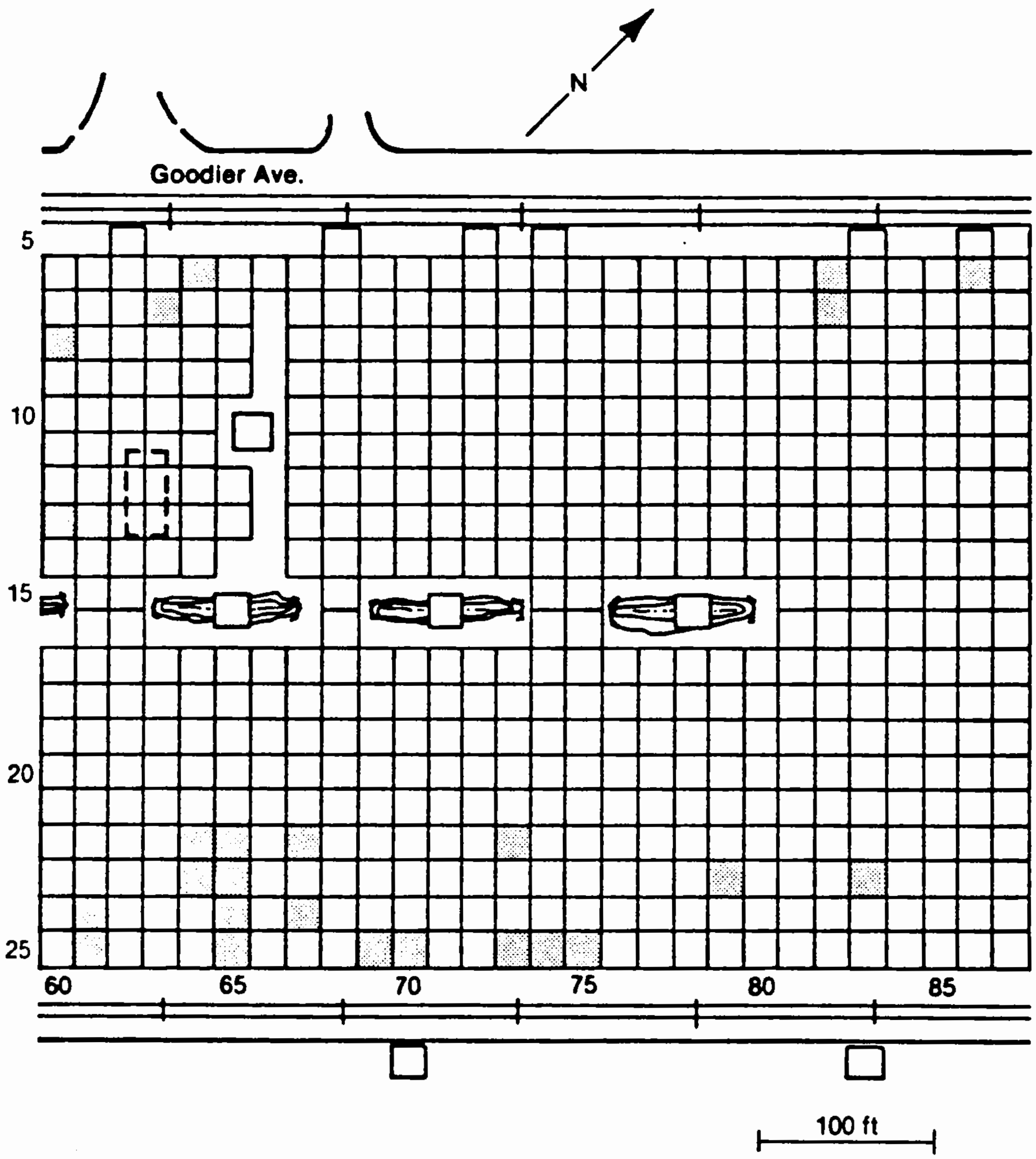


FIGURE 2-16
ORIGINAL EXPANSION AREA -- TCDD CONCENTRATIONS IN COMPOSITED SURFACE SOILS, > 10 ppb THROUGH 25 ppb

Source: Crockett et al., 1987.

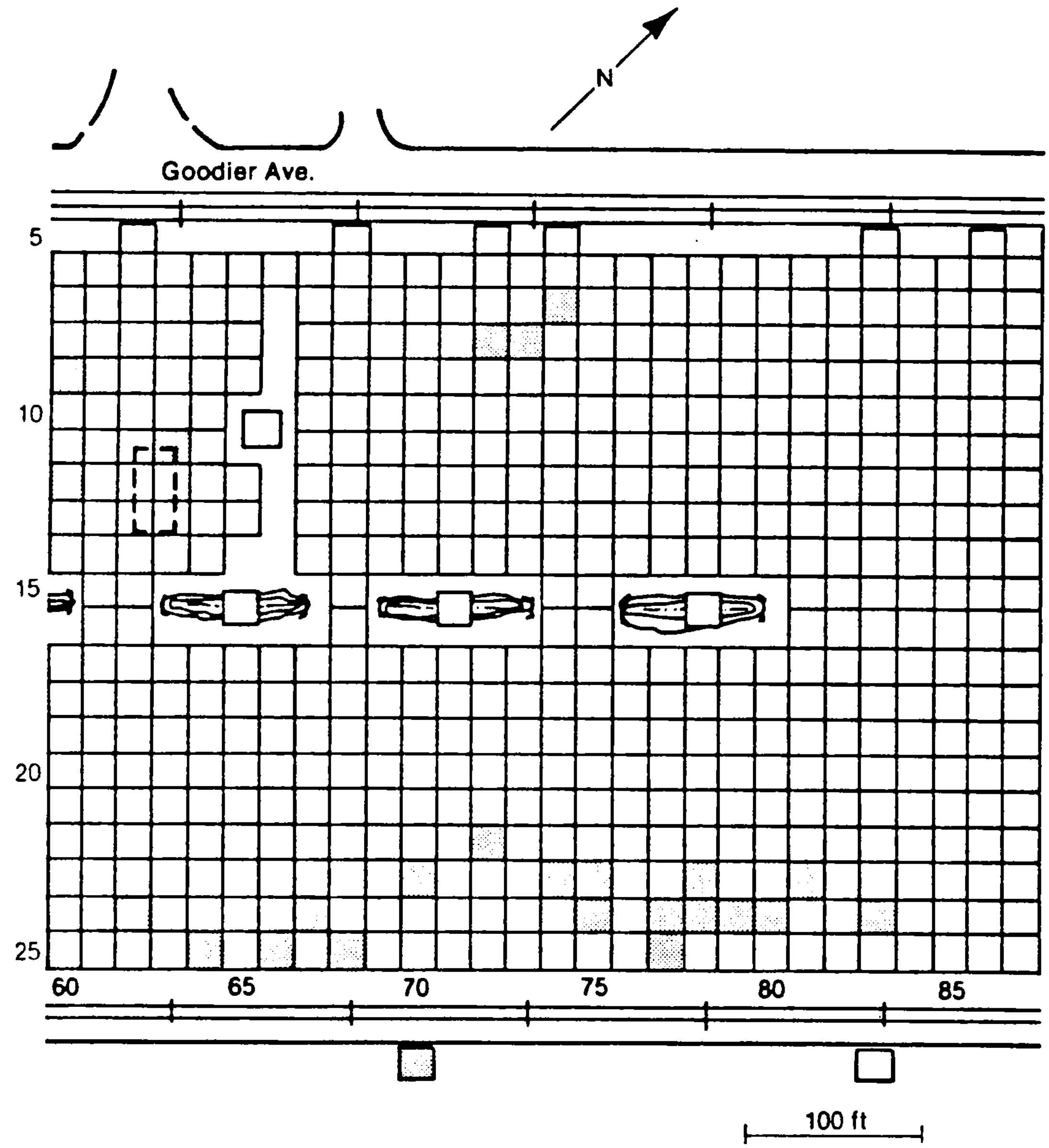


FIGURE 2-17
ORIGINAL EXPANSION AREA -- TCDD CONCENTRATIONS IN COMPOSITED SURFACE SOILS,>25 ppb THROUGH 50 ppb

Source: Crockett et al., 1987.

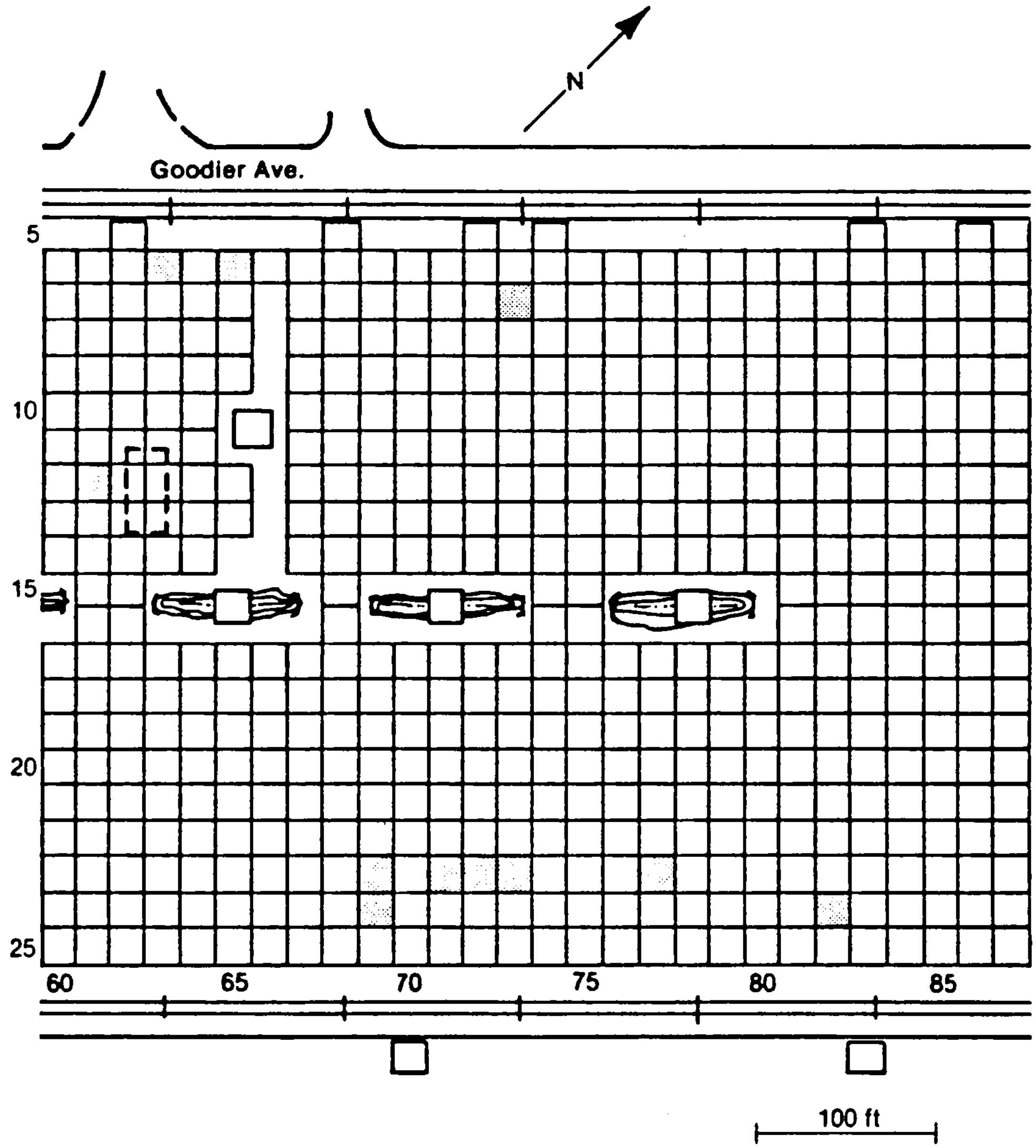


FIGURE 2-18
ORIGINAL EXPANSION AREA -- TCDD CONCENTRATIONS
IN COMPOSITED SURFACE SOILS, >50 ppb THROUGH 100 ppb

Source: Crockett et al., 1987.

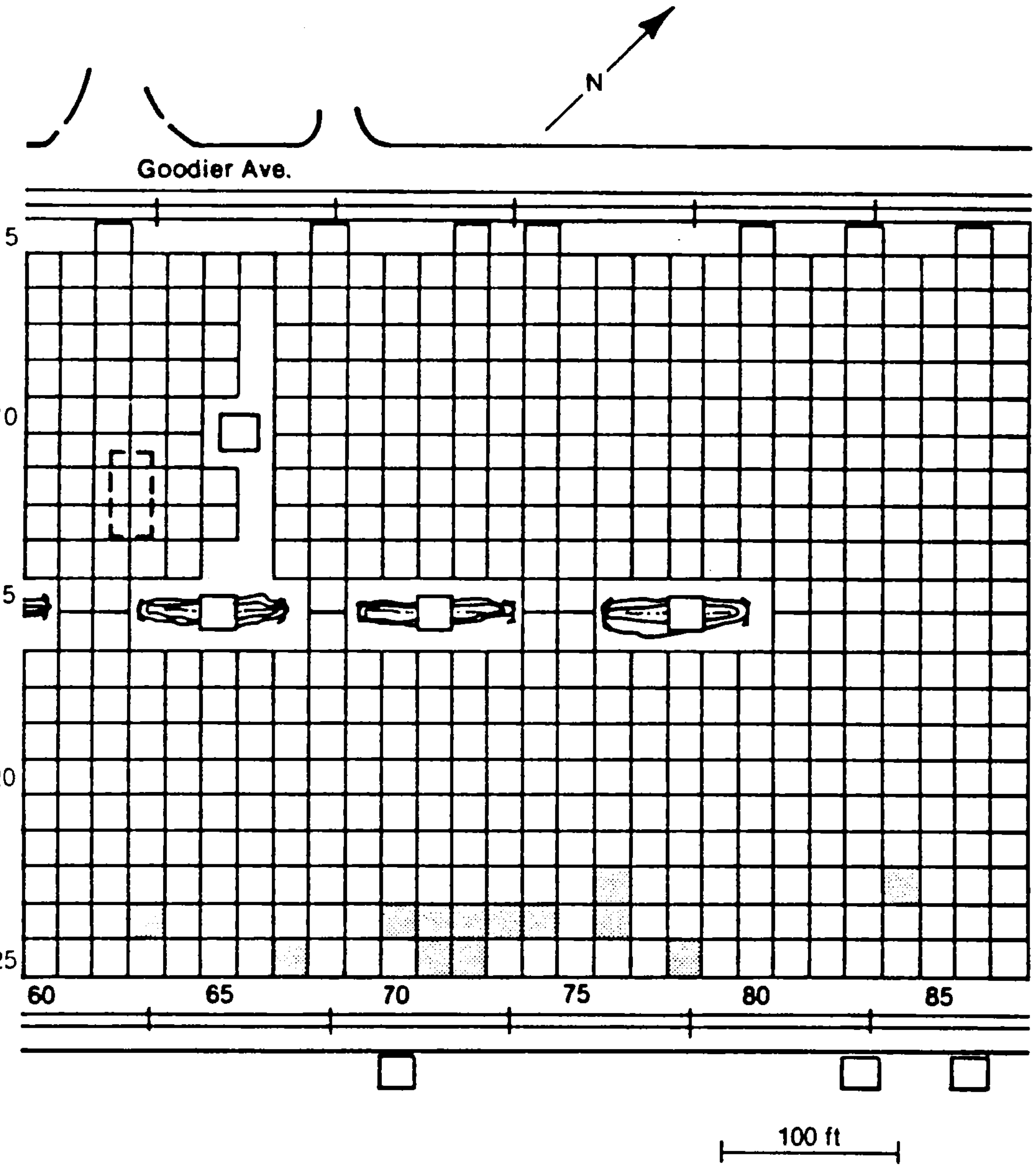
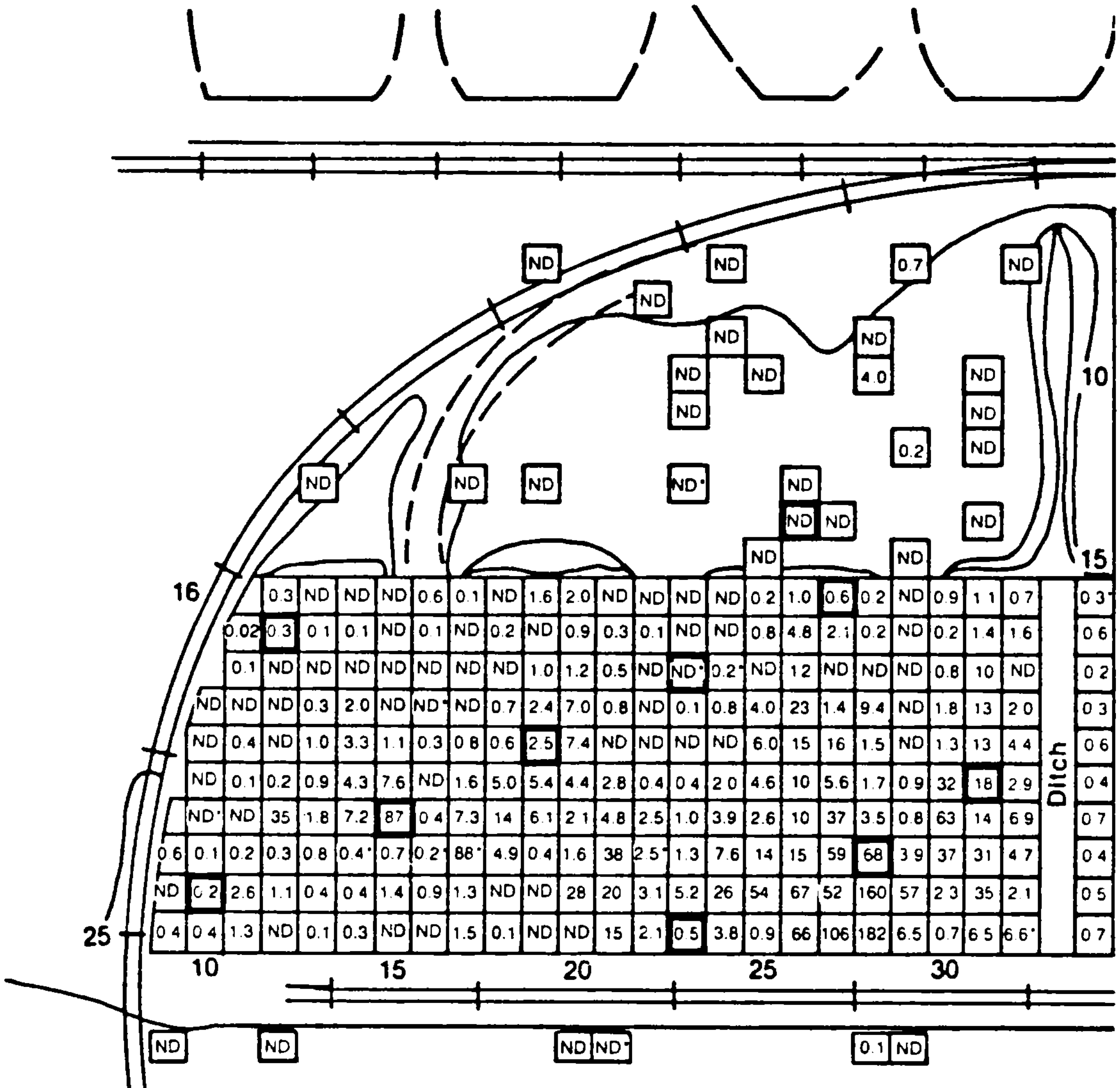


FIGURE 2-19
ORIGINAL EXPANSION AREA -- TCDD CONCENTRATIONS IN COMPOSITED SURFACE SOILS, >100 ppb

Source: Crockett et al., 1987.



ND-indicates none detected above detection limit identified in Appendix A

☐ Indicates replicated plot, value given is arithmetic mean of all replicates

• Indicates result may be invalid due to quality assurance variances

FIGURE 2-20
EXPANSION WEST AREA -- TCDD CONCENTRATIONS IN COMPOSITED SURFACE SOILS

Source: Crockett et al., 1987.

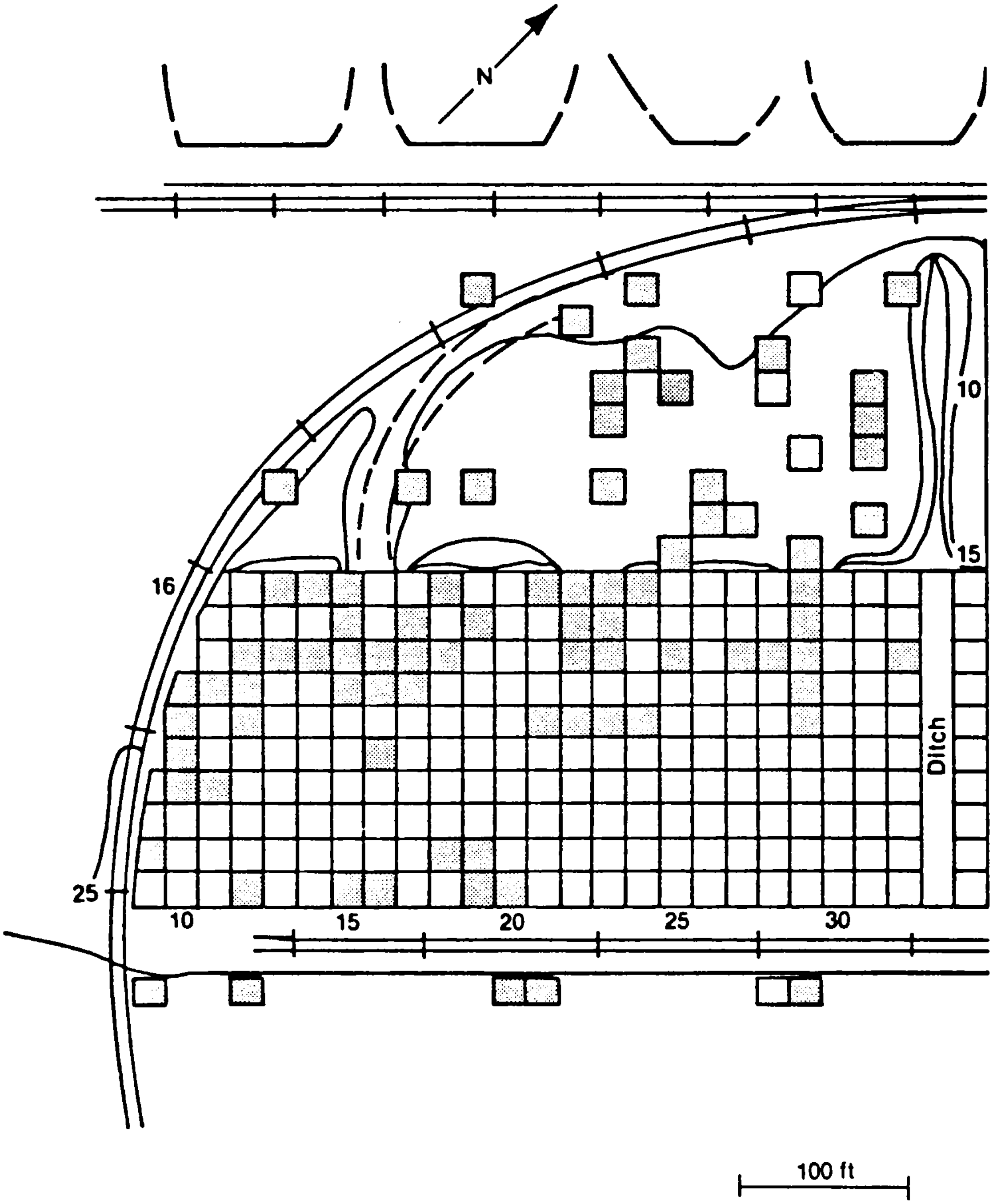


FIGURE 2-21
EXPANSION WEST AREA -- TCDD CONCENTRATIONS IN COMPOSITED SURFACE SOILS, >DETECTION LIMIT

Source: Crockett et al., 1987.

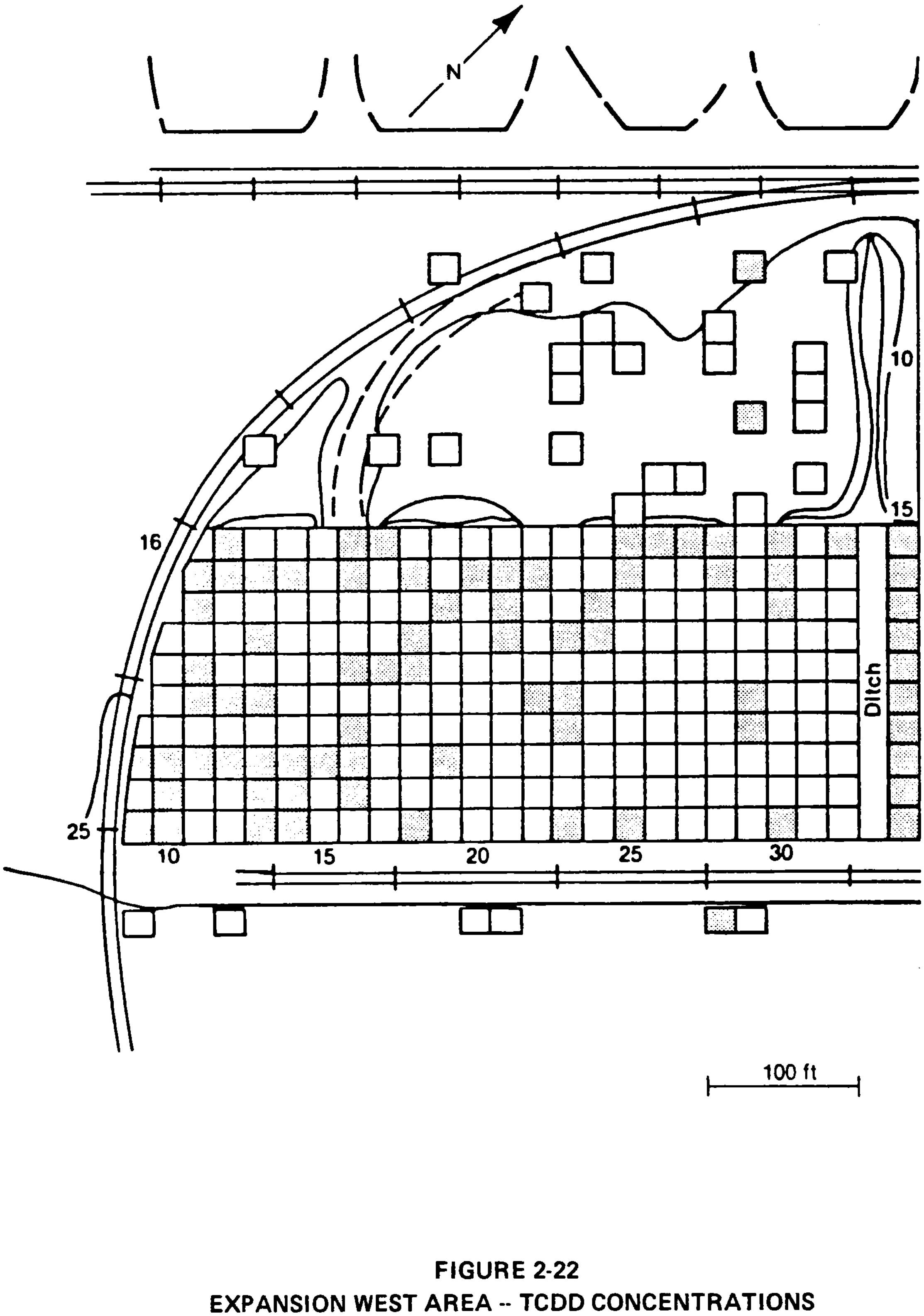


FIGURE 2-22
EXPANSION WEST AREA -- TCDD CONCENTRATIONS
IN COMPOSITED SURFACE SOILS,>DETECTION LIMIT THROUGH 1.0 ppb

Source: Crockett et al., 1987.

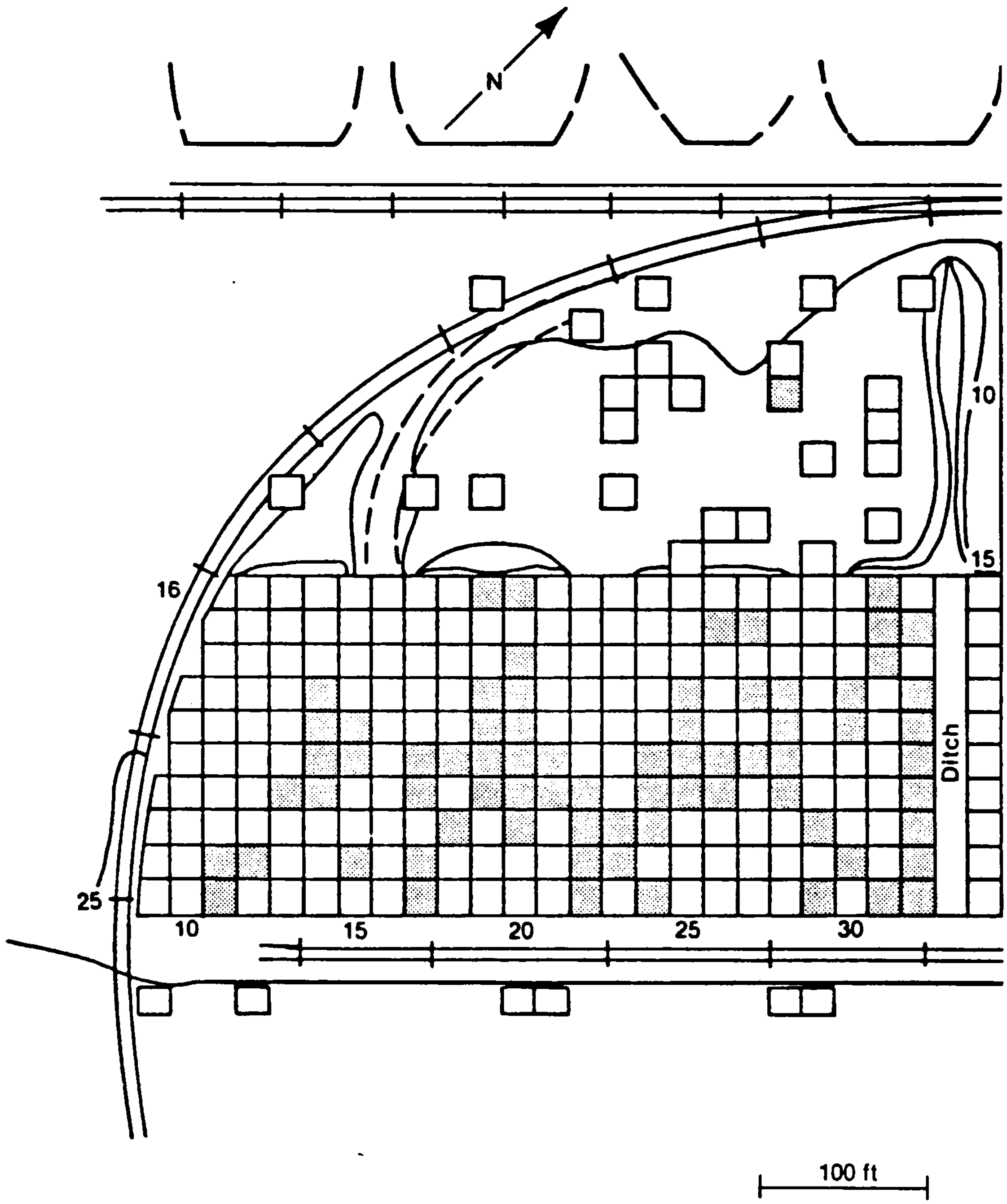


FIGURE 2-23
EXPANSION WEST AREA-- TCDD CONCENTRATIONS
IN COMPOSITED SURFACE SOILS, >1.0 ppb THROUGH 10 ppb

Source: Crockett et al., 1987.

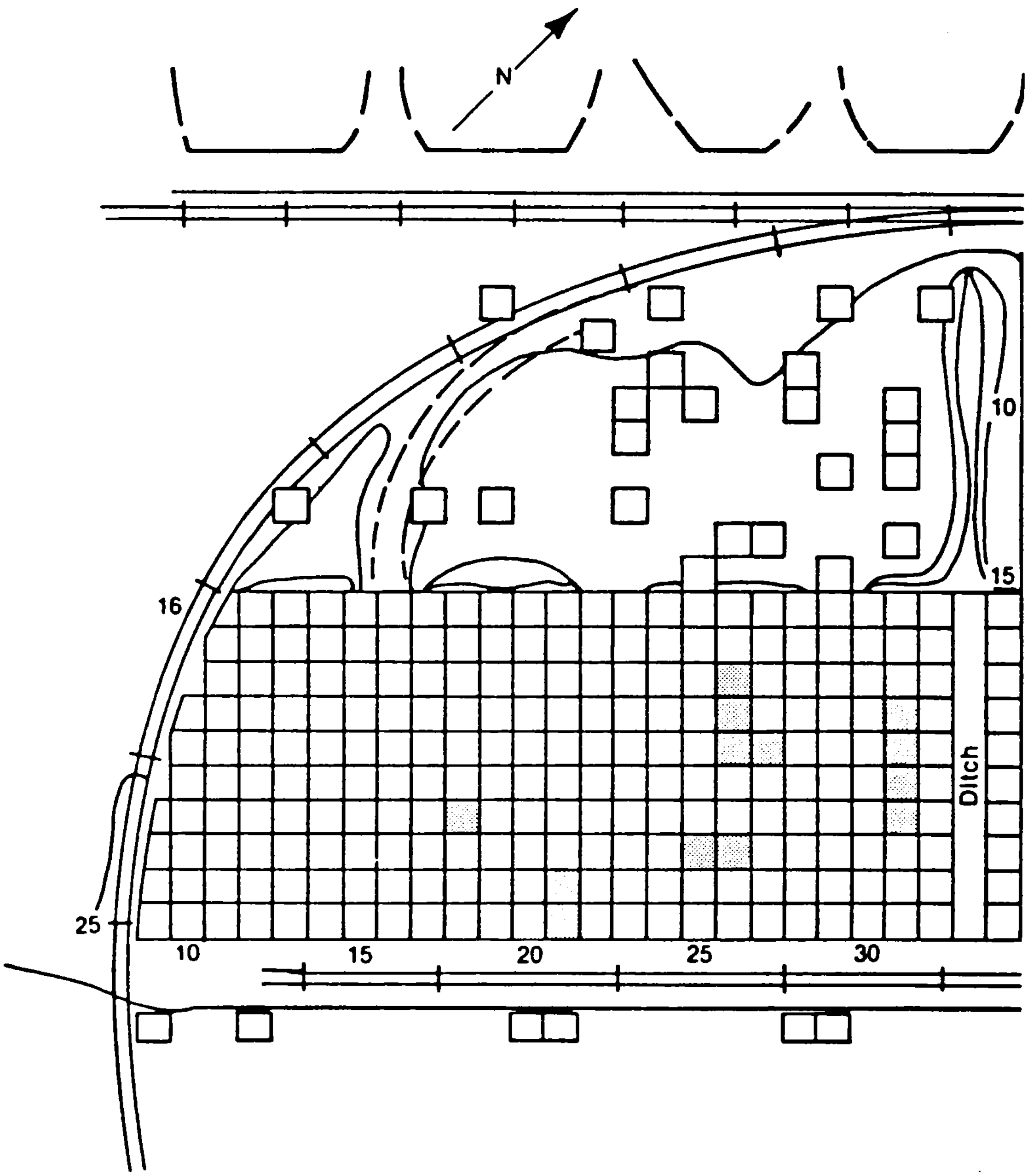


FIGURE 2-24
EXPANSION WEST AREA -- TCDD CONCENTRATIONS
IN COMPOSITED SURFACE SOILS, >10 ppb THROUGH 25 ppb

Source: Crockett et al., 1987.

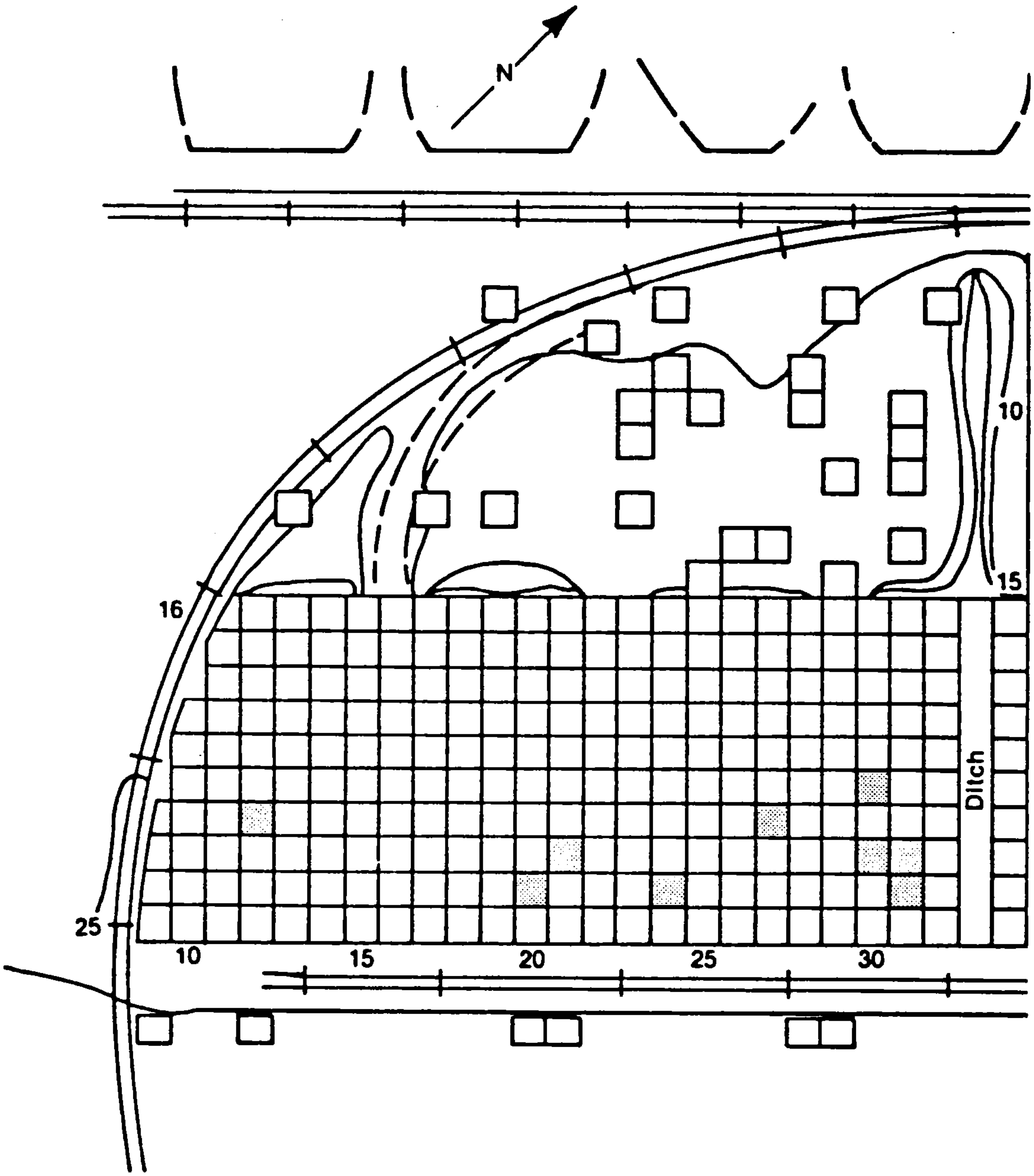


FIGURE 2-25
EXPANSION WEST AREA -- TCDD CONCENTRATIONS
IN COMPOSITED SURFACE SOILS, >25 ppb THROUGH 50 ppb

Source: Crockett et al., 1987.

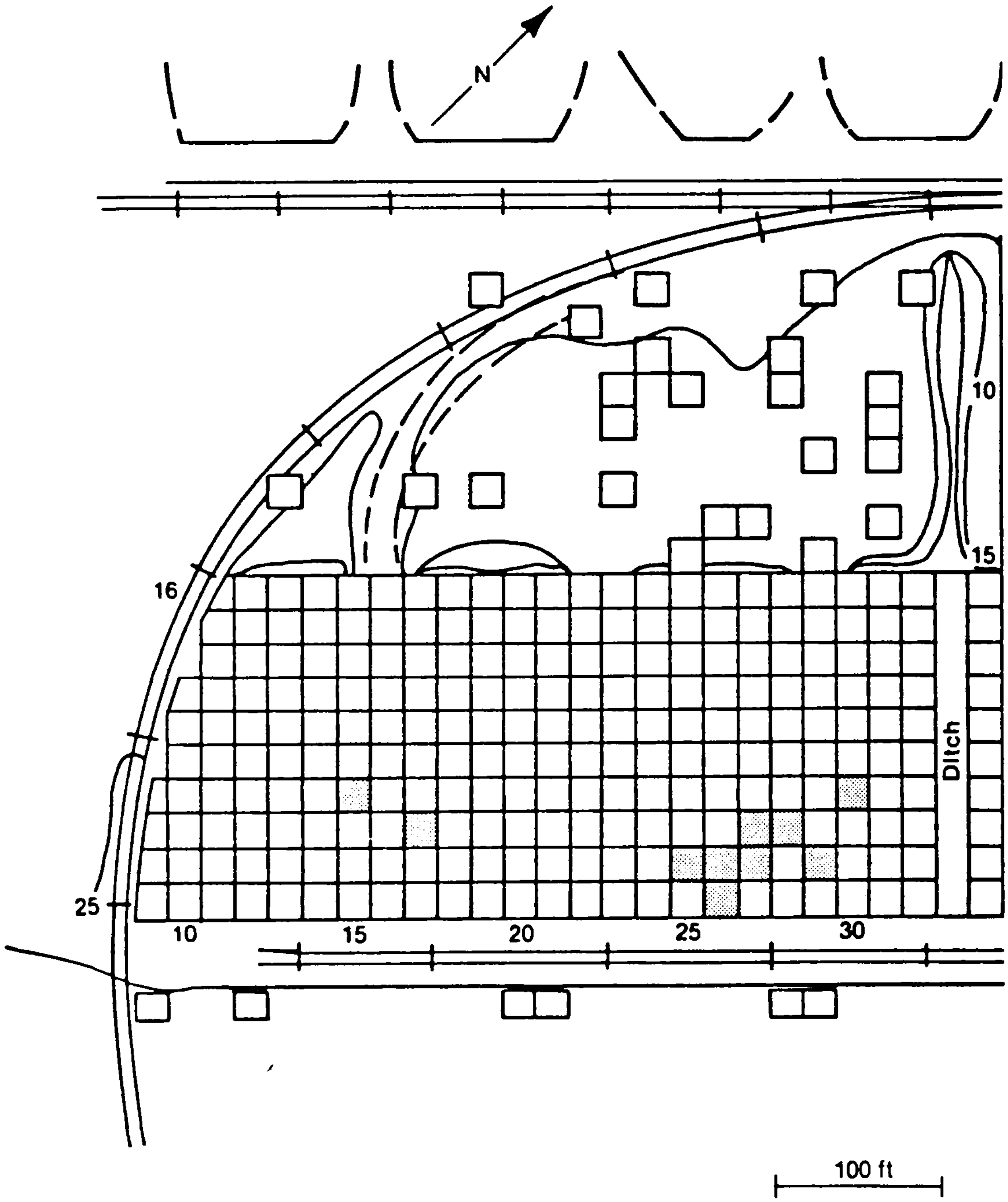


FIGURE 2-26
EXPANSION WEST AREA -- TCDD CONCENTRATIONS
IN COMPOSITED SURFACE SOILS,>50 ppb THROUGH 100 ppb

Source: Crockett et al., 1987.

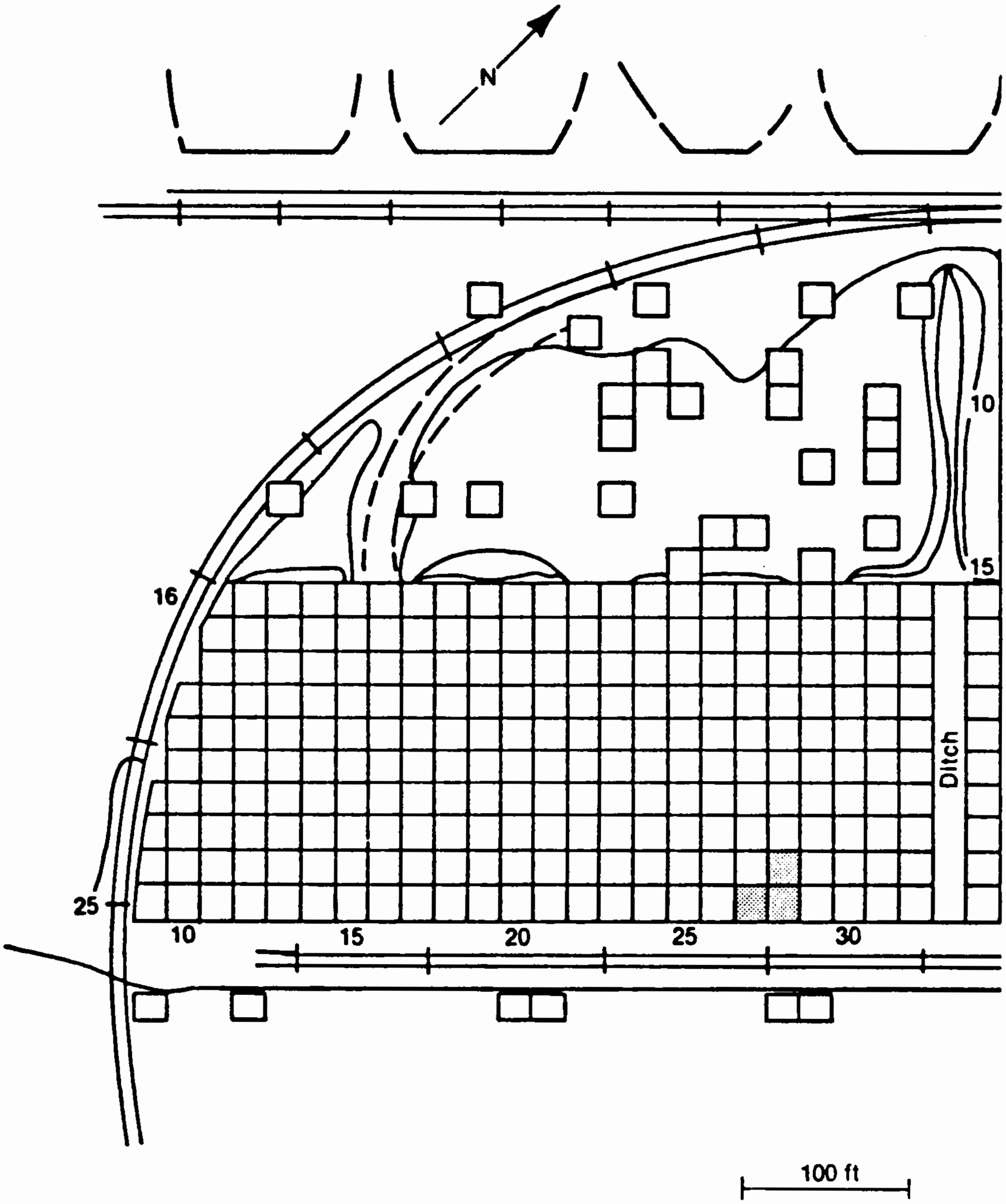


FIGURE 2-27
EXPANSION WEST AREA -- TCDD CONCENTRATIONS
IN COMPOSITED SURFACE SOILS, >100 ppb

Source: Crockett et al., 1987.

if any, of TCDD contamination, 49 plots were randomly scattered throughout the area. Trace levels of TCDD concentration were found in seven of the 49 plots, ranging from 0.02 to 0.3 ppb. One of the 49 composited samples is missing. Figure 2-28 shows the locations and TCDD concentrations of the composited sample plots.

2.1.2.1.3 Near-Surface Sampling Results. Near-surface soil samples were collected from 35 locations identified in Figure 2-29. Sampling sites were determined in the field based on a limited amount of analytical results from surface soil samples. Those sites with the highest concentrations of TCDD in surface composites were selected for subsurface sampling at 15 locations.

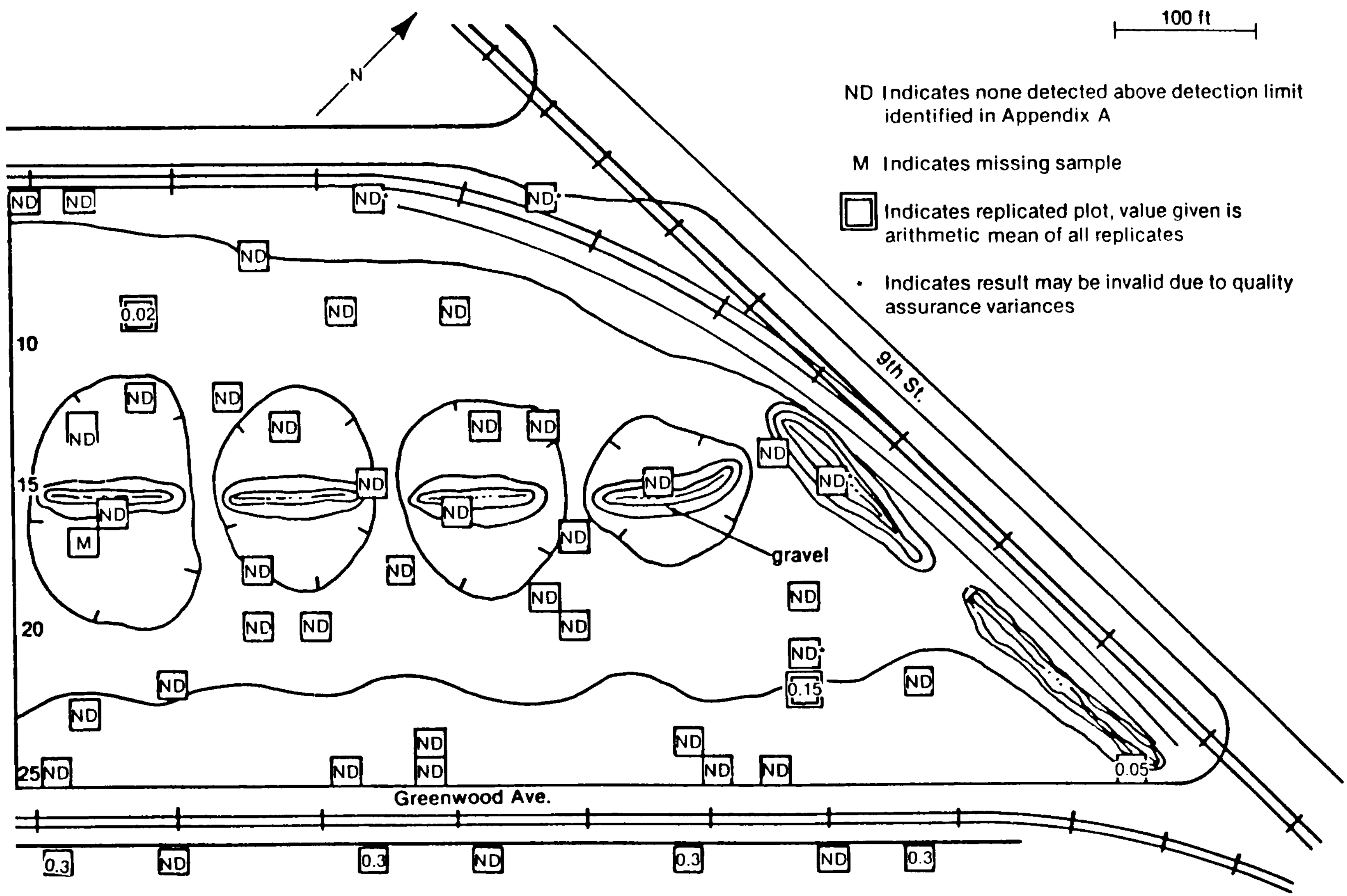
Near-surface samples were collected at the following intervals--surface soil that varied in thickness from 0 to 6 inches and averaged 2 to 3 inches, soil/cement layer averaging 6 to 9 inches thick, 0 to 3 inches below the soil/cement layer, and 3 to 7 inches below the soil/cement layer.

The analytical results of the near-surface samples are summarized in Table 2-14. TCDD concentrations of surface soils ranged from 0.64 ppb to 430 ppb. The arithmetic mean for the surface soils is 89 ppb. TCDD concentrations in the soil/cement layer for near-surface samples ranged from less than 0.02 ppb to 1,000 ppb, with an arithmetic mean of 73 ppb.

The near-surface samples collected from a depth of 0 to 3 inches below the soil/cement layer had TCDD concentrations ranging from less than 0.01 ppb to 150 ppb, averaging 16 ppb. Samples collected from 3 to 7 inches below the soil/cement layer had TCDD concentrations ranging from less than 0.04 ppb to 315 ppb. However, the outlier value of 315 ppb is invalid because of QA variances. The average concentration of TCDD for this depth, eliminating the potentially invalid result, is 8.7 ppb. Including the value of 315 raises the average concentration to 17.5 ppb.

The results of the analyses of near-surface samples indicate that the soil/cement layer was a restriction but not an impervious boundary to the vertical transport of TCDD. In general, the data indicate (based on the arithmetic means) that the average TCDD concentration decreases significantly from 92 ppb at the surface to about 9 ppb at an approximate depth of 1 foot.

2.1.2.1.4 Subsurface Sampling Results. Subsurface samples were collected from the surface to an approximate depth of 5 feet at 15 locations shown in Figure 2-29.



Source: Crockett et al., 1987.

FIGURE 2-28
EXPANSION EAST AREA -- TCDD CONCENTRATIONS IN COMPOSITED SURFACE SOILS

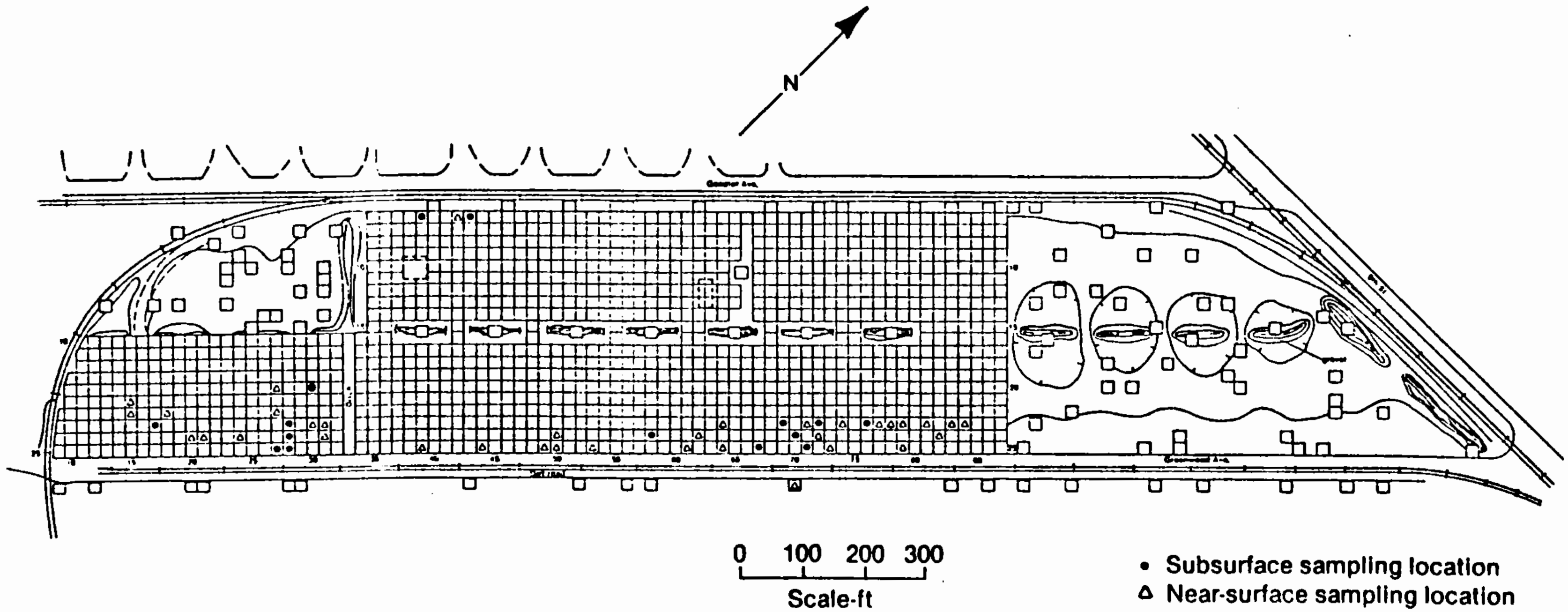


FIGURE 2-29

LOCATION OF NEAR SURFACE AND SUBSURFACE SAMPLES

Source: Crockett et al., 1987.

TABLE 2-14

Summary of Near-Surface Samples

Location	Depth[a]	TCDD (ppb)
0642	Surface	370
0642	Soil/cement	150
0642	0-3 inches	145
0642	3-7 inches	96
2027	Surface	12
2027	Soil/cement	5.0
2027	0-3 inches	0.08
2027	3-7 inches	0.12
2115	Surface	8.4
2115	Soil/cement	0.17
2115	0-3 inches	7.6
2115	3-7 inches	8.5
2115	Surface	425
2115	Soil/cement	8.77
2115	0-3 inches	95
2115	3-7 inches	75
2218	Surface	14c
2218	Soil/cement	6.2
2218	0-3 inches	7.6
2218	3-7 inches	0.34
2227	Surface	17
2227	Soil/cement	0.85
2227	0-3 inches	0.02[b]
2227	3-7 inches	0.22
2330	Surface	3.4
2330	Soil/cement	0.26
2330	0-3 inches	0.01[b]
2330	3-7 inches	0.04[b]

TABLE 2-14 (cont'd)

Location	Depth[a]	TCDD (ppb)
2331	Surface	37
2331	Soil/cement	2.7
2331	0-3 inches	0.66
2331	3-7 inches	3.1
2364	Surface	12
2364	Soil/cement	0.12[b]
2364	0-3 inches	0.10
2364	3-7 inches	0.08
2371	Surface	78
2371	Soil/cement	150
2371	0-3 inches	17
2371	3-7 inches	2.6
2374	Surface	105
2374	Soil/cement	1.9
2374	0-3 inches	0.77
2374	3-7 inches	0.36
2377	Surface	48
2377	Soil/cement	2.0
2377	0-3 inches	1.2
2377	3-7 inches	0.20
2378	Surface	12
2378	Soil/cement	1.1
2378	0-3 inches	0.13
2378	3-7 inches	0.48
2379	Surface	6.5
2379	Soil/cement	1.6
2379	0-3 inches	5.8

TABLE 2-14 (cont'd)

Location	Depth[a]	TCDD (ppb)
2379	3-7 inches	0.27
2381	Surface	0.64
2381	Soil/cement	0.22
2381	0-3 inches	0.32
2381	3-7 inches	0.09[b]
2383	Surface	18
2383	Soil/cement	8.0
2383	0-3 inches	4.2
2383	3-7 inches	0.59
2384	Surface	12
2384	Surface	0.17[b]
2384	0-3 inches	0.19
2384	3-7 inches	0.28
2420	Surface	130
2420	Soil/cement	2.2
2420	0-3 inches	3.3
2420	3-7 inches	0.61
2421	Surface	5.3
2421	Soil/cement	0.17
2421	0-3 inches	0.41
2421	3-7 inches	6.7
2424	Surface	21
2424	Soil/cement	15
2424	0-3 inches	0.04
2424	3-7 inches	0.11
2431	Surface	190
2431	Soil/cement	120

TABLE 2-14 (cont'd)

Location	Depth[a]	TCDD (ppb)
2431	0-3 inches	4.2
2431	3-7 inches	315[c]
2450	Surface	49
2450	Soil/cement	0.16
2450	0-3 inches	0.21
2450	3-7 inches	4.1
2462	Surface	100
2462	Soil/cement	94
2462	0-3 inches	76
2462	3-7 inches	39
2472	Surface	430[c]
2472	Soil/cement	1000
2472	0-3 inches	6.6
2472	3-7 inches	3.7
2482	Surface	
2482	Soil/cement	1.9
2482	0-3 inches	2.0
2482	3-7 inches	18
2539	Surface	410[c]
2539	Soil/cement	230[c]
2539	0-3 inches	3.5
2539	3-7 inches	4.4
2544	Surface	3.6
2544	Soil/cement	2.4
2544	0-3 inches	8.7
2544	3-7 inches	0.49
2549	Surface	230[c]

TABLE 2-14 (cont'd)

Location	Depth[a]	TCDD (ppb)
2549	Soil/cement	140
2549	0-3 inches	150
2549	3-7 inches	8.5
2550	Surface	160[b]
2550	Soil/cement	280
2550	0-3 inches	14[c]
2550	3-7 inches	2.2
2553	Surface	140
2553	Soil/cement	310[c]
2553	0-3 inches	8.3
2553	3-7 inches	18[c]
2561	Surface	12
2561	Soil/cement	4.6[b]
2561	0-3 inches	7.8
2561	3-7 inches	0.59
2564	Surface	36
2564	Soil/cement	2.8
2564	0-3 inches	0.04[b]
2564	3-7 inches	0.13
2573	Surface	15
2573	Soil/cement	9.2
2573	0-3 inches	0.23
2573	3-7 inches	0.23
2579	Surface	7.6
2579	Soil/cement	2.9
2579	0-3 inches	0.65[c]
2579	3-7 inches	0.24

TABLE 2-14 (cont'd)

Location	Depth[a]	TCDD (ppb)
2870	Surface	5.7
2870	Soil/cement	0.95
2870	0-3 inches	0.13
2870	3-7 inches	1.2

SOURCE: Crockett *et al.*, 1987.

[a]Measured depths are from the bottom of the soil/cement layer.

[b]None detected above the DL given.

[c]Result may be invalid due to QA variances.

As previously discussed, the locations were selected based on preliminary analytical data identifying those plots with the highest TCDD concentrations in surface soils. As a result, most locations were concentrated in the southern portion of the study area. Notable exceptions are two locations in the original area (Row 5, Columns 39 and 43) that had composited surface soil TCDD concentrations of 242 ppb and 150 ppb.

The results of the subsurface sampling are tabulated in Table 2-15, and plots of TCDD concentration versus depth are presented in Figures 2-30 through 2-33. The results indicate that, in general, TCDD concentrations decrease with depth, and the soil/cement layer is a restriction but not an impervious barrier to downward transport of TCDD. TCDD concentrations at 7 to 12 inches below soil/cement ranged from less than 0.01 to 12 ppb, with an arithmetic mean of 1.7 ppb. At an approximate depth of 2 feet below the soil/cement layer, TCDD concentrations ranged from less than 0.01 to 8.0 ppb, and averaged 1.0 ppb. At 3 feet below the soil/cement layer, TCDD concentrations ranged from less than 0.01 to 3.4 ppb, with a mean of 0.31 ppb. At 4 feet below the soil/cement layer, TCDD concentrations ranged from less than 0.01 ppb to 5.1 ppb, with a mean of 0.62 ppb.

Table 2-16, summarizes both the near-surface and the subsurface samples and indicates the total number of samples, the range in ppb, and the arithmetic mean for each sampling depth. As shown in Table 2-16, the arithmetic mean decreases consistently from a high of 107 ppb at the surface to 0.31 ppb at 3 feet below the soil/cement layer. The mean then increases to 0.62 ppb at a depth of 4 feet below the soil/cement layer.

A plot of the data in Table 2-16 is shown in Figure 2-34. The trend of decreasing TCDD concentration with depth is apparent. A significant break between the slope of the best-fit lines is seen at the 1.5- to 2-foot depth below ground surface. This may be due to a change in the number of samples in the data base from 50 to 15, or it may also reflect retardation of downward transport of TCDD at the 1.5- to 2-foot level; however, the first hypothesis is more likely.

2.1.2.1.5 Herbicide Orange Analytical Results. All subsurface samples were analyzed for the herbicides 2,4-D and 2,4,5-T in addition to TCDD. The results of the herbicide analyses at the 15 subsurface locations are presented in Appendix C. Concentrations of 2,4-D ranged from less than a DL of 20 ppb to 20,800,000 ppb.

TABLE 2-15

Summary of Subsurface Samples

Location	Depth[a]	TCDD (ppb)
0639	Surface	242
0639	Soil/cement	440
0639	0-3 inches	260[c]
0639	3-7 inches	0.99[b]
0639	8-12 inches	1.2
0639	23-26 inches	0.02
0639	35-38 inches	0.02
0639	45-48 inches	0.01[b]
0643	Surface	650
0643	Soil/cement	6.0
0643	0-3 inches	0.01[b,c]
0643	3-7 inches	93
0643	8-12 inches	0.25
0643	23-26 inches	0.03
0643	35-38 inches	0.02
0643	45-48 inches	1.9
2030	Surface	2.3
2030	Soil/cement	0.03
2030	0-3 inches	0.41
2030	3-7 inches	0.07
2030	8-12 inches	0.01[b]
2030	23-26 inches	0.01
2030	35-38 inches	0.02
2030	45-48 inches	0.02
2317	Surface	120
2317	Soil/cement	2.0
2317	0-3 inches	1.2
2317	3-7 inches	0.28
2317	8-12 inches	0.04

TABLE 2-15 (cont'd)

Location	Depth[a]	TCDD (ppb)
2317	23-26 inches	0.07
2317	35-38 inches	0.01
2317	45-48 inches	0.01[b]
2328	Surface	14
2328	Soil/cement	13
2328	0-3 inches	0.05[b,c]
2328	3-7 inches	0.30
2328	8-12 inches	0.15
2328	23-26 inches	0.06
2328	35-38 inches	0.01
2328	45-48 inches	0.01[b]
2369	Surface	16
2369	Soil/cement	0.19
2369	0-3 inches	0.19
2369	3-7 inches	0.20
2369	8-12 inches	0.03
2369	23-26 inches	0.01[b]
2369	35-38 inches	0.01[b]
2369	45-48 inches	0.01[b]
2372	Surface	26
2372	Soil/cement	22
2372	0-3 inches	7.9
2372	3-7 inches	2.5
2372	8-12 inches	8.9
2372	23-26 inches	8.0
2372	35-38 inches	3.4
2372	45-48 inches	5.1
2376	Surface	13

TABLE 2-15 (cont'd)

Location	Depth[a]	TCDD (ppb)
2376	Soil/cement	1.4
2376	0-3 inches	0.56
2376	3-7 inches	0.12
2376	8-12 inches	0.03
2376	23-26 inches	0.03
2376	35-38 inches	0.01[b]
2376	45-48 inches	0.01[b]
2428	Surface	200
2428	Soil/cement	3.5[b]
2428	0-3 inches	46
2428	3-7 inches	12
2428	8-12 inches	0.06
2428	23-26 inches	0.02
2428	35-38 inches	0.10
2428	45-48 inches	0.01[b]
2458	Surface	74
2458	Soil/cement	5.2
2458	0-3 inches	1.1
2458	3-7 inches	0.73
2458	8-12 inches	0.04
2458	23-26 inches	0.08
2458	35-38 inches	0.01[b]
2458	45-48 inches	0.01
2470	Surface	21[c]
2470	Soil/cement	310
2470	0-3 inches	3.6
2470	3-7 inches	6.5
2470	8-12 inches	12

TABLE 2-15 (cont'd)

Location	Depth[a]	TCDD (ppb)
2470	23-26 inches	0.01
2470	35-38 inches	0.21
2470	45-48 inches	0.11
2527	Surface	1.7
2527	Soil/cement	1.8
2527	0-3 inches	310
2527	3-7 inches	9.3
2527	8-12 inches	0.33
2527	23-26 inches	4.5
2527	35-38 inches	0.73
2527	45-48 inches	2.0
2528	Surface	0.67
2528	Soil/cement	0.50
2528	0-3 inches	0.17
2528	3-7 inches	0.22
2528	8-12 inches	0.03
2528	23-26 inches	0.01[b]
2528	35-38 inches	0.01[b]
2528	45-48 inches	0.01[b]
2567	Surface	58
2567	Soil/cement	6.6
2567	0-3 inches	26
2567	3-7 inches	12
2567	8-12 inches	0.40
2567	23-26 inches	0.01
2567	35-38 inches	0.01[b]
2567	45-48 inches	0.03
2571	Surface	590

TABLE 2-15 (cont'd)

Location	Depth[a]	TCDD (ppb)
2571	Soil/cement	480
2571	0-3 inches	120
2571	3-7 inches	78
2571	8-12 inches	1.8
2571	23-26 inches	2.1
2571	35-38 inches	0.01
2571	45-48 inches	0.04

SOURCE: Crockett et al., 1987.

[a]Measured depths are from the bottom of the soil/cement layer.

[b]None detected above the DL given.

[c]Result may be invalid because of QA variances.

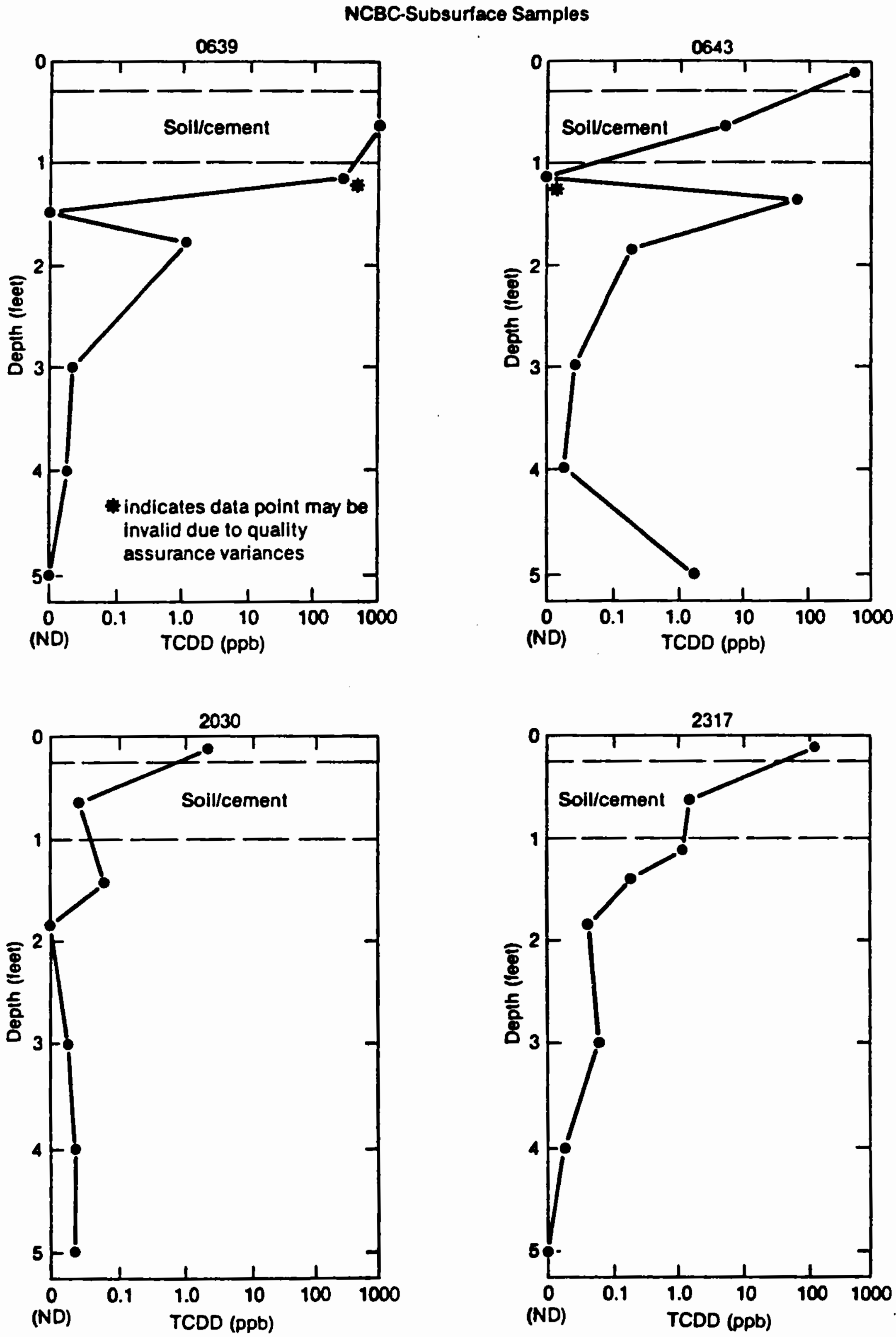


FIGURE 2-30
SUBSURFACE SAMPLES -- TCDD CONCENTRATIONS
VS. DEPTH: 0639, 0643, 2030, AND 2317

Source: Crockett et al., 1987.

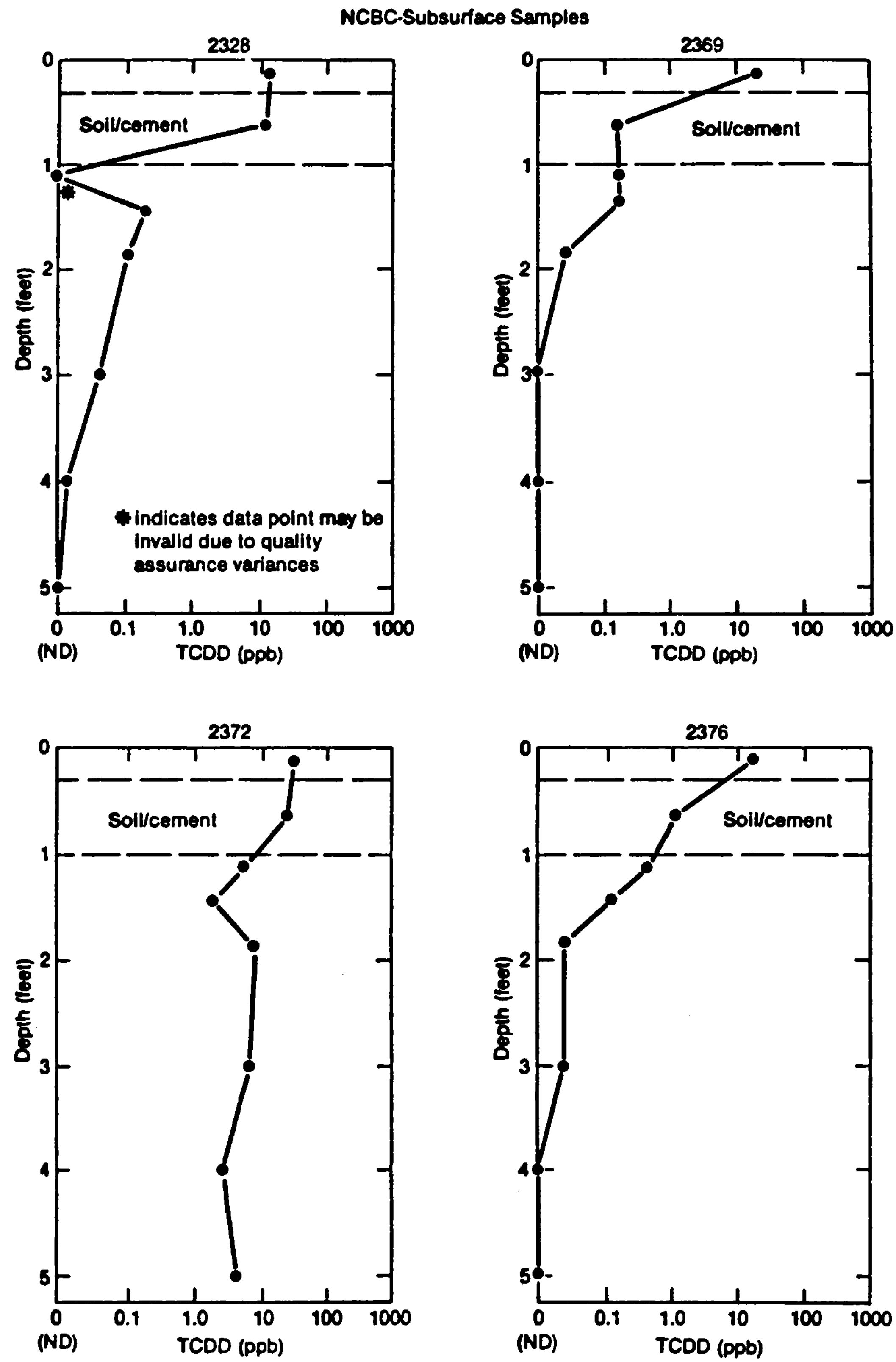


FIGURE 2-31
SUBSURFACE SAMPLES -- TCDD CONCENTRATIONS
VS. DEPTH: 2328, 2369,2372, AND 2376

Source: Crockett et al., 1987.

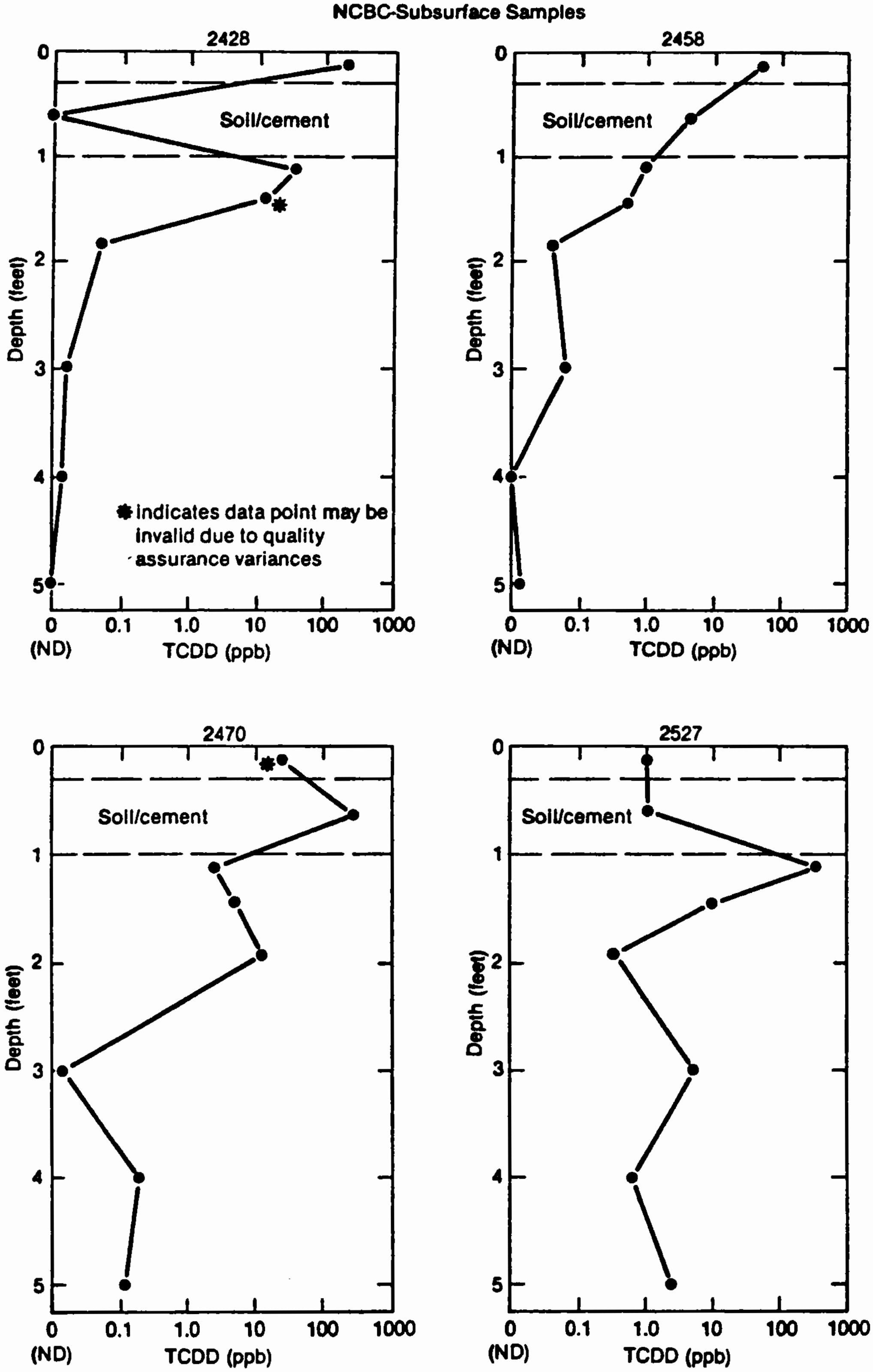


FIGURE 2-32
SUBSURFACE SAMPLES -- TCDD CONCENTRATIONS VS. DEPTH: 2428, 2458, 2470, AND 2527

Source: Crockett et al., 1987.

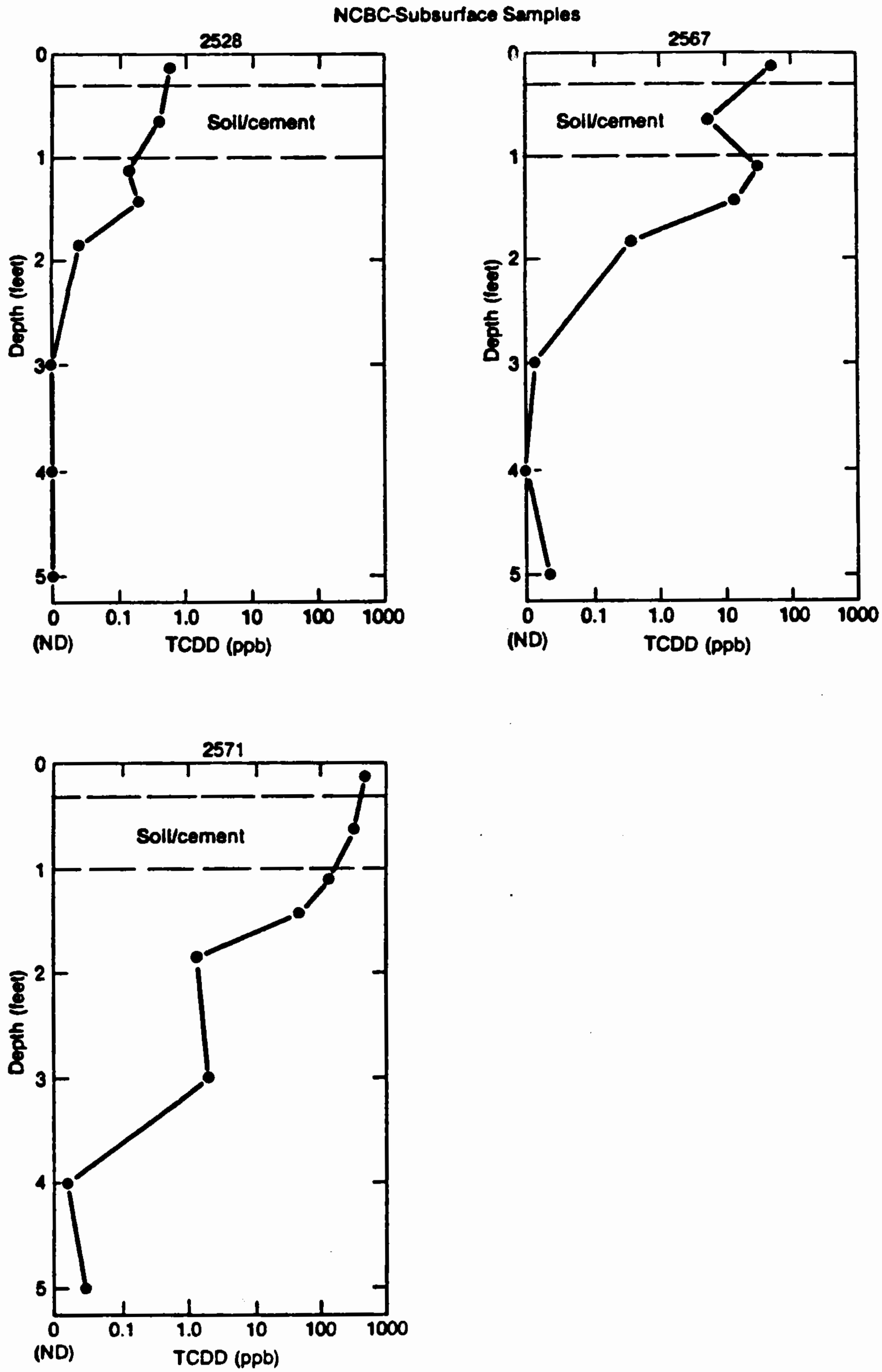


FIGURE 2-33
SUBSURFACE SAMPLES --TCDD CONCENTRATIONS
VS. DEPTH: 2528, 2567, AND 2571

Source: Crockett et al., 1987.

TABLE 2-16

Summary of Near-Surface and Subsurface Sample Results

Depth[a]	Number of Samples	Range (ppb)	Arithmetic Mean (ppb)
Surface	50	0.64-650	107
Soil/Cement	50	0.12-1000	77
0-3 inches	50	0.01-310	27
3-7 inches	50	0.04-315	17
7-12 inches	15	0.01-12	1.7
23-26 inches	15	0.01-8.0	1.0
35-38 inches	15	0.01-3.4	0.31
45-48 iches	15	0.01-5.1	0.62

SOURCE: Crockett et al., 1987.

[a]Measured depths are from the bottom of the soil/cement layer.

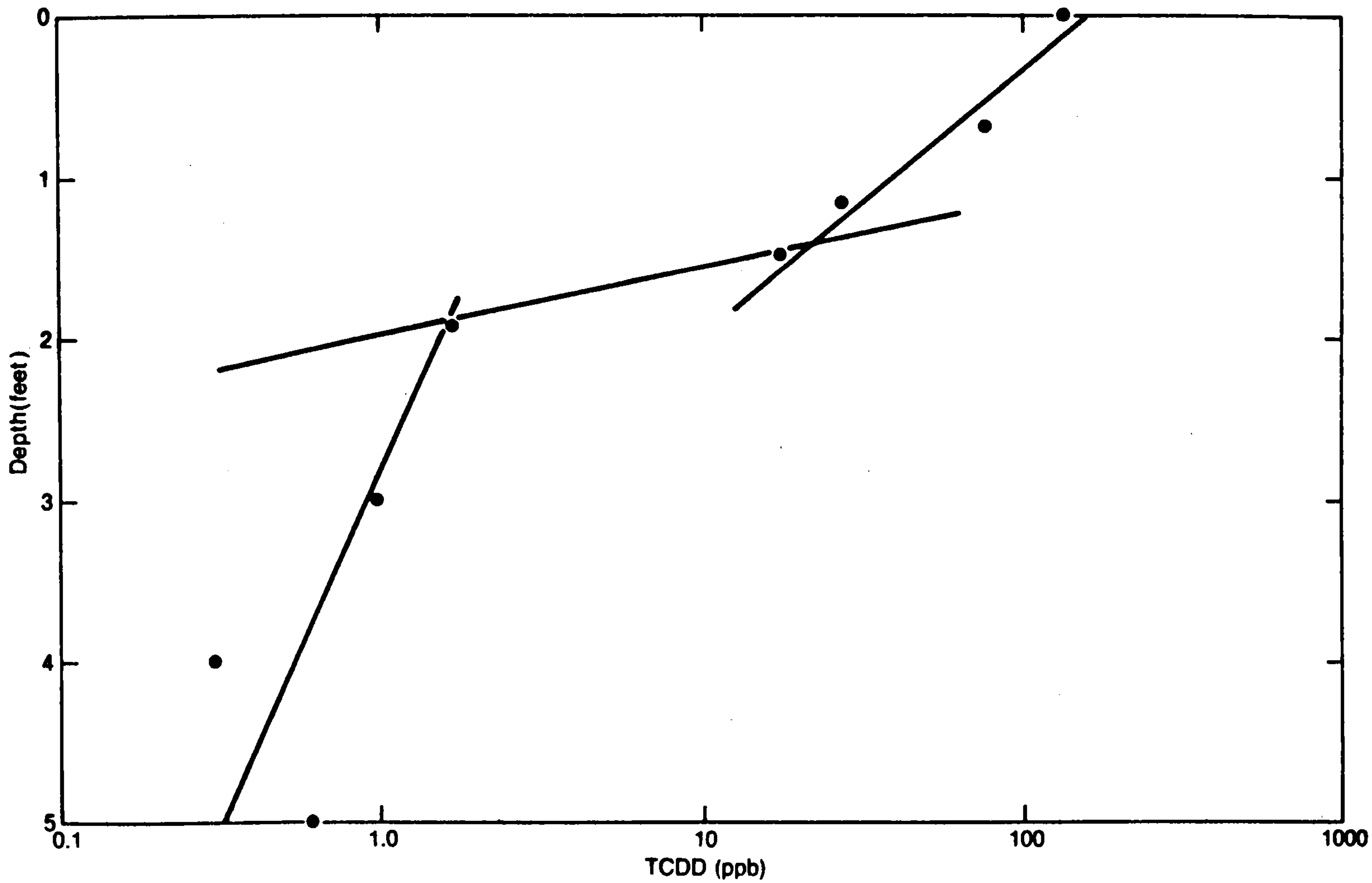


FIGURE 2-34
AVERAGE TCDD CONCENTRATIONS IN NEAR-SURFACE
AND SUBSURFACE SOILS VS. DEPTH

Source: Crockett et al., 1987.

The highest concentrations appear to be located in the soil/cement layer. Note that DL's for both 2,4-D and 2,4,5-T ranged as high as 5,000 ppb. Concentrations of 2,4,5-T ranged from less than a DL of 20 ppb to 27,700,000 ppb. The highest concentration was again in the soil/cement layer at Row 6, Column 39. A discussion of the correlation of 2,4-D; 2,4,5-T; and TCDD is presented in Section 2.1.2.1.7.

2.1.2.1.6 Results for Miscellaneous Samples. Three groups of miscellaneous samples were obtained on, or near, the former HO storage site. The results of all miscellaneous samples are presented in Table 2-17. The first group of four samples consisted of three taken around the equipment storage shed located southeast from grid 2839 and across Greenwood Avenue, the tracks, and the dirt road. Offsite work was performed in and around this shed without protective clothing. The analysis showed no contamination. The fourth sample was a random sample taken in the expansion east area around grid 1597 but not in the 20- by 20-foot grid layout. The analysis showed no contamination.

The second group of 10 samples was obtained on the HO site. These samples were taken from tar, asphalt, or road oil that was randomly found on the site surface. At the start of the analysis of NCBC samples, the contract laboratory had identified problems in cleanup of extracts and consequent faulty TCDD readings. These samples were sent to the laboratory to refine its cleanup techniques. The laboratory was successful in this effort, which resulted in the high validation percentage of grid samples.

The third group of 11 samples was obtained from the drainage ditches according to the sampling protocol. The results of ditch sampling are discussed in Section 3.2 in association with surface water and sediments investigation results.

2.1.2.1.7 Statistical Analysis

2.1.2.1.7.1 Surface, Near-Surface, and Subsurface Sampling. Tables 2-18 and 2-19 provide descriptive statistics on all surface samples at NCBC. Statistics are presented, both with (Table 2-19) and without (Table 2-18) the possible invalid results, and are presented separately for the original area, original expansion area, expansion east, and expansion west. Table 2-20 combines these areas to characterize all surface samples at NCBC. Approximately 85 percent of the results in the expansion east area is less than detectable, and the maximum

TABLE 2-17

TCDD Analytical Results
for Miscellaneous Samples

Sample Number[a]	Corresponds To Plots	Remarks	Concentration (ppb)
7001	2839	Taken around Equipment Storage shed	0.10[b]
7002	2839	Near dirt road intersection in	0.10[b]
7003	2839	Plot 40	0.10[b]
7004	1958	Tar	4.46[c]
7005	2436 2437 2536 2537	Tar	1.3[c]
7007	1441 1442 1541 1542	Tar	0.50[b]
7008	1351	Tar	9.1
7009	2573 2574	Tar	5.91[b]
7010	1764	Tar	0.04
7011	2380	Tar	0.12[b]
7012	2065 2066	Tar	0.53[b]
7013	1270 1370	Tar	0.50
7014	1543 1548 1648 1643	Ditch	10.60

TABLE 2-17 (cont'd)

Sample Number[a]	Corresponds To Plots	Remarks	Concentration (ppb)
7015	1597	Random sample	0.08[b]
7016	2585	Ditch	1.70
	2586		
	1686		
	1585		
7017	1549	Ditch	107.00
	1554		
	1649		
	1654		
7018	1556	Ditch	33.20
	1561		
	1656		
	1661		
7019	1582	Ditch	0.90
	1581		
	1682		
	1685		
7020	1575	Ditch	0.40
	1580		
	1675		
	1670		
7021	1562	Ditch	2.70
	1567		
	1662		
	1667		

TABLE 2-17 (cont'd)

Sample Number[a]	Corresponds To Plots	Remarks	Concentration (ppb)
7022	0660	Ditch	2.67
	0666		
	1565		
	1566		
7023	1569	Ditch	0.20[b]
	1574		
	1669		
	1674		
7024	1691	Ditch	0.10
7025	1536	Ditch	4.80
	1541		
	1636		
	1641		

SOURCE: Crockett _et al._, 1987.

[a]Sample numbers are preceded by NC-, and followed by 01000. All are surface samples.

[b]None detected above the DL given.

[c]Result may be invalid due to QA variances

TABLE 2-18

Surface Sampling Summary Excluding Invalid Results
(concentrations in ppb)

Parameters	Expansion West	Original Area	Original Expansion Area	Expansion East
Number of samples[a,b]	260	425	487	44
Arithmetic mean	7.1	14.3	9.2	0.12
Arithmetic standard deviation	20.6	44.9	30.3	0.09
Median	0.7	3.2	0.6	0.1
Maximum	182	646	282	0.5
Geometric mean	0.91	2.9	0.83	0.10
Geometric standard deviation	7.5	6.3	8.5	1.9

SOURCE: Crockett et al., 1987.

[a]Less than detectables replaced by RL.

[b]Replicated plots represented by the arithmetic mean of the composite samples.

TABLE 2-19

Surface Sampling Summary Including Invalid Results
(concentrations in ppb)

Parameters	Expansion West	Original Area	Original Expansion Area	Expansion East
Number of samples[a,b]	270	465	516	48
Arithmetic mean	7.2	14.5	10.0	0.12
Arithmetic standard deviation	20.8	44.9	32.3	0.09
Median	0.7	3.1	0.6	0.1
Maximum	182	646	282	0.5
Geometric mean	0.90	2.9	0.87	0.10
Geometric standard deviation	7.5	6.3	8.8	2.0

SOURCE: Crockett *et al.*, 1987.

[a]Less than detectables replaced by RL.

[b]Replicated plots represented by the arithmetic mean of the composite samples.

TABLE 2-20

Composite Surface Sampling Summary

Parameter	
Number of samples[a,b]	1300
Arithmetic mean	10.7
Arithmetic standard deviation	35.2
Median	1.1
Maximum	626
Geometric mean	1.2
Geometric standard deviation	8.4

SOURCE: Crockett et al., 1987.

[a]Less than detectables replaced by RL.

[b]Replicated plots represented by the arithmetic mean of the composite samples.

positive result is 0.3 ppb, so there is strong evidence of little TCDD contamination in that area.

The plots with replicate composite samples were used to estimate the within-plot variance. Less-than-detectable results were replaced by the RL. Plots with 0 or 1 positive results were discarded, because they provide an estimate of the variance of the RL rather than estimating the variance of the results. The sample results were transformed using the natural logarithm. The Shapiro-Wilk W test (Hahn and Shapiro, 1967) for normality indicated that the composite samples within the replicated plots are better fit by a log-normal than a normal distribution. It is necessary to assume that the within-plot variation is consistent from plot to plot because of the lack of replicate samples within each plot. The estimate of the pooled variance (a weighted average of the individual variances from each replicated plot) combines both sampling and analytical variability, and this estimate was used to calculate upper confidence limits on the surface samples. These limits are presented in Appendix D for 65-, 80-, 90-, and 95-percent confidence levels. For replicated plots, the upper confidence limit is a limit on the geometric mean of the composite samples. In plots with a single sample, it is a limit on the single composite result. Figures 2-35 through 2-59 display the plots with upper 65- and 95-percent confidence limits exceeding cleanup criteria of 1.0, 10.0, 25.0, and 50.0 ppb. Figure 2-60 presents the probability of not cleaning up a plot for a range of values of the true mean TCDD concentration. The probabilities are plotted for the cleanup criteria of 2.0, 10.0, 25.0, and 50.0 ppb with 95-percent confidence.

Sample NC-0540 has a composite result of 21.8 ppb, with a 95-percent upper confidence limit of 130.2 ppb. This can be interpreted, for example, as follows--there is 95-percent confidence that the true concentration of TCDD in the plot is less than 130.2 ppb. The confidence statement calculation may be inverted to say that the true mean concentration is less than 10 ppb with 95-percent confidence when the field sample is less than 1.7 ppb. Alternatively, one can state with 95-percent confidence that the true mean concentration is less than 25 ppb when the composite sample result is less than 4.2 ppb.

The near-surface samples are summarized in Tables 2-21 and 2-22. The differences between the means, medians, and maximum values in Table 2-21 and those in Table 2-22 indicate that several samples that could not be validated are

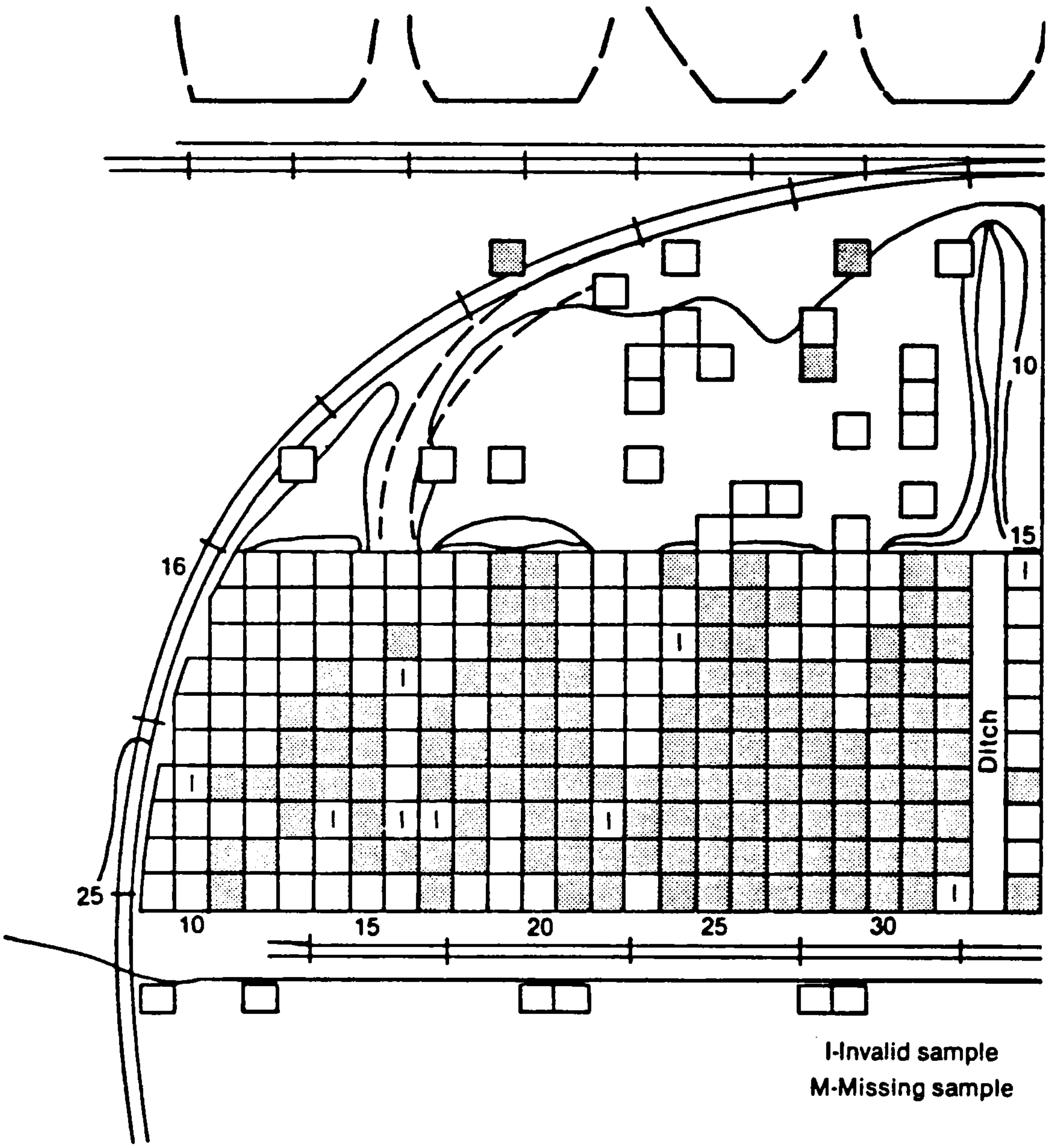
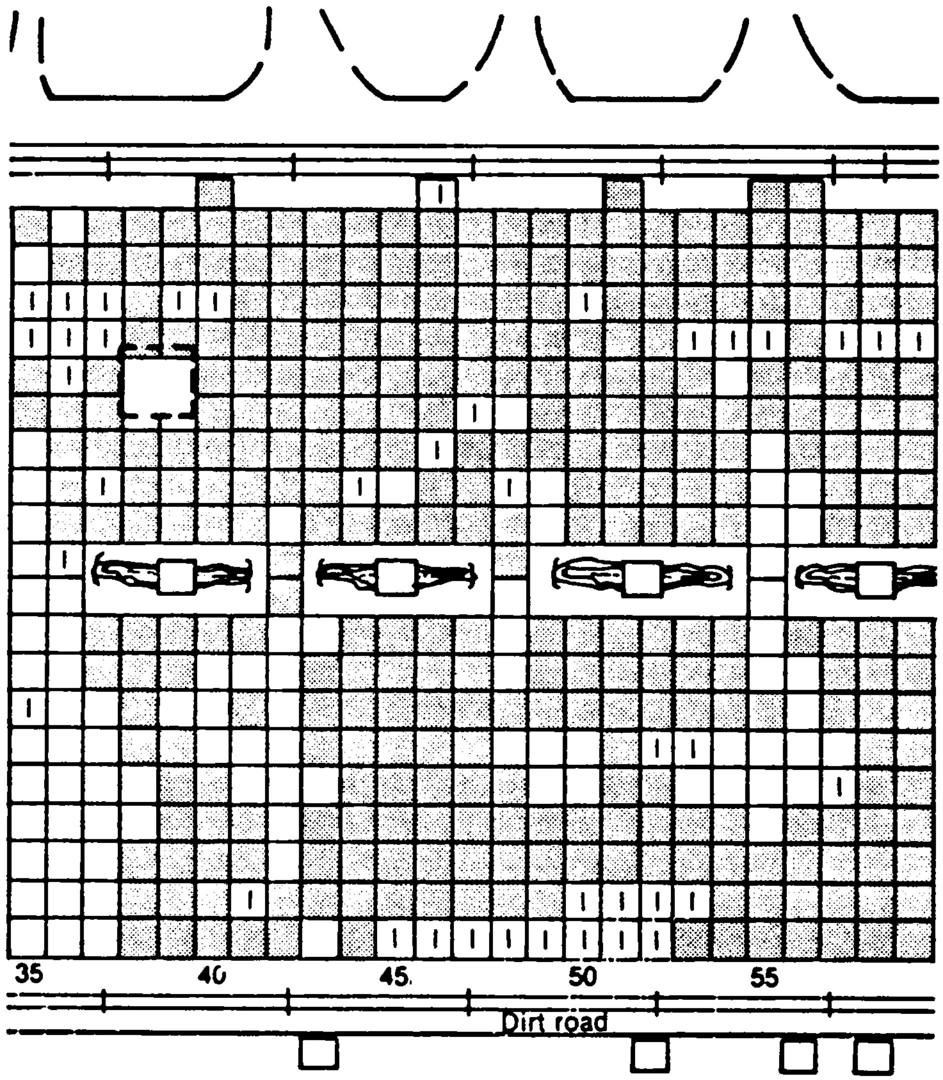


FIGURE 2-35
NCBC EXPANSION WEST PLOTS WITH 65-PERCENT UPPER CONFIDENCE LIMIT EXCEEDING 1 ppb

Source: Crockett et al., 1987.



I-Invalid sample
M-Missing sample

FIGURE 2-36
NCBC ORIGINAL AREA PLOTS WITH
65-PERCENT UPPER CONFIDENCE LIMIT EXCEEDING 1 ppb

Source: Crockett et al., 1987.

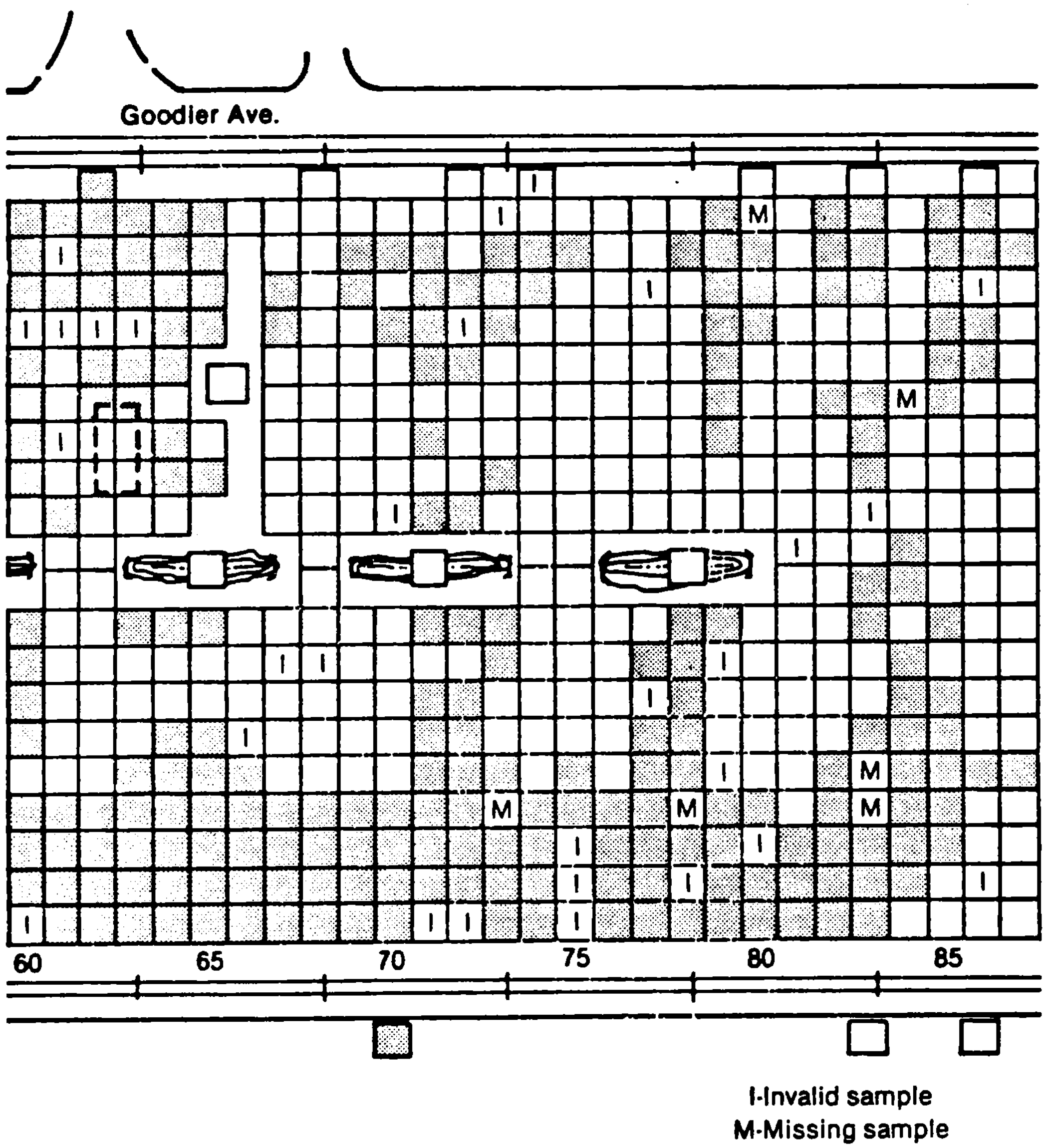


FIGURE 2-37
NCBC ORIGINAL EXPANSION AREA PLOTS
WITH 65-PERCENT UPPER CONFIDENCE LIMIT EXCEEDING 1 ppb

Source: Crockett et al., 1987.

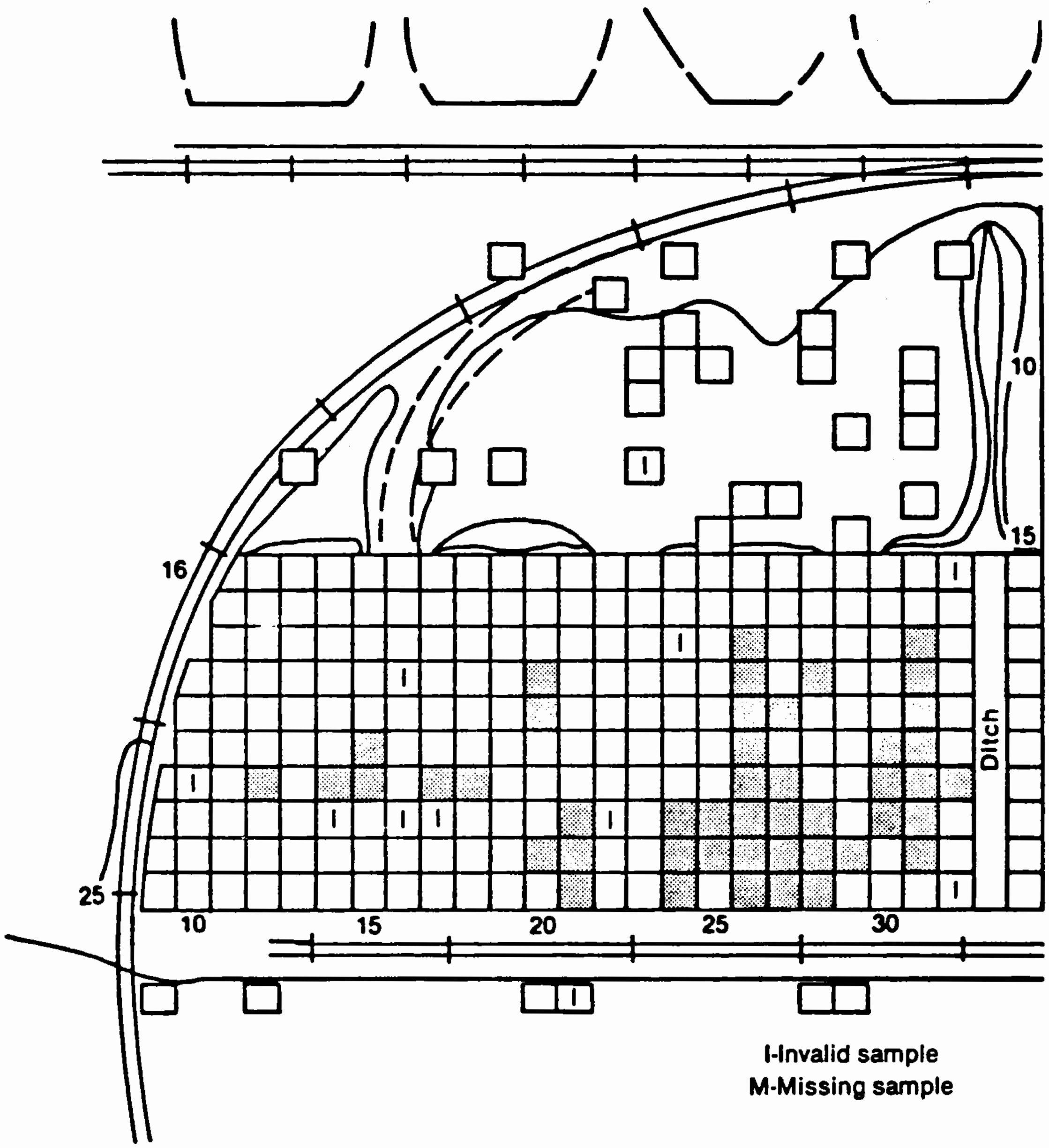


FIGURE 2-38
NCBC EXPANSION WEST PLOTS WITH 65-PERCENT UPPER CONFIDENCE LIMIT EXCEEDING 10 ppb

Source: Crockett *et al.*, 1987.

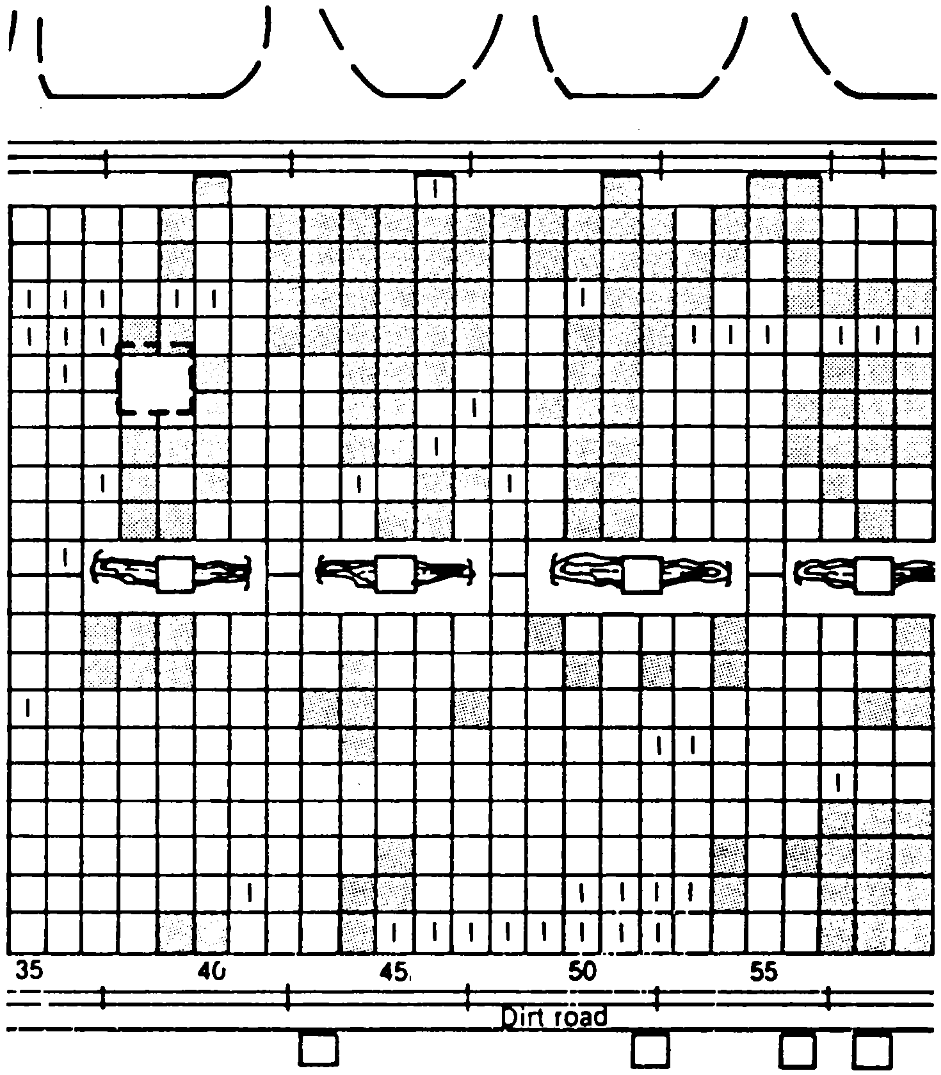


FIGURE 2-39
ORIGINAL AREA PLOTS WITH 65-PERCENT UPPER CONFIDENCE LIMIT EXCEEDING 10 ppb

Source: Crockett et al., 1987.

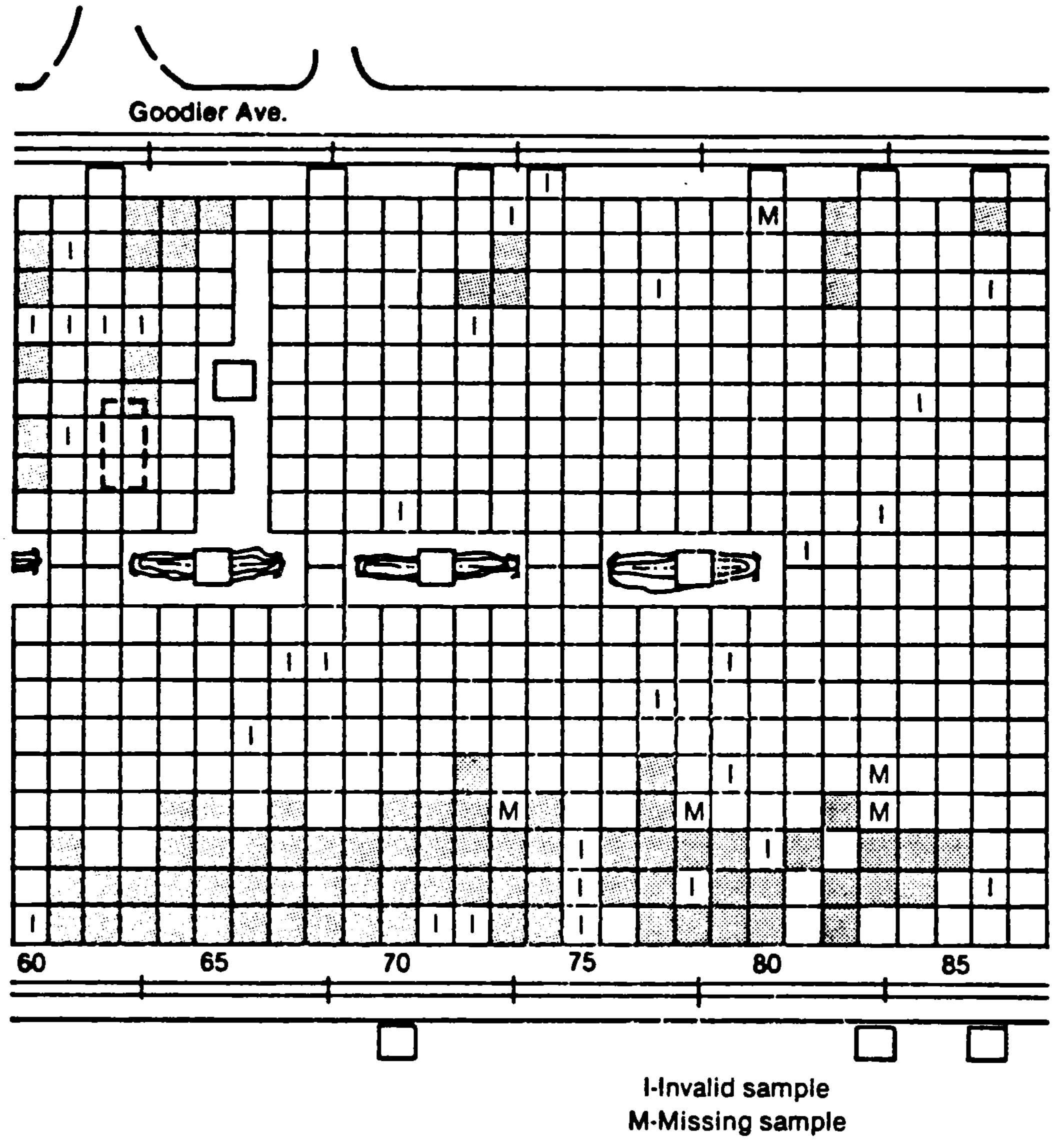


FIGURE 2-40
NCBC ORIGINAL EXPANSION AREA PLOTS WITH 65-PERCENT
UPPER CONFIDENCE LIMIT EXCEEDING 10 ppb

Source: Crockett et al., 1987.

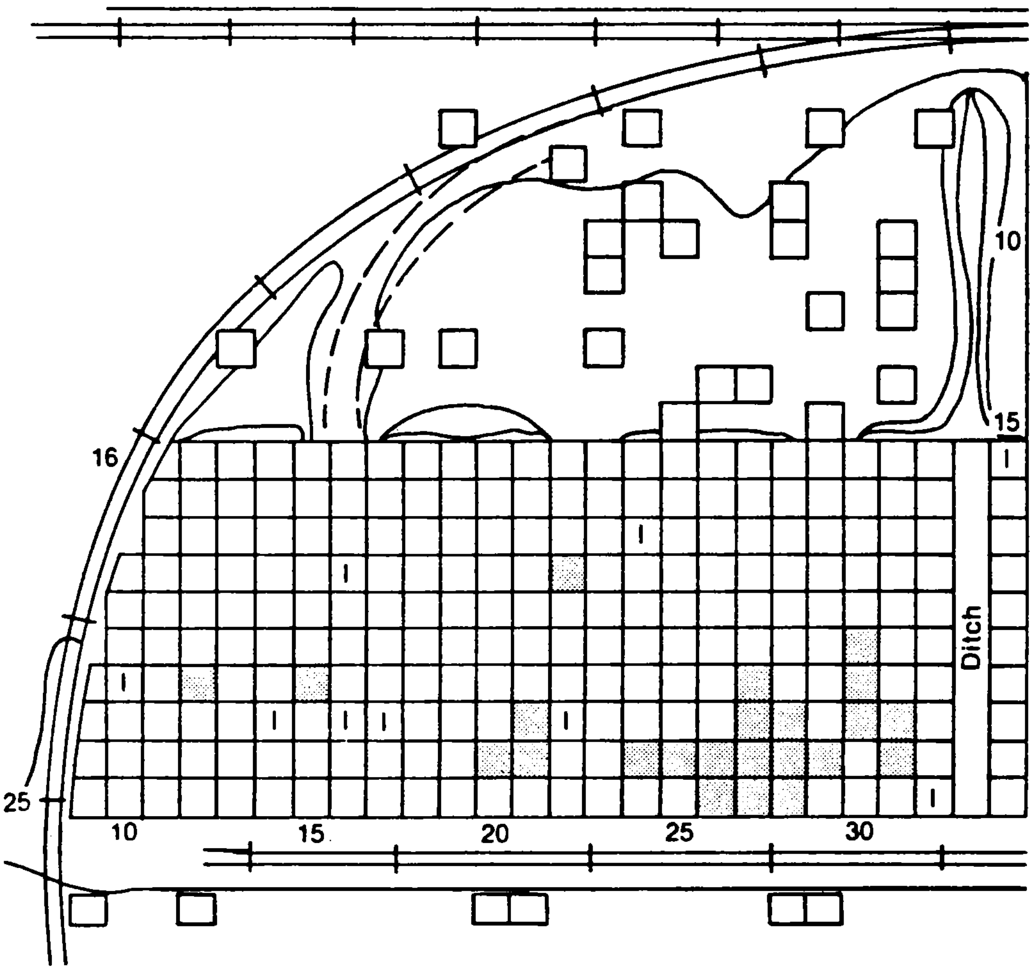


FIGURE 2-41
NCBC EXPANSION WEST PLOTS WITH 65-PERCENT
UPPER CONFIDENCE LIMIT EXCEEDING 25 ppb

Source: Crockett et al., 1987.

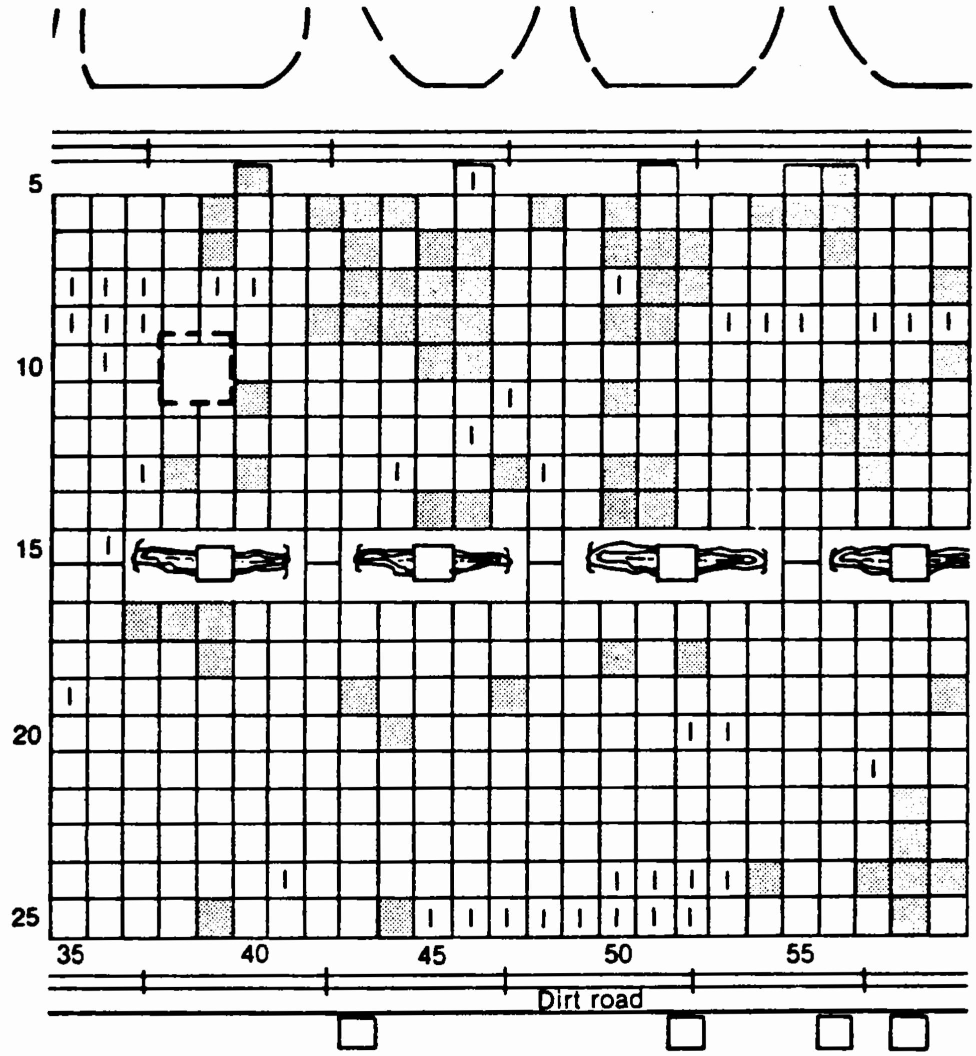


FIGURE 2-42
ORIGINAL AREA PLOTS WITH 65-PERCENT
UPPER CONFIDENCE LIMIT EXCEEDING 25 ppb

Source: Crockett et al., 1987.

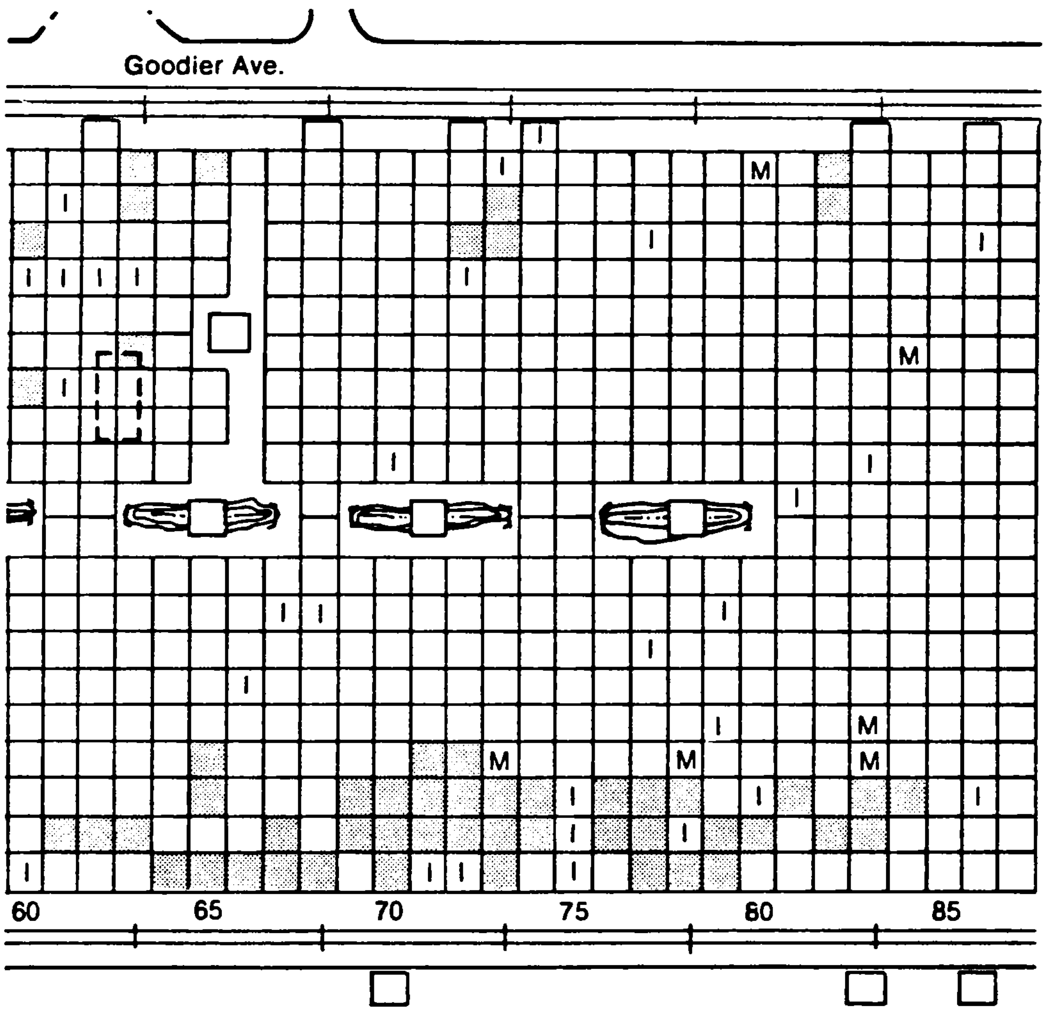


FIGURE 2-43

NCBC ORIGINAL EXPANSION AREA PLOTS WITH 65-PERCENT UPPER CONFIDENCE LIMIT EXCEEDING 25 ppb

Source: Crockett et al., 1987.

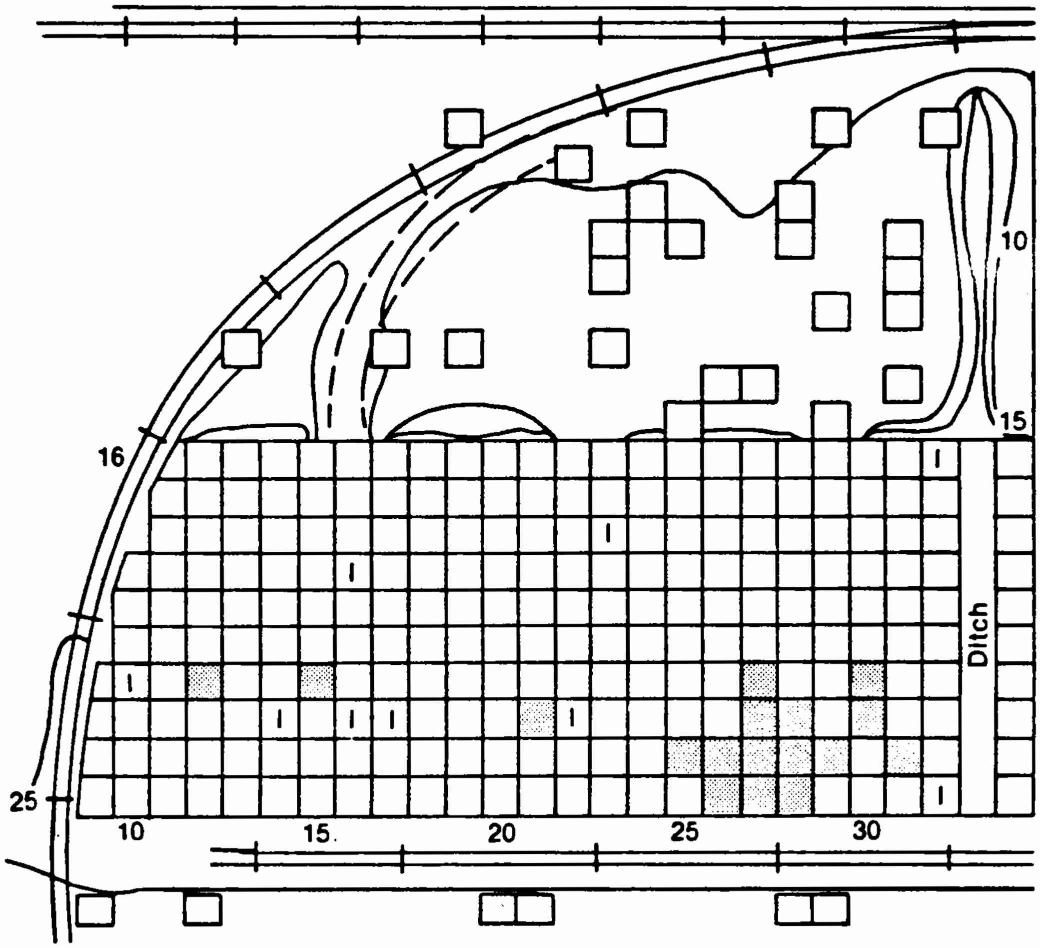


FIGURE 2-44
NCBC EXPANSION WEST PLOTS WITH 65-PERCENT UPPER CONFIDENCE LIMIT EXCEEDING 50 ppb

Source: Crockett et al., 1987.

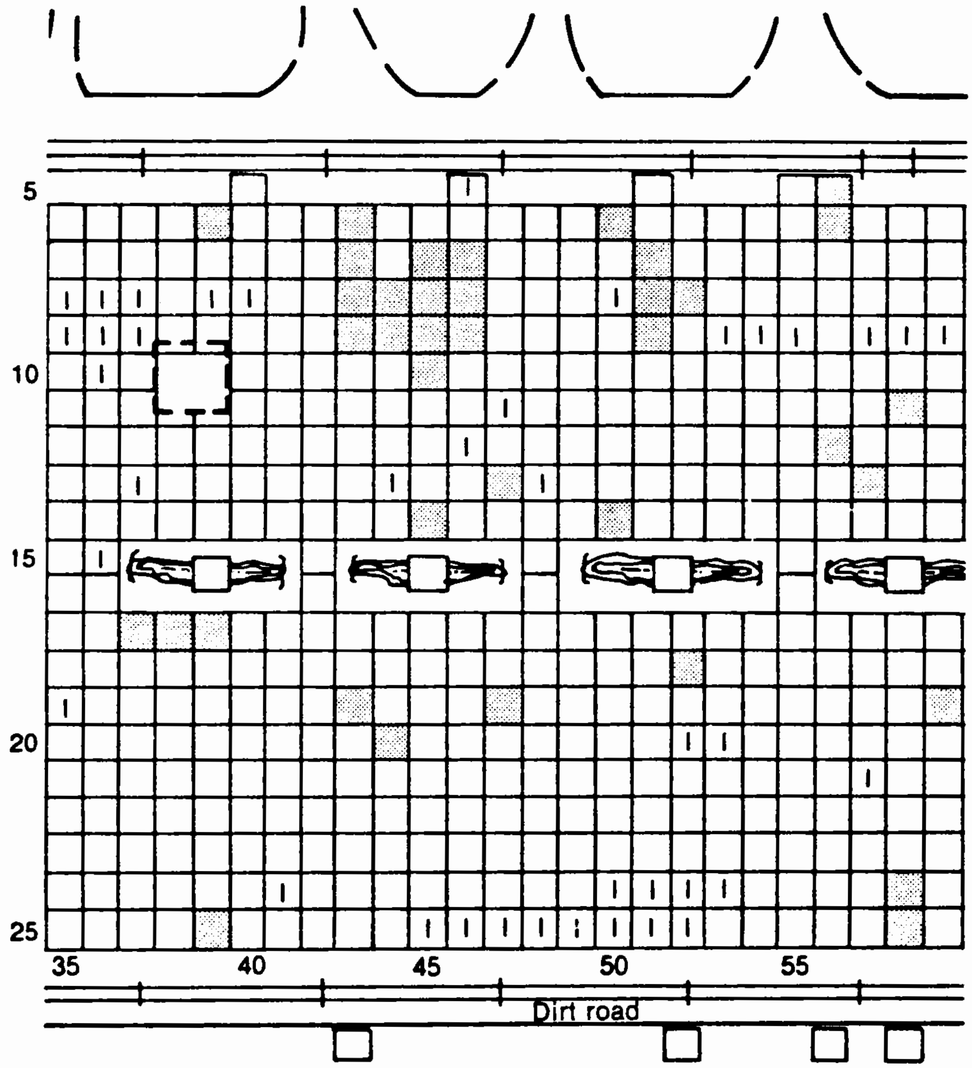


FIGURE 2-45
ORIGINAL AREA PLOTS WITH 65-PERCENT UPPER CONFIDENCE LIMIT EXCEEDING 50 ppb

Source: Crockett et al., 1987.

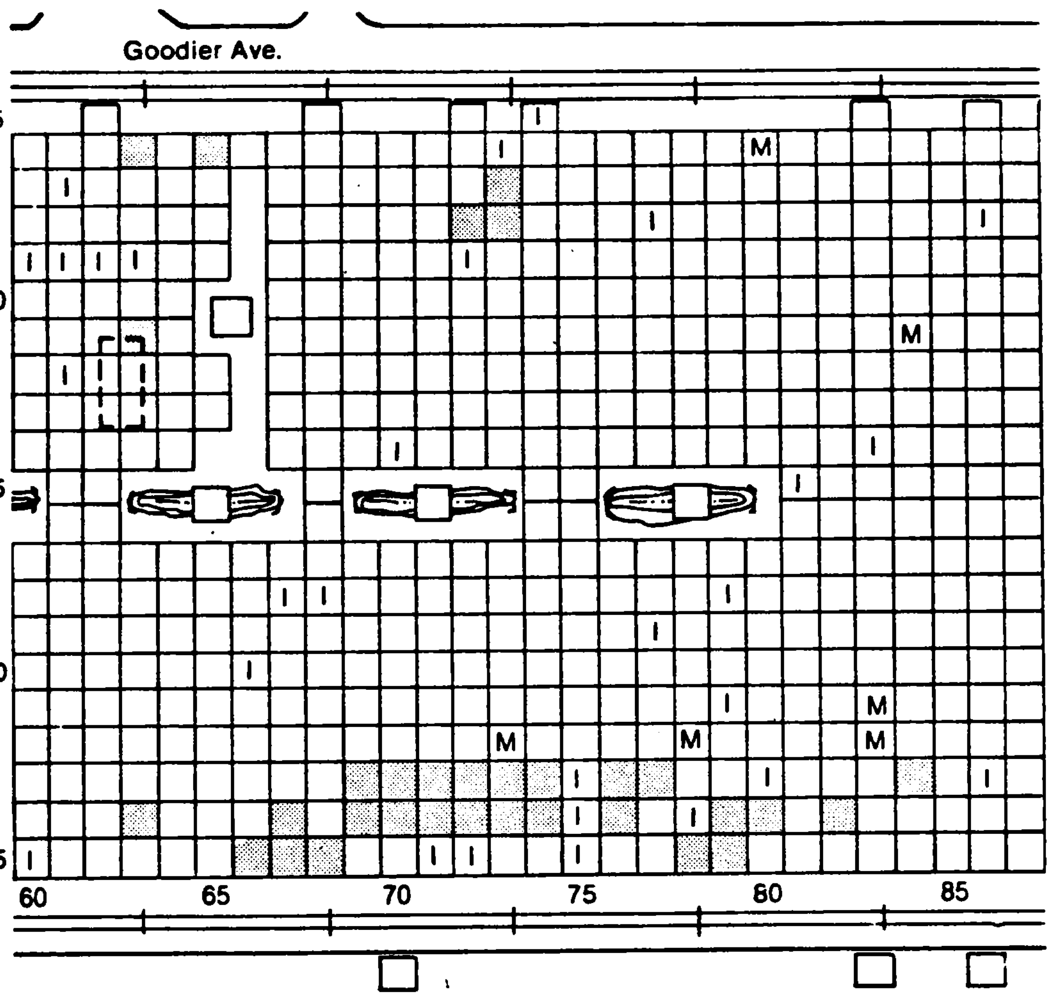


FIGURE 2-46
NCBC ORIGINAL EXPANSION AREA PLOTS WITH 65-PERCENT UPPER CONFIDENCE LIMIT EXCEEDING 50 ppb

Source: Crockett et al., 1987.

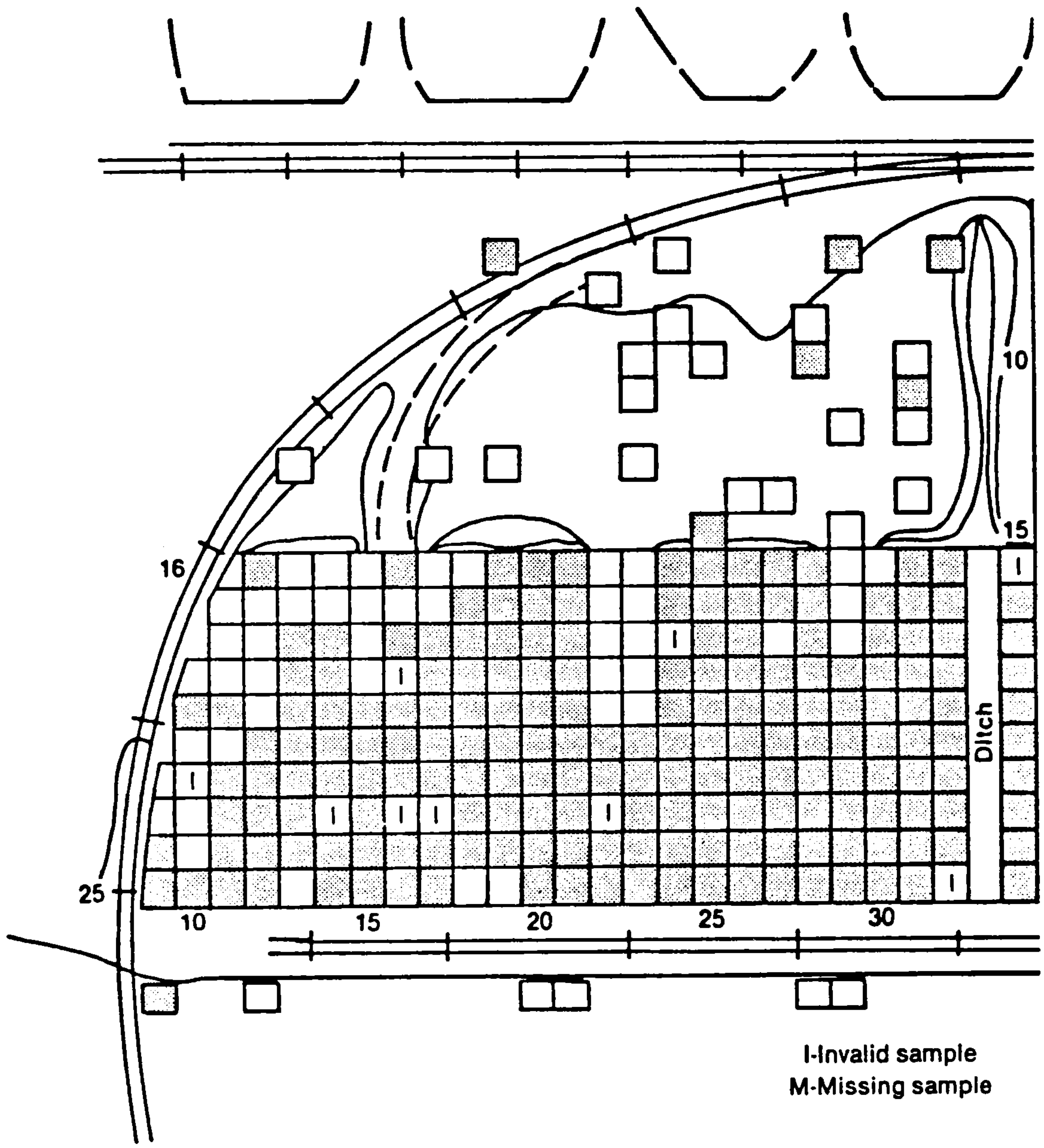


FIGURE 2-47
NCBC EXPANSION WEST PLOTS WITH 95- PERCENT UPPER CONFIDENCE LIMIT EXCEEDING 1 ppb

Source: Crockett et al., 1987.

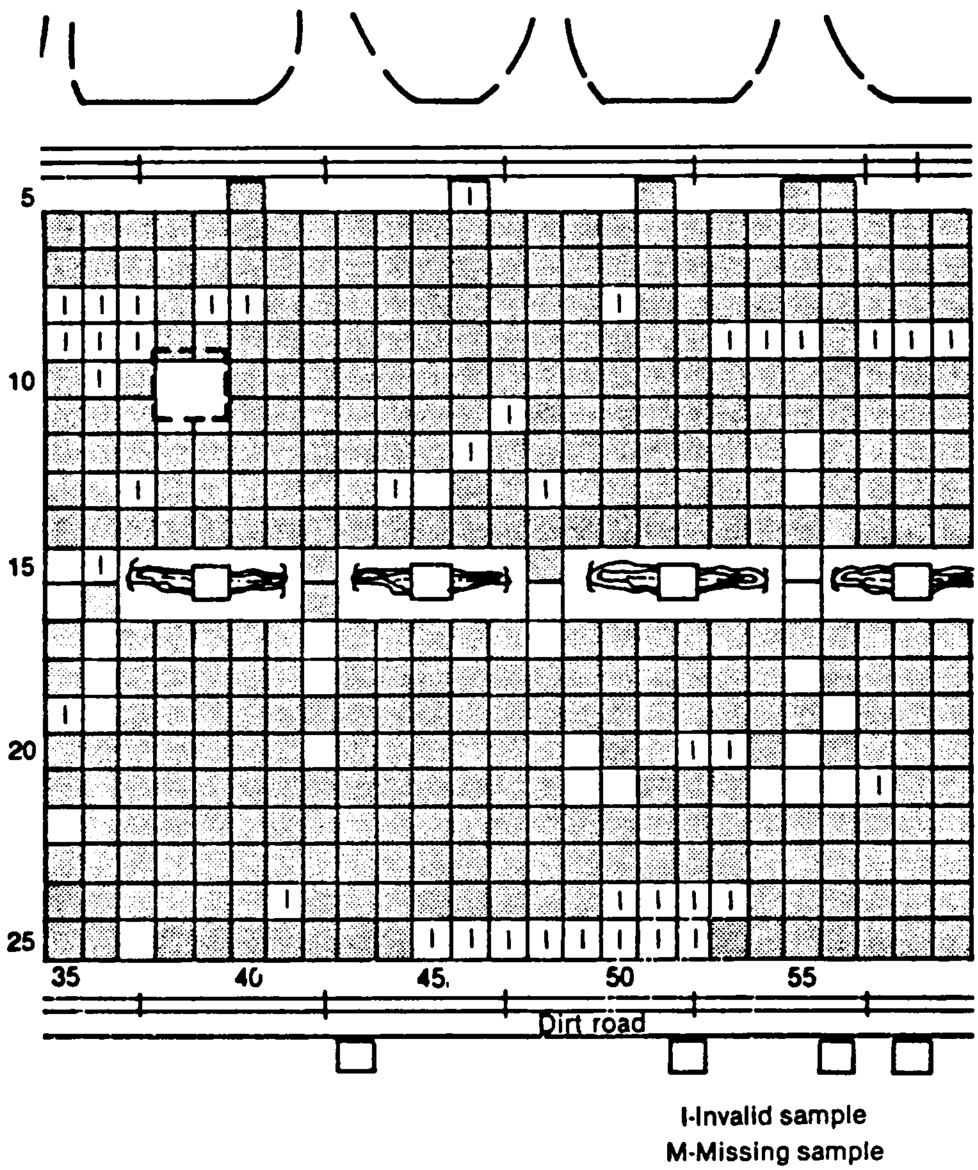


FIGURE 2-48
NCBC ORIGINAL AREA PLOTS WITH 95-PERCENT
UPPER CONFIDENCE LIMIT EXCEEDING 1 ppb

Source: Crockett et al., 1987.

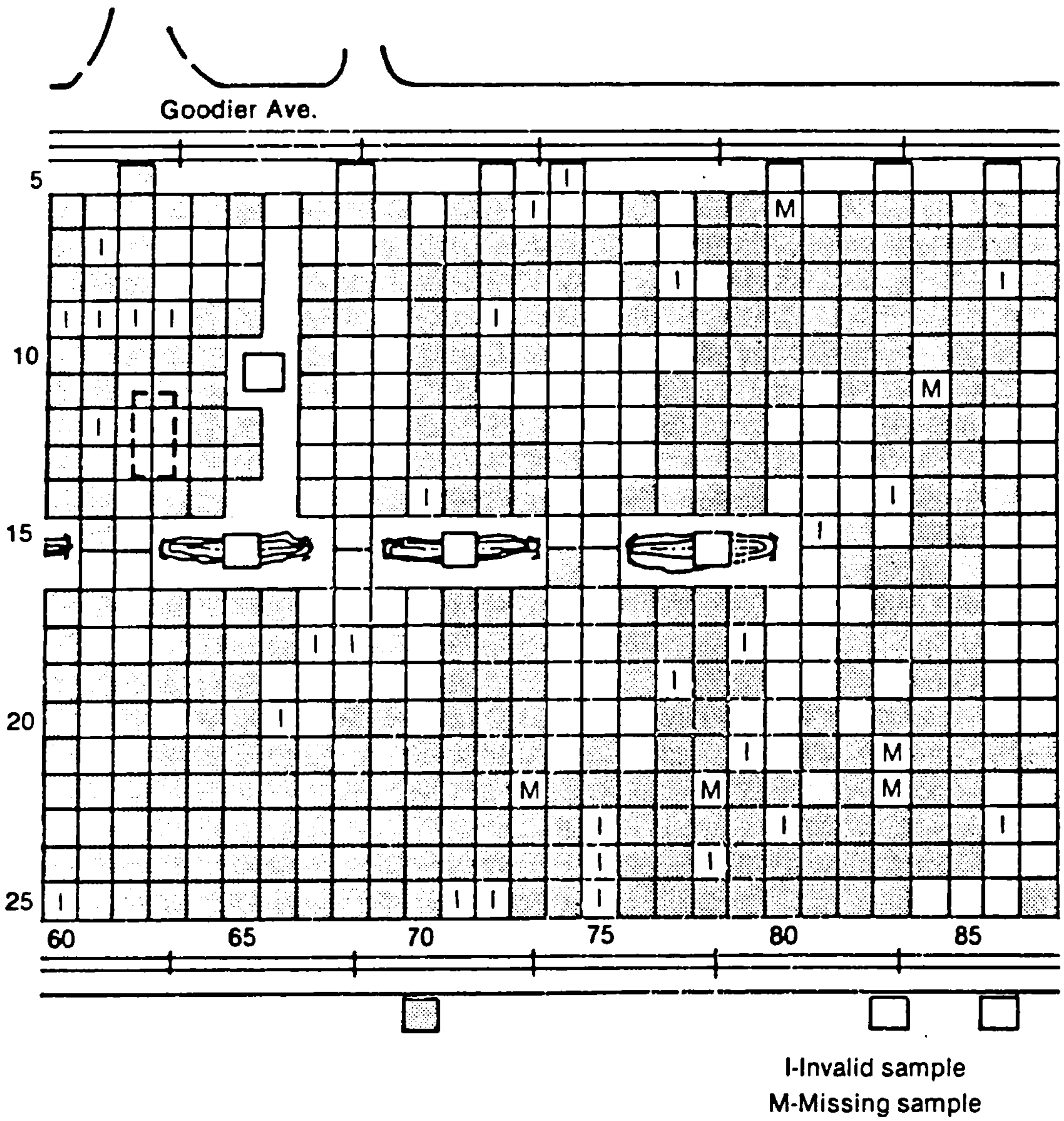


FIGURE 2-49
NCBC ORIGINAL EXPANSION AREA PLOTS WITH 95-PERCENT UPPER CONFIDENCE LIMIT EXCEEDING 1 ppb

Source: Crockett et al., 1987.

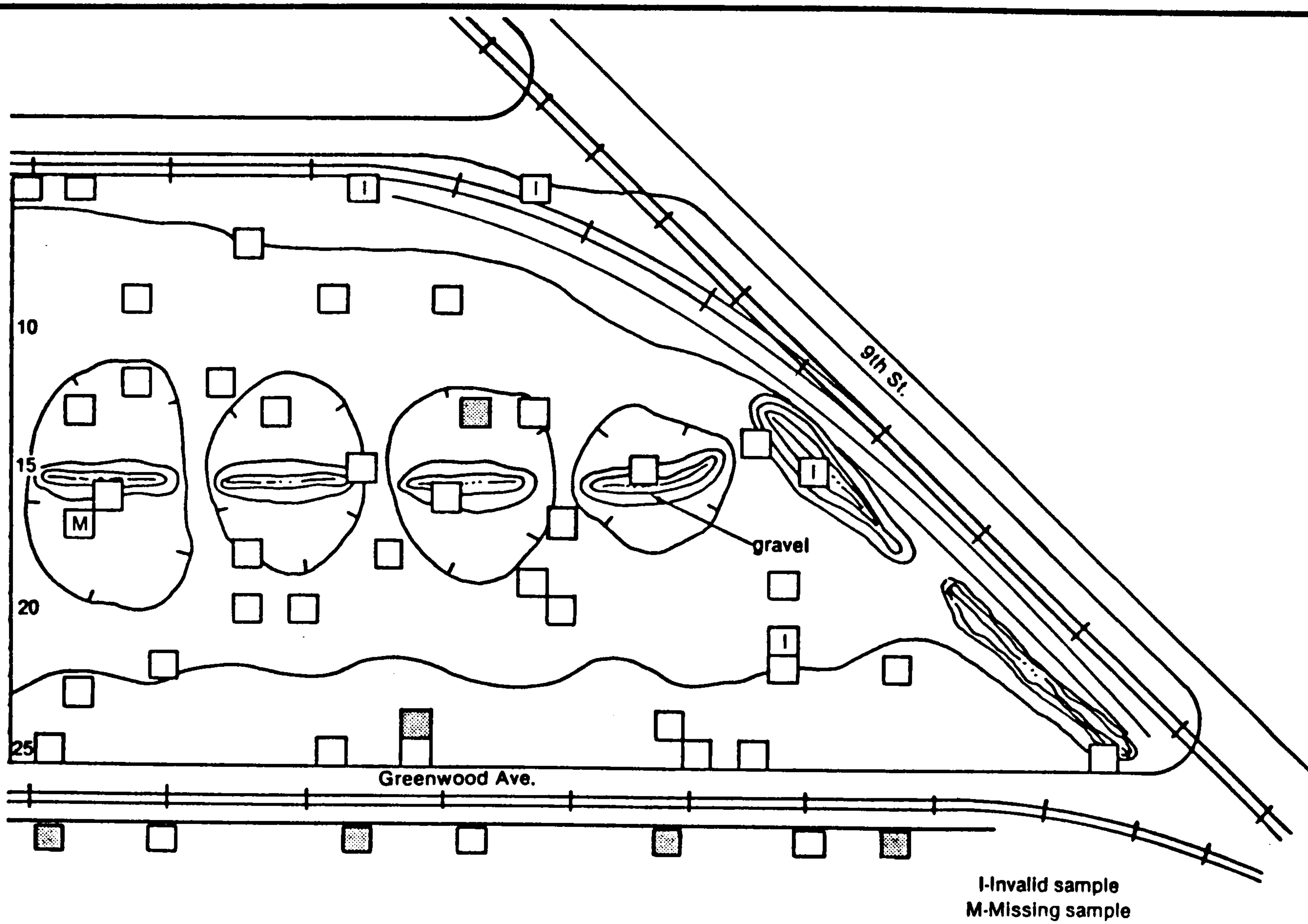


FIGURE 2-50
NCBC EXPANSION EAST PLOTS WITH 95-PERCENT
UPPER CONFIDENCE LIMIT EXCEEDING 1 ppb

Source: Crockett et al., 1987.

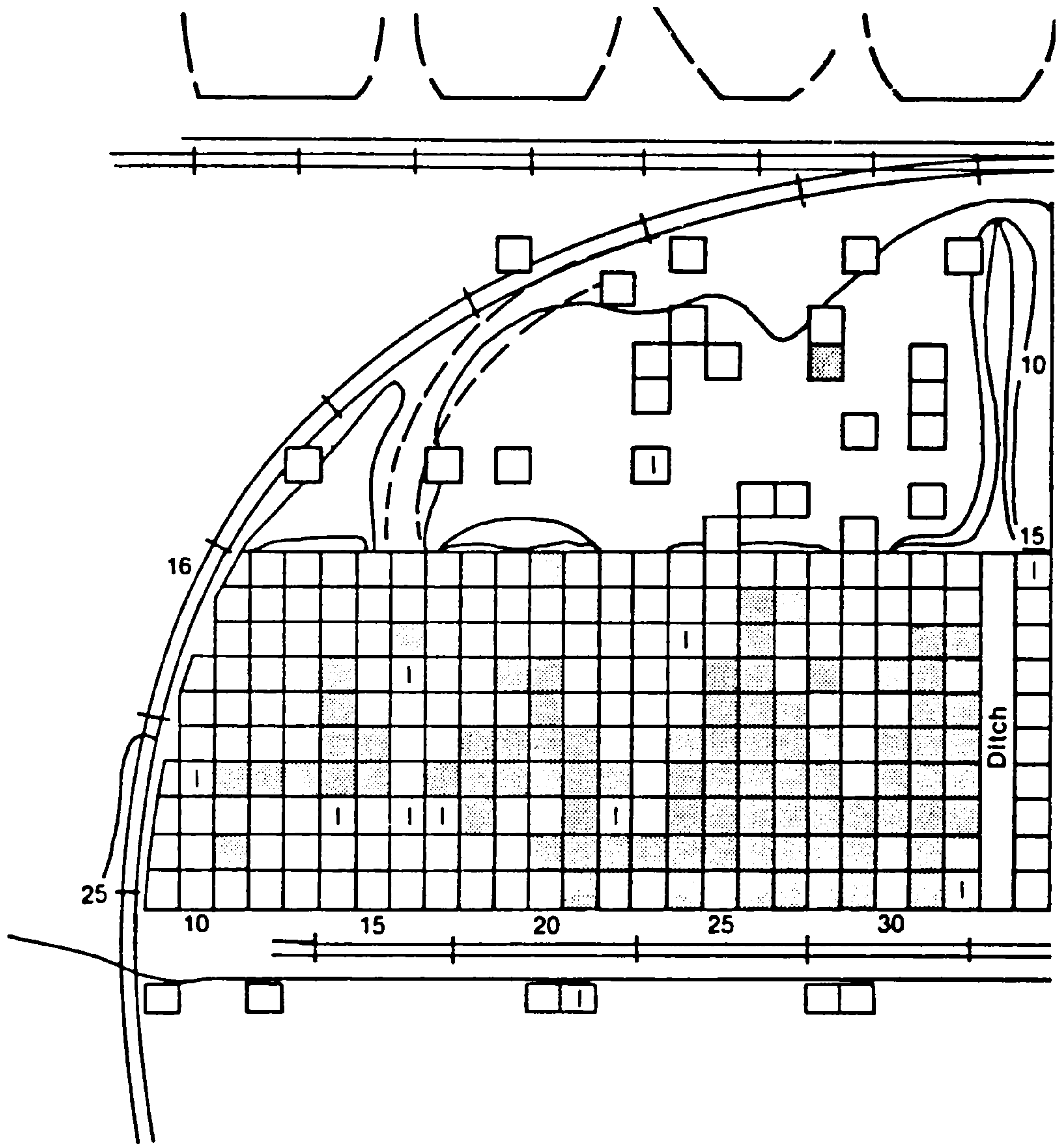


FIGURE 2-51
NCBC EXPANSION AREA WEST PLOTS WITH 95-PERCENT UPPER CONFIDENCE LIMIT EXCEEDING 10 ppb

Source: Crockett et al., 1987.

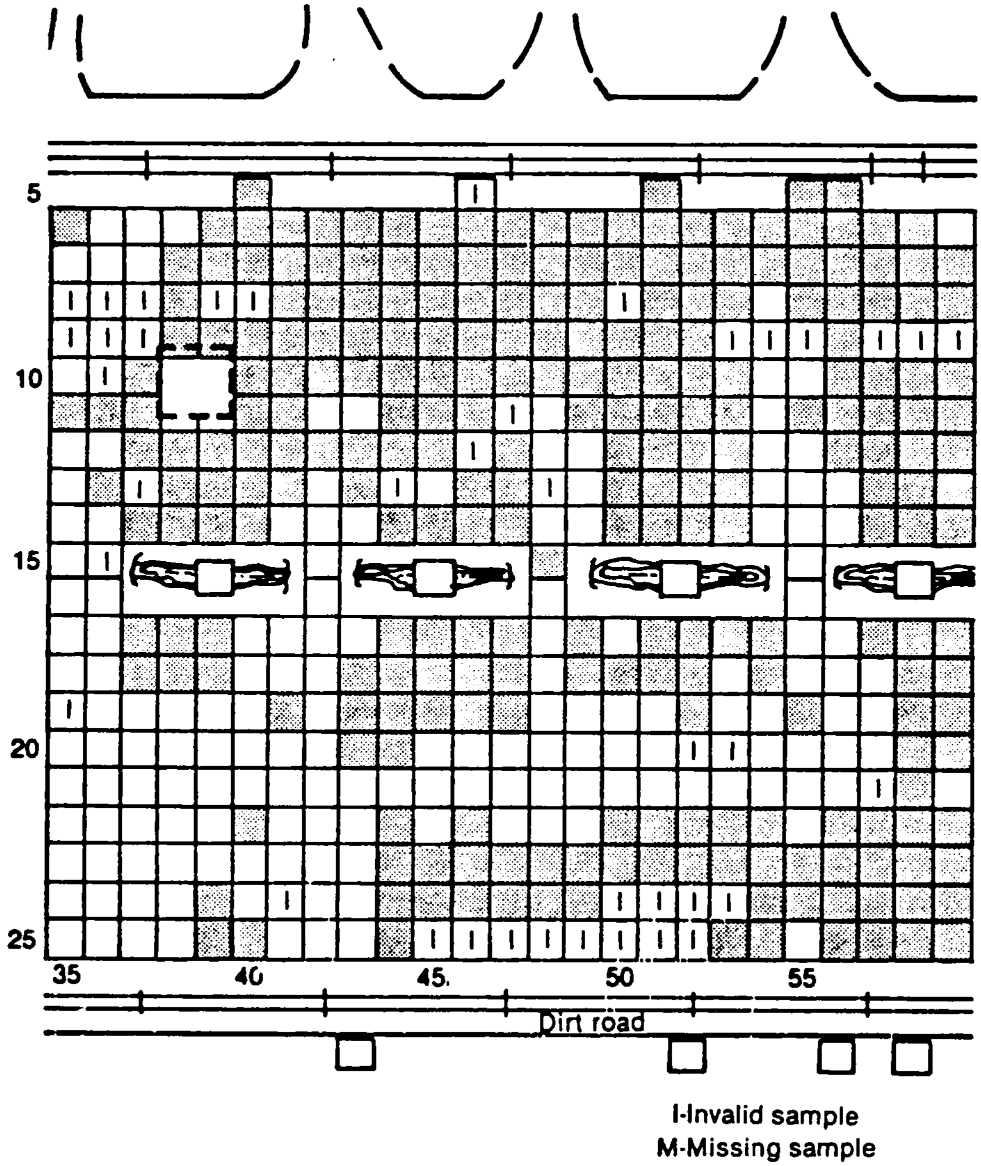


FIGURE 2-52
NCBC ORIGINAL AREA PLOTS WITH 95-PERCENT
UPPER CONFIDENCE LIMIT EXCEEDING 10 ppb

Source: Crockett et al., 1987.

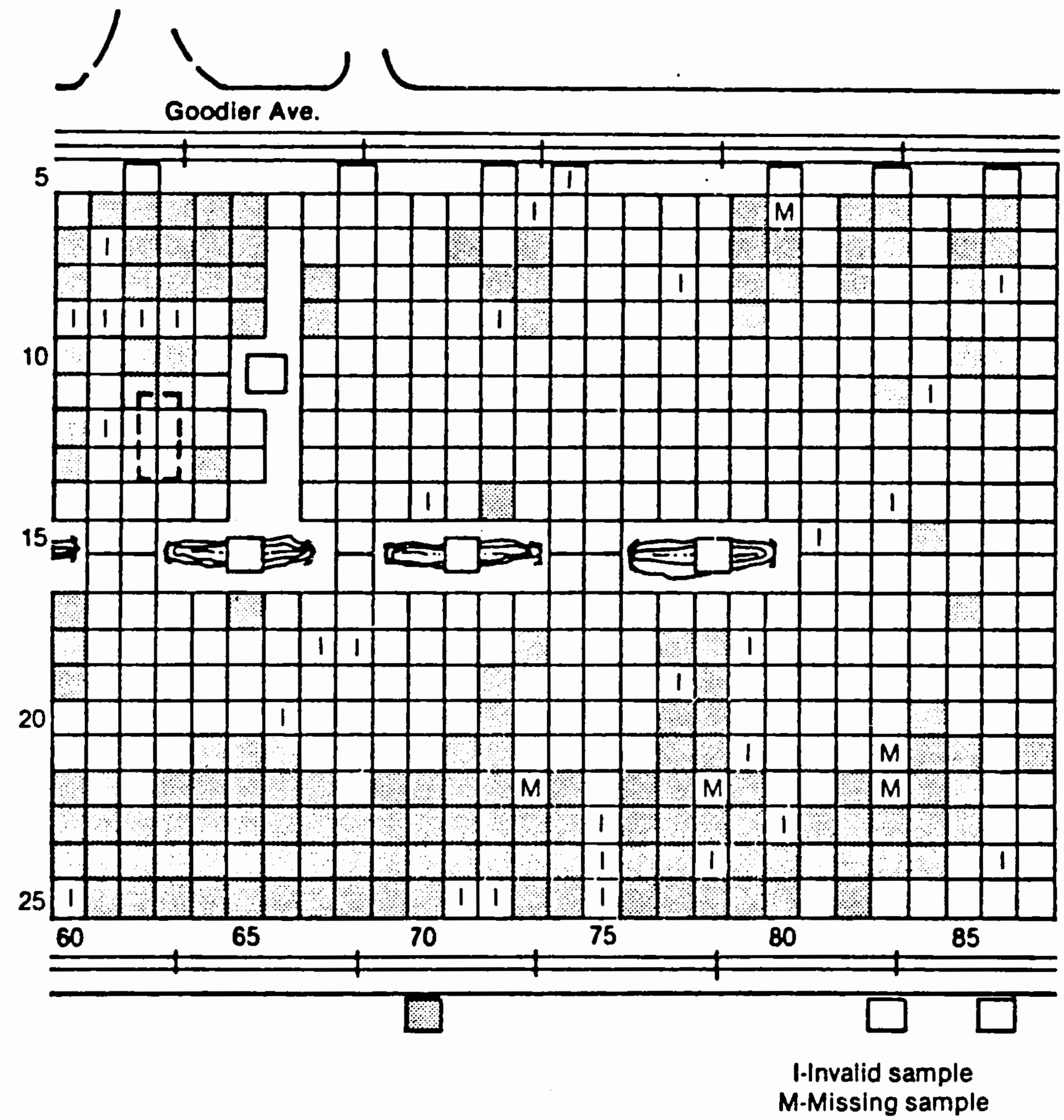


FIGURE 2-53
NCBC ORIGINAL EXPANSION AREA PLOTS WITH 95-PERCENT UPPER CONFIDENCE LIMIT EXCEEDING 10 ppb

Source: Crockett et al., 1987

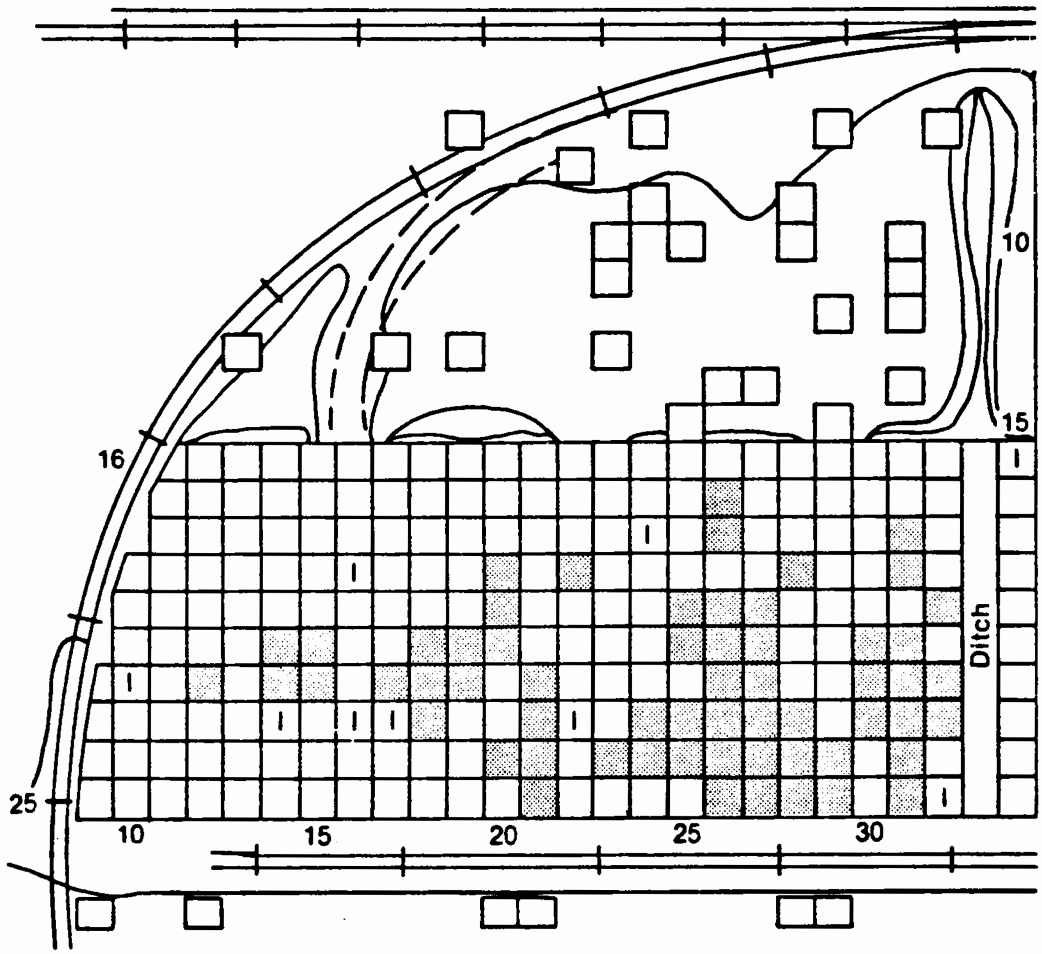


FIGURE 2-54
NCBC EXPANSION AREA WEST PLOTS WITH 95-PERCENT UPPER CONFIDENCE LIMIT EXCEEDING 25 ppb

Source: Crockett *et al.*, 1987.

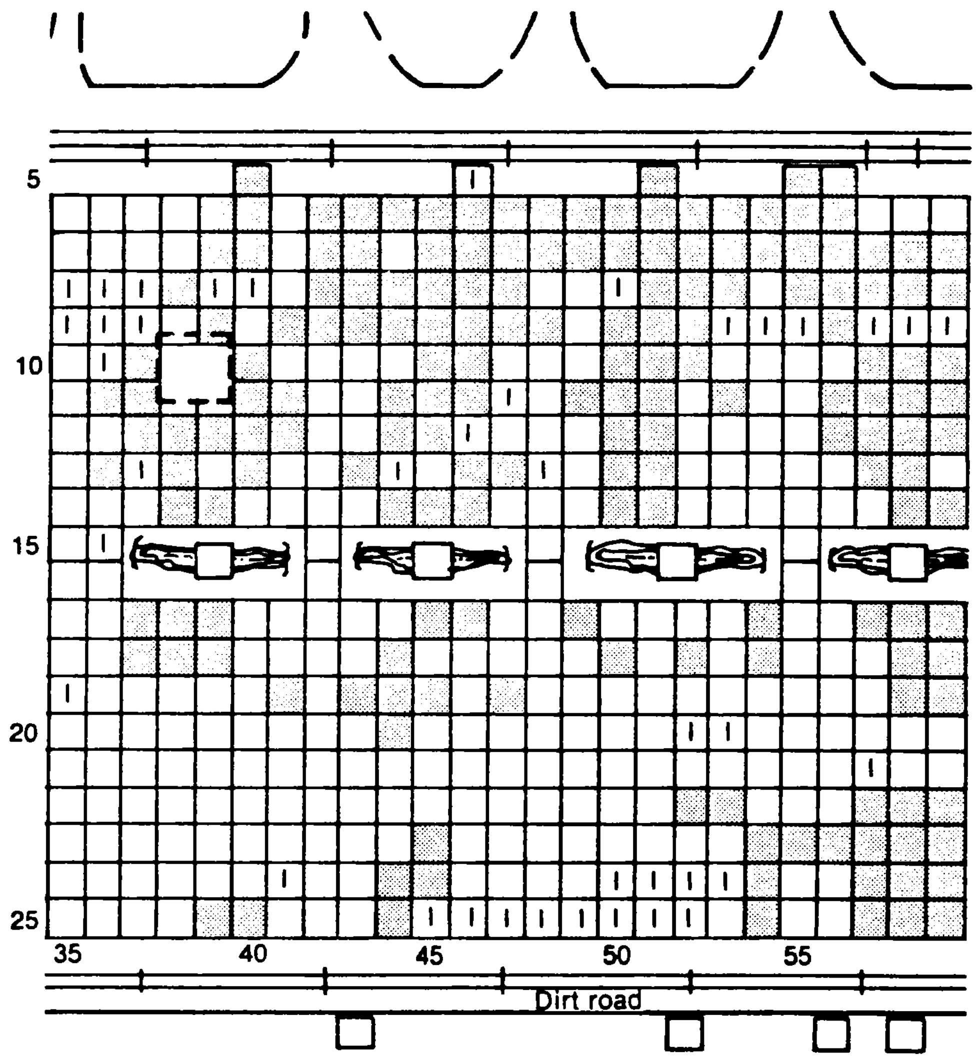


FIGURE 2-55
NCBC ORIGINAL AREA PLOTS WITH 95-PERCENT UPPER CONFIDENCE LIMIT EXCEEDING 25 ppb

Source: Crockett et al., 1987.

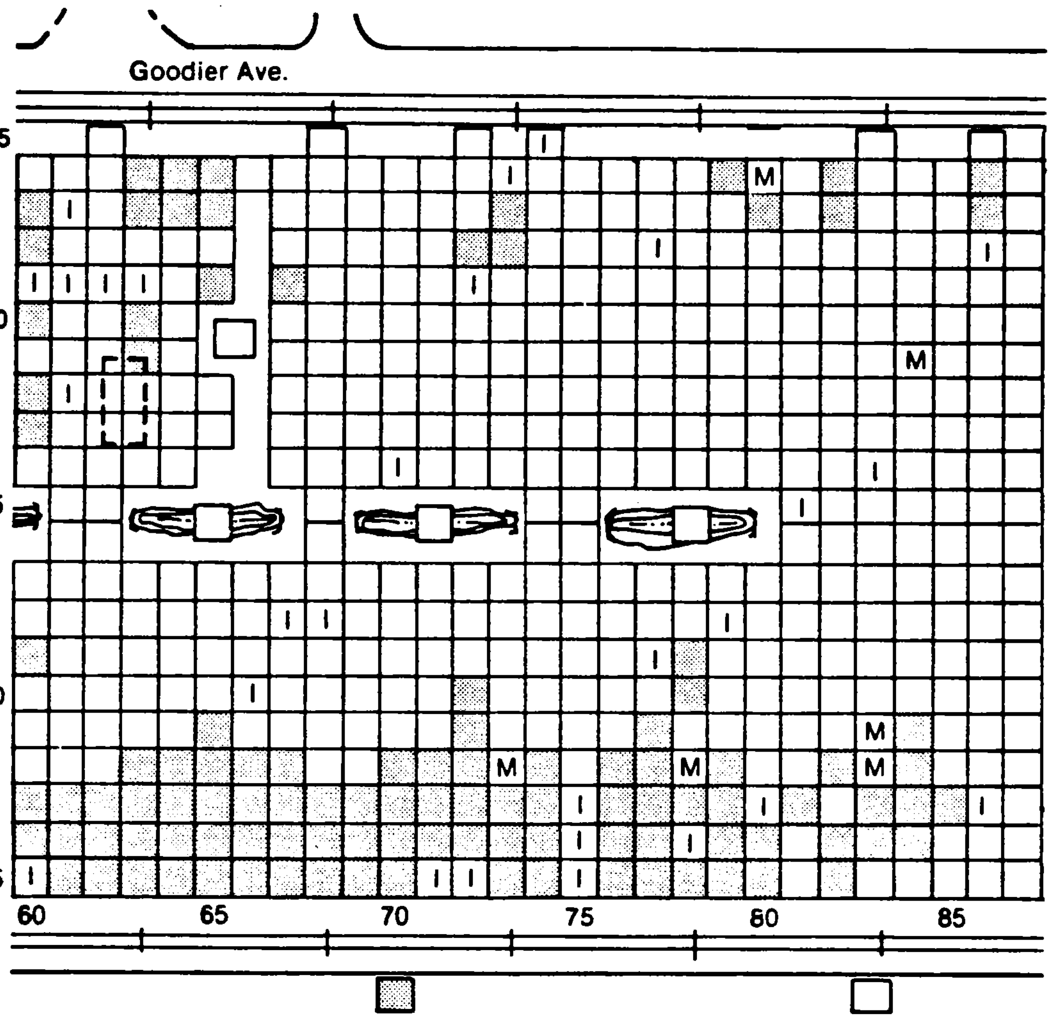


FIGURE 2-56
NCBC ORIGINAL EXPANSION AREA PLOTS WITH 95-PERCENT UPPER CONFIDENCE LIMIT EXCEEDING 25 ppb

Source: Crockett et al., 1987.

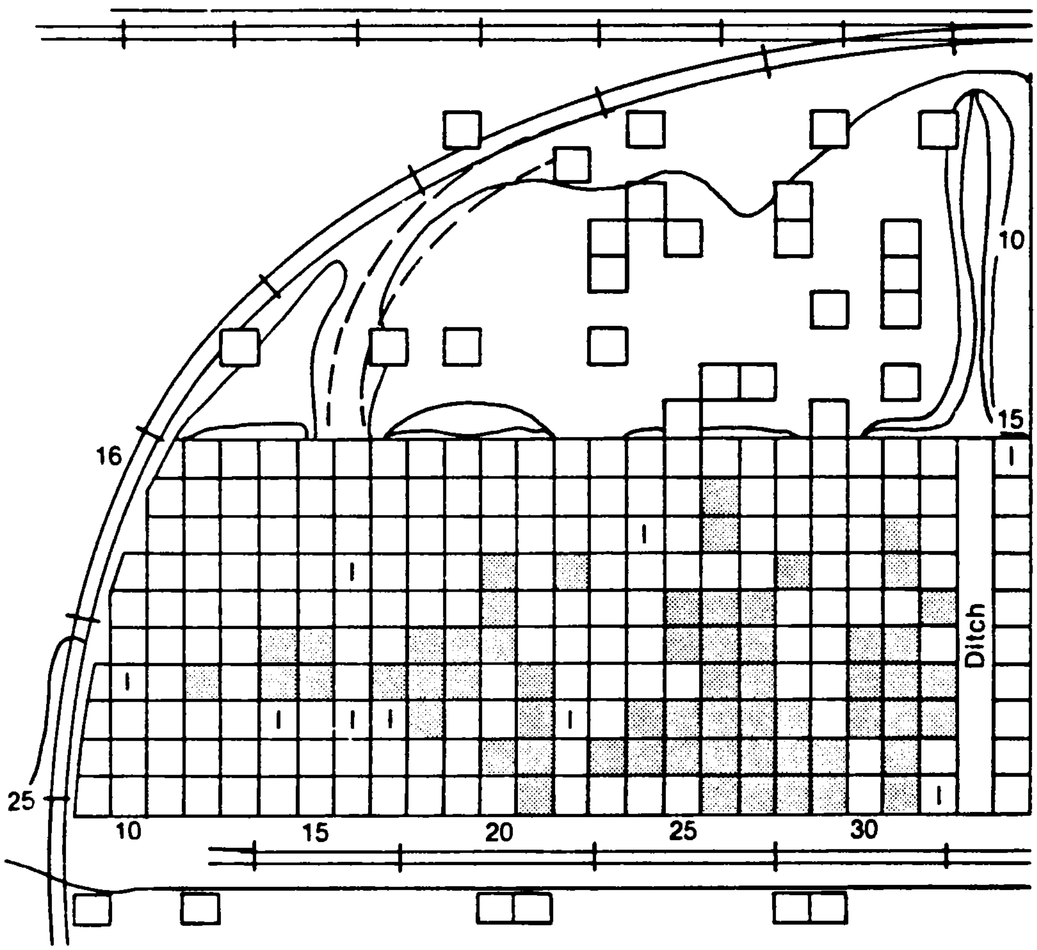


FIGURE 2-57
NCBC ORIGINAL EXPANSION AREA WEST PLOTS WITH 95-PERCENT UPPER CONFIDENCE LIMIT EXCEEDING 50 ppb

Source: Crockett et al., 1987.

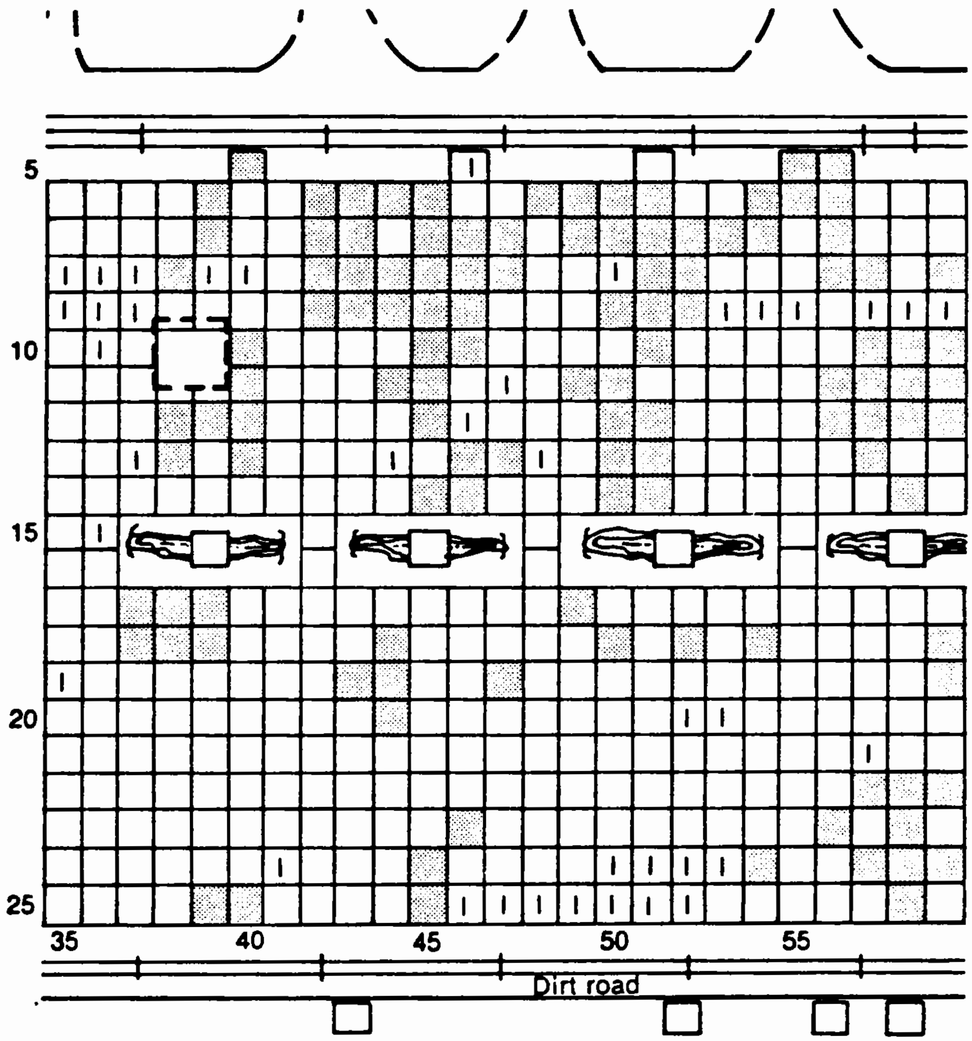


FIGURE 2-58
NCBC ORIGINAL AREA PLOTS WITH 95-PERCENT UPPER CONFIDENCE LIMIT EXCEEDING 50 ppb

Source: Crockett et al., 1987.

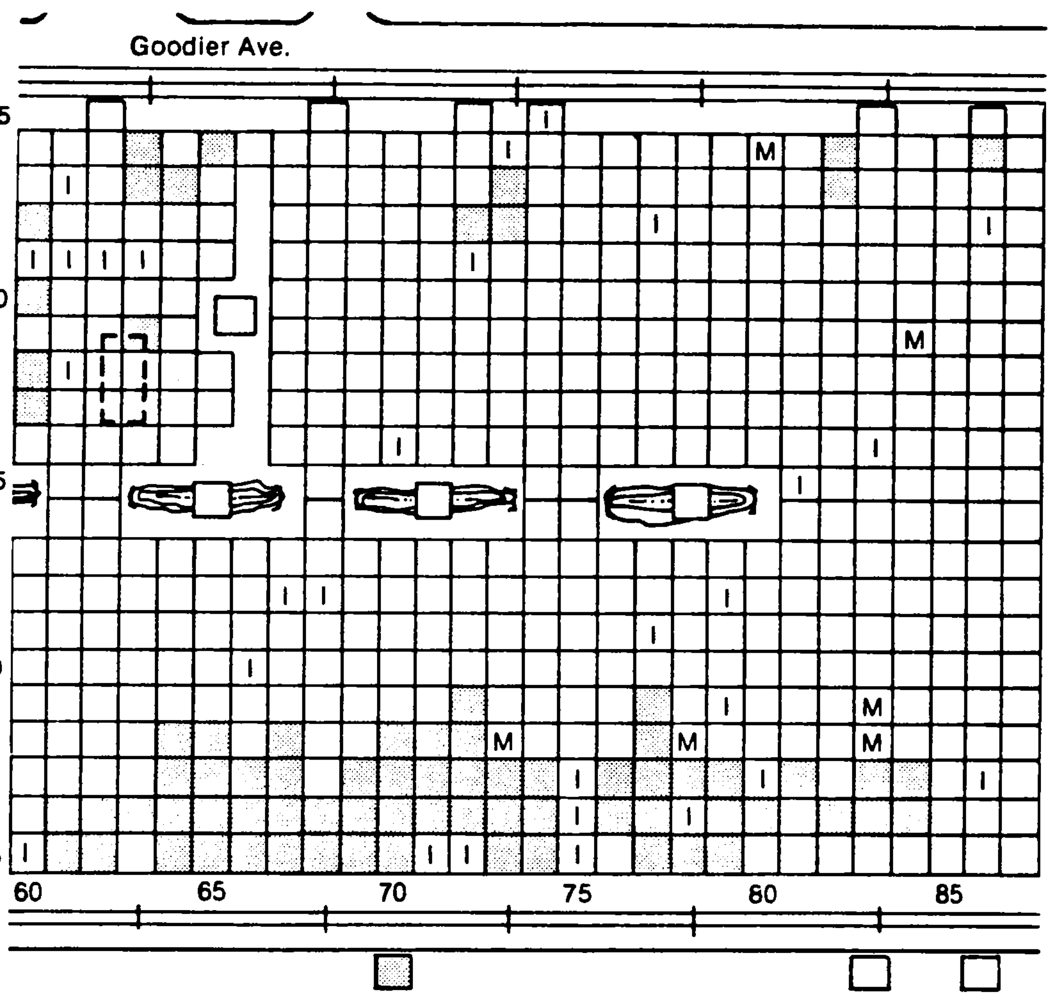


FIGURE 2-59
NCBC ORIGINAL EXPANSION AREA PLOTS WITH 95-PERCENT UPPER CONFIDENCE LIMIT EXCEEDING 50 ppb

Source: Crockett et al., 1987.

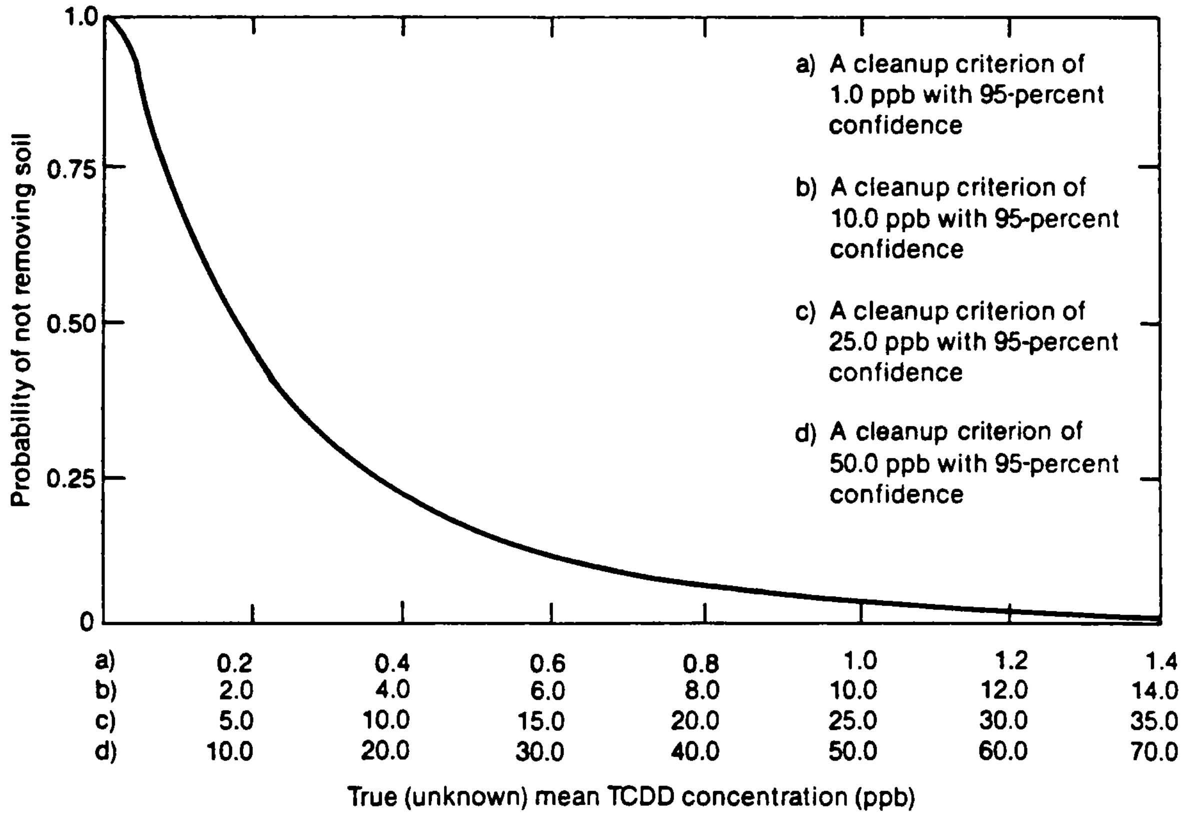


FIGURE 2-60
PROBABILITY OF NOT REMOVING SOIL FROM THE PLOT WITH CLEANUP CRITERIA OF 1.0, 10.0, AND 50.0 ppb WITH 95-PERCENT CONFIDENCE

Source: Crockett et al., 1987.

TABLE 2-21

Near-Surface Sampling Summary Excluding Invalid Results

Parameter	Depth			
	Surface	Soil/Cement	0-3 Inches (Below Soil/Cement)	3-7 Inches (Below Soil/Cement)
Number of samples [a,b]	31	32	33	33
Arithmetic mean (ppb)	65.5	62.3	16.8	8.4
Arithmetic standard deviation (ppb)	100.5	182.7	39.1	21.3
Median (ppb)	17.9	2.5	2.0	0.59
Maximum (ppb)	425	998	147	95.5
Geometric mean (ppb)	24.9	4.0	1.4	1.0
Geometric standard deviation (ppb)	4.5	11.9	13.5	7.8

SOURCE: Crockett et al., 1987.

[a]Excludes possible invalid results.

[b]Less than detectables replaced by RL.

TABLE 2-22

Near-Surface Sampling Summary Including Invalid Results

Parameter	Depth			
	Surface	Soil/Cement	0-3 Inches (Below Soil/Cement)	3-7 Inches (Below Soil/Cement)
Number of samples[a,b]	35	35	35	35
Arithmetic mean (ppb)	89.0	72.5	16.3	17.5
Arithmetic standard deviation (ppb)	129.0	181.9	38.0	55.8
Median (ppb)	21.1	2.8	2.0	0.59
Maximum (ppb)	432.0	998	147	315
Geometric mean (ppb)	30.7	5.1	1.4	1.3
Geometric standard deviation (ppb)	4.95	13.0	12.9	9.6

SOURCE: Crockett et al., 1987.

[a]Includes possible invalid results.

[b]Less than detectables replaced by RL.

high values. The summary indicates a drop in TCDD concentrations below the soil/cement layer, although there are still validated samples as high as 95.5 at 1 foot below the soil/cement layer.

Subsurface sampling results are summarized in Tables 2-23 and 2-24. Again, there is indication of decreasing TCDD concentrations with geometric means of 0.03 ppb and 0.04 ppb at 3 feet and 4 feet, respectively, below the soil/cement layer.

However, several locations have consistently higher concentrations at depth. Location 2372 has a result of 5.1 ppb at 4 feet below the soil/cement layer, and location 2527 has 2.0 ppb at 4 feet.

2.1.2.1.7.2 Herbicide Orange. All subsurface samples were analyzed for HO (2,4-D and 2,4,5-T). The results are presented in Appendix C. Depth profiles for each location are given in Figures 2-61 through 2-75.

These profiles indicate that, except for the increase at the soil/cement level, HO concentrations decrease with depth. This follows the tendency of the TCDD concentrations to decrease with depth, with the exception of locations 2372 and 2527. The concentrations at these two locations remain within a limited range.

2.1.2.2 Investigation of Areas B and C. As discussed earlier, Areas B and C were not discovered until after the report on what is now designated as Area A was originally issued in October 1986. The data for Areas B and C reported by Friedrich (1988) are listed in Appendix C. The data for these areas are summarized in Table 2-25 and compared to similar data from Area A. The Area B and C results are plotted in Figures 1-5A, 1-5B, and 1-6 (Section 1), respectively. A data analysis of the type performed for Area A (see Section 2.1.2.1) has not been performed for Areas B and C to date.

2.2 GEOLOGY AND GROUNDWATER

2.2.1 Offsite Dioxin Contamination Survey

Of the three potable water samples collected from NCBC well heads during the June 23-24, 1986, survey, the results for two have been reported (Markland, 1986). These results are presented in Table 2-26, along with analytical results for the blank and matrix spikes. As shown in Table 2-26, there were no measurable levels of TCDD in the potable water samples at a DL of 20 parts per quadrillion (ppq). It should be noted that the analytical laboratory achieved a 100-percent

TABLE 2-23

Subsurface Sampling Summary Excluding Invalid Results

Depth	Number[a] of Samples	Maximum	Arithmetic Mean (ppb)	Arithmetic Standard Deviation (ppb)	Geometric Mean (ppb)	Geometric Standard Deviation (ppb)
Surface	13	646	135.6	222.5	28.4	8.7
Soil/cement	15	482	86.1	171.1	5.7	15.8
0-3 inches (below soil/cement)	12	307	43.0	90.4	3.9	12.9
3-7 inches (below soil/cement)	14	93.2	14.6	30.4	1.5	10.6
7-12 inches (below soil/cement)	15	11.6	1.7	3.6	0.20	8.8
24 inches (below soil/cement)	15	8.0	1.0	2.3	0.06	10.1
36 inches (below soil/cement)	15	3.4	0.31	0.88	0.03	6.4
48 inches (below soil/cement)	15	5.1	0.62	1.4	0.04	9.4

SOURCE: Crockett et al., 1987.

[a]Excludes possible invalid results.

[b]Less than detectables replaced by the RL.

TABLE 2-24

Subsurface Sampling Summary Including Invalid Results

Depth	Number[a] of Samples	Maximum (ppb)	Arithmetic Mean (ppb)	Arithmetic Standard Deviation (ppb)	Geometric Mean (ppb)	Geometric Standard Deviation (ppb)
Surface	14	646	127.4	215.9	27.8	8.0
Soil/cement	15	482	86.1	171.1	5.7	15.8
0-3 inches (below soil/cement)	15	307	51.7	99.7	2.6	24.0
3-7 inches (below soil/cement)	15	93.2	14.4	29.3	1.7	10.3
7-12 inches (below soil/cement)	15	11.6	1.7	3.6	0.20	8.8
24 inches (below soil/cement)	15	8.0	1.0	2.3	0.06	10.1
36 inches (below soil/cement)	15	3.4	0.31	0.88	0.03	6.4
48 inches (below soil/cement)	15	5.1	0.62	1.4	0.04	9.4

SOURCE: Crockett et al., 1987.

[a]Includes possible invalid results.

[b]Less than detectables replaced by the RL.

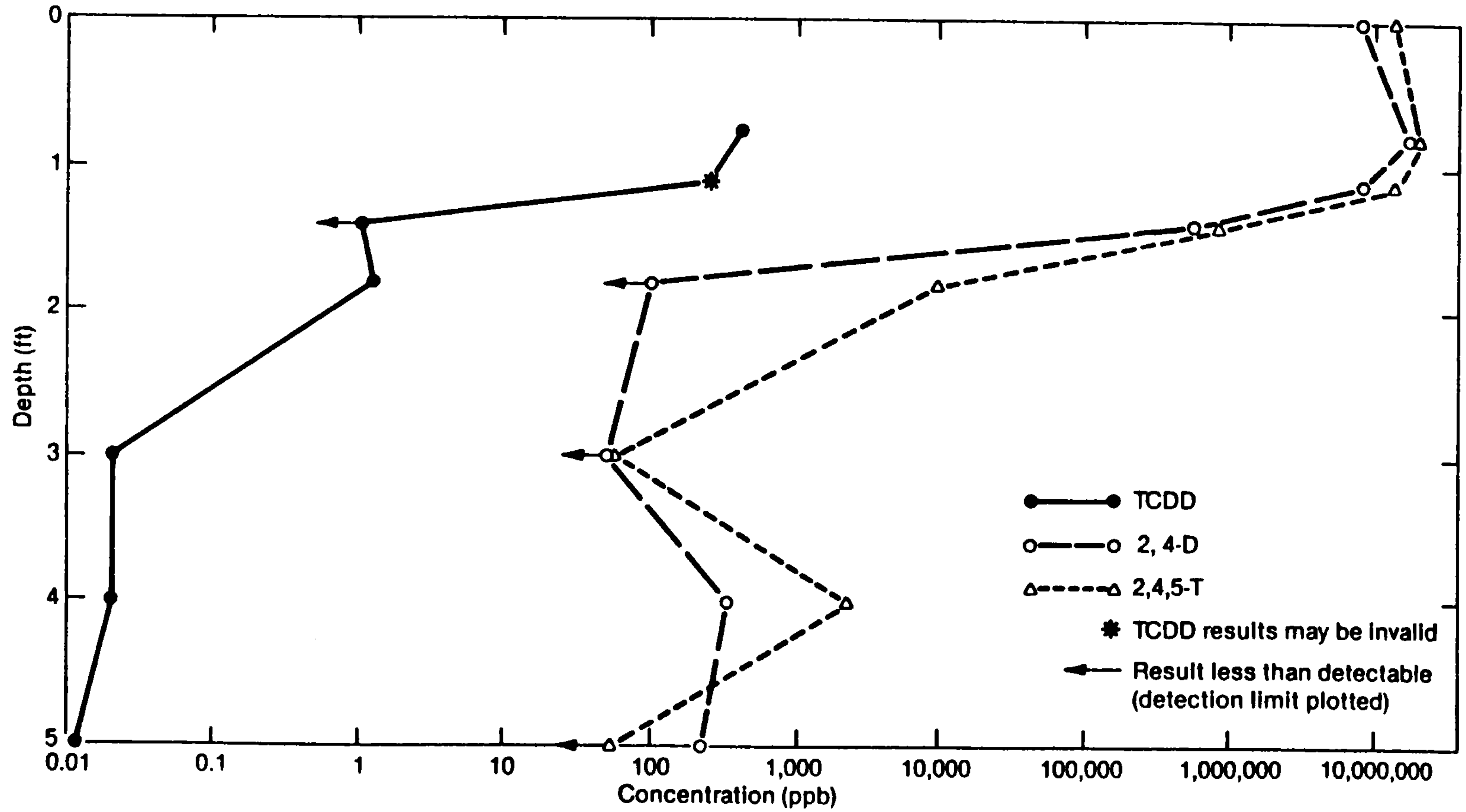


FIGURE 2-61
NCBC HO DEPTH PROFILE, LOCATION 0639

Source: Crockett et al., 1987.

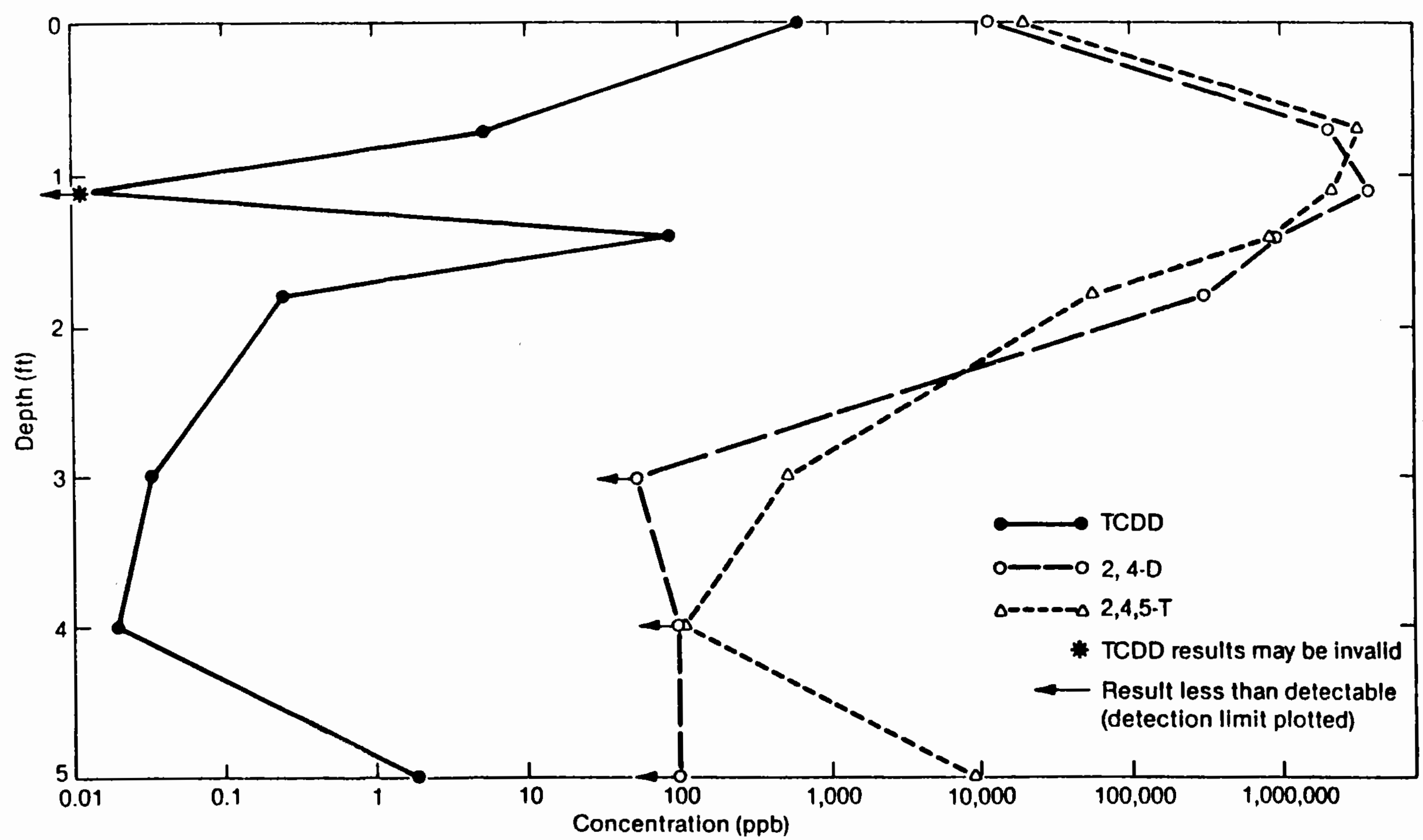


FIGURE 2-62
NCBC HO DEPTH PROFILE, LOCATION 0643

Source: Crockett et al., 1987.

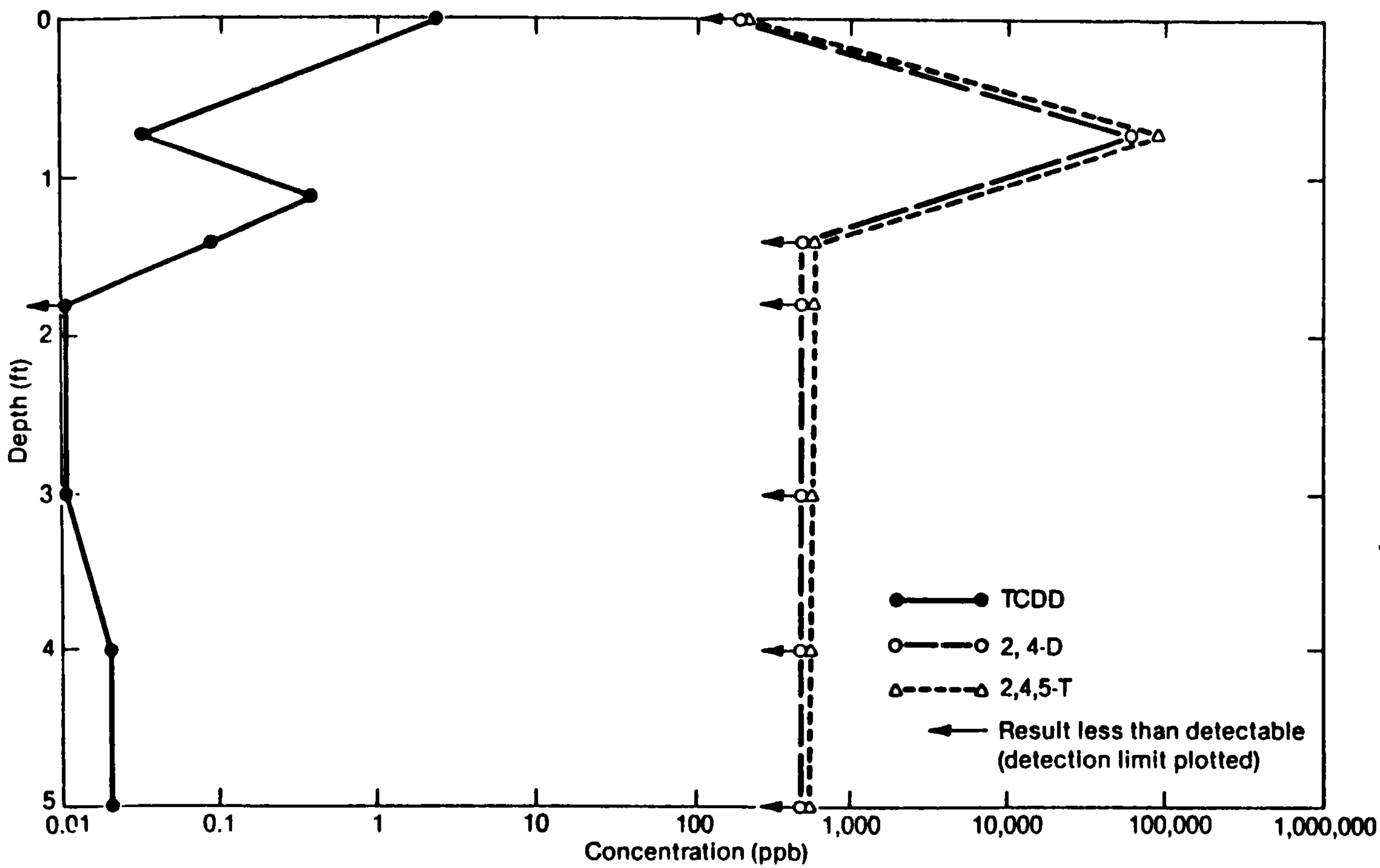


FIGURE 2-63
NCBC HO DEPTH PROFILE, LOCATION 2030

Source: Crockett et al., 1987.

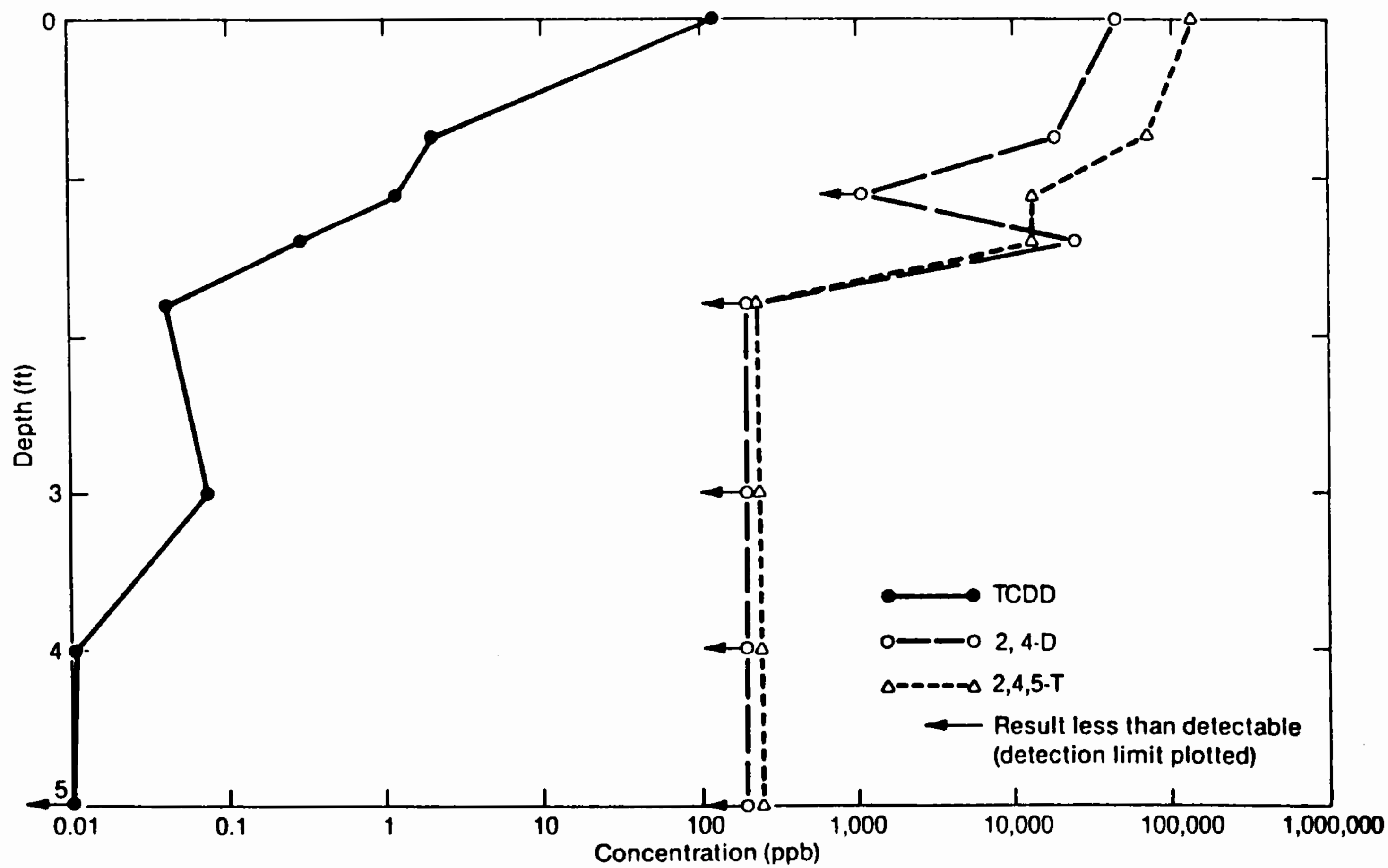


FIGURE 2-64
NCBC HO DEPTH PROFILE, LOCATION 2312

Source: Crockett et al., 1987.

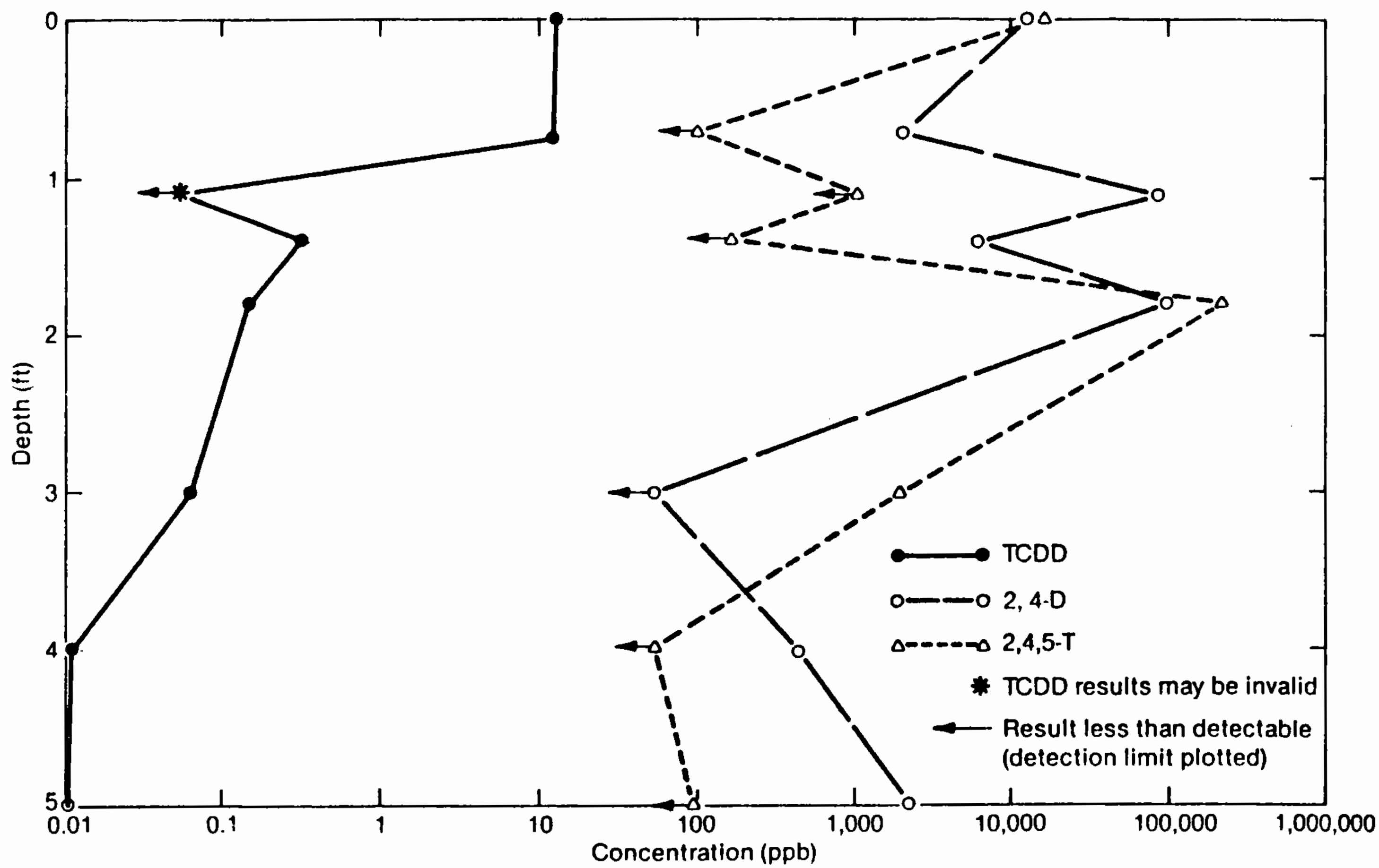


FIGURE 2-65
NCBC HO DEPTH PROFILE, LOCATION 2328

Source: Crockett et al., 1987.

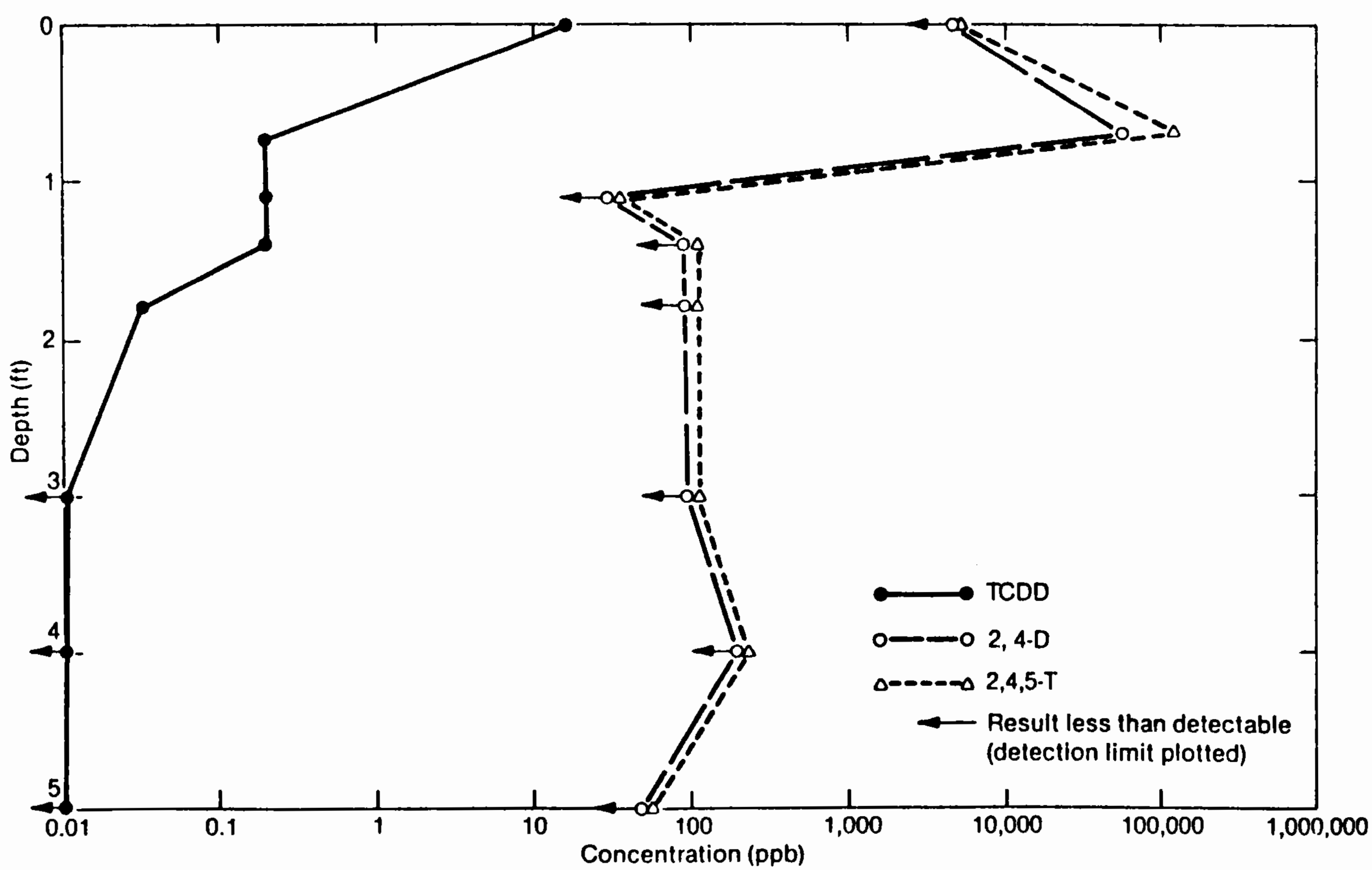


FIGURE 2-66
NCBC HO DEPTH PROFILE, LOCATION 2369

Source: Crockett et al., 1987.

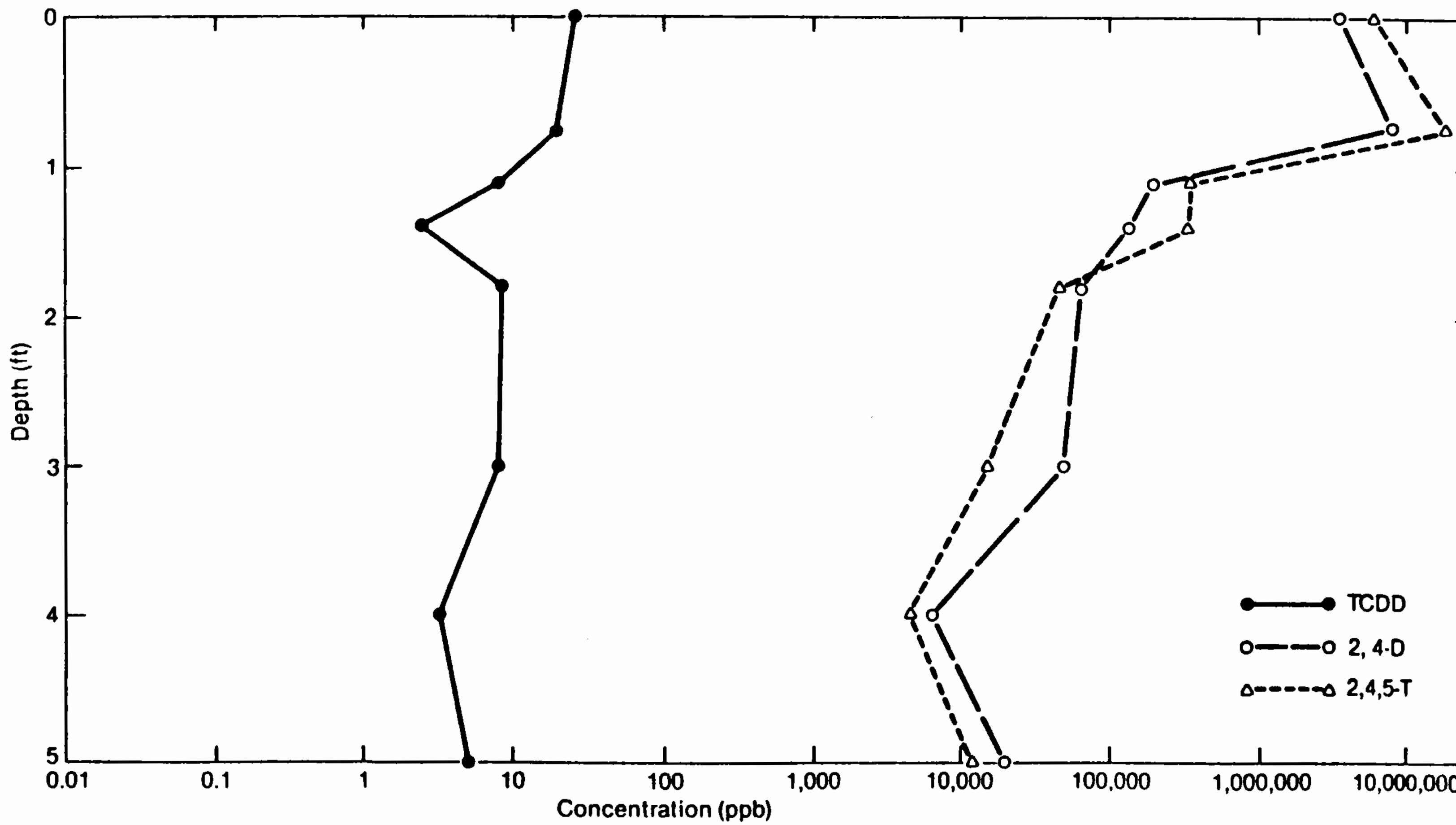


FIGURE 2-67

NCBC HO DEPTH PROFILE, LOCATION 2372

Source: Crockett et al., 1987.

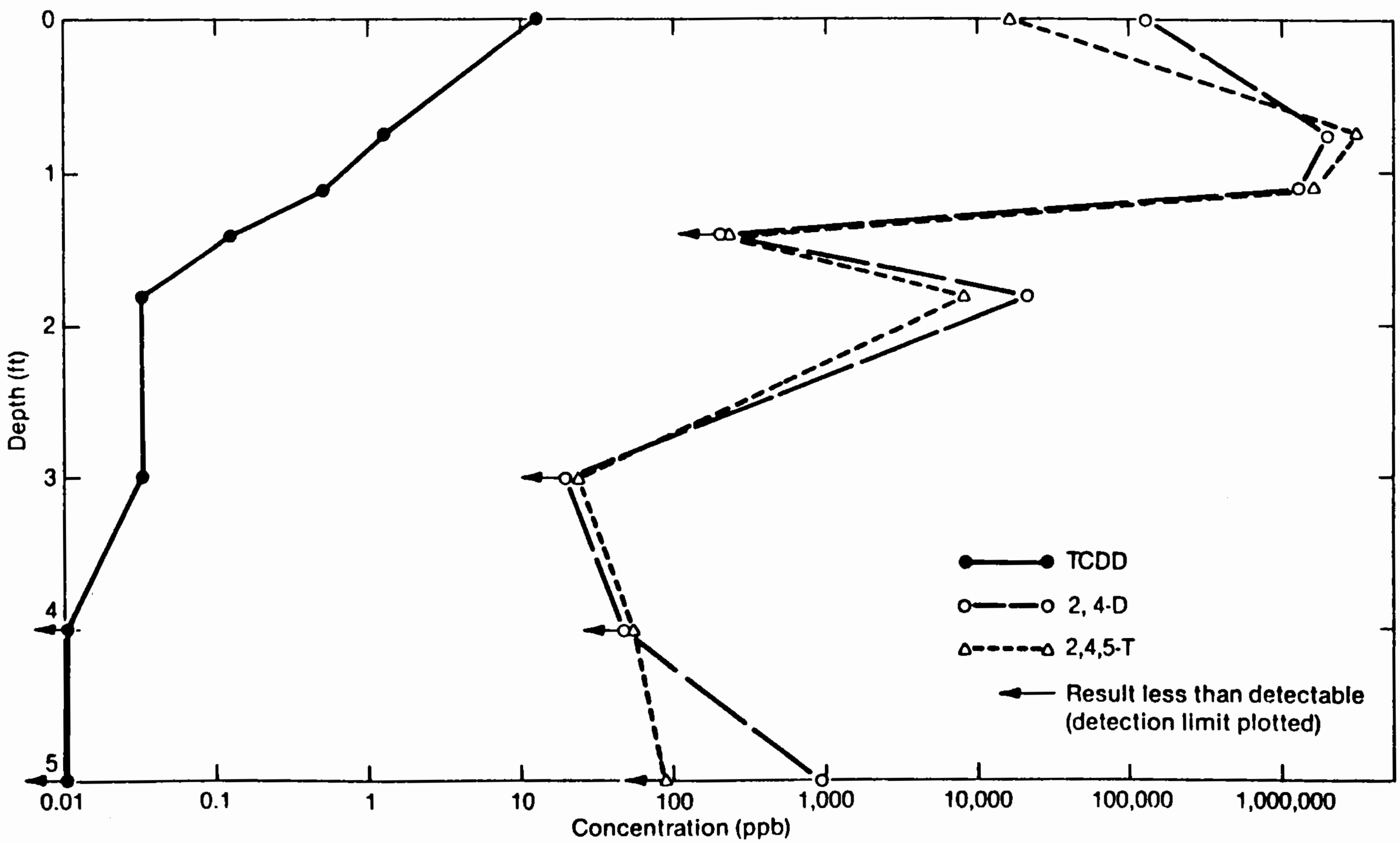


FIGURE 2-68
NCBC HO DEPTH PROFILE, LOCATION 2376

Source: Crockett et al., 1987.

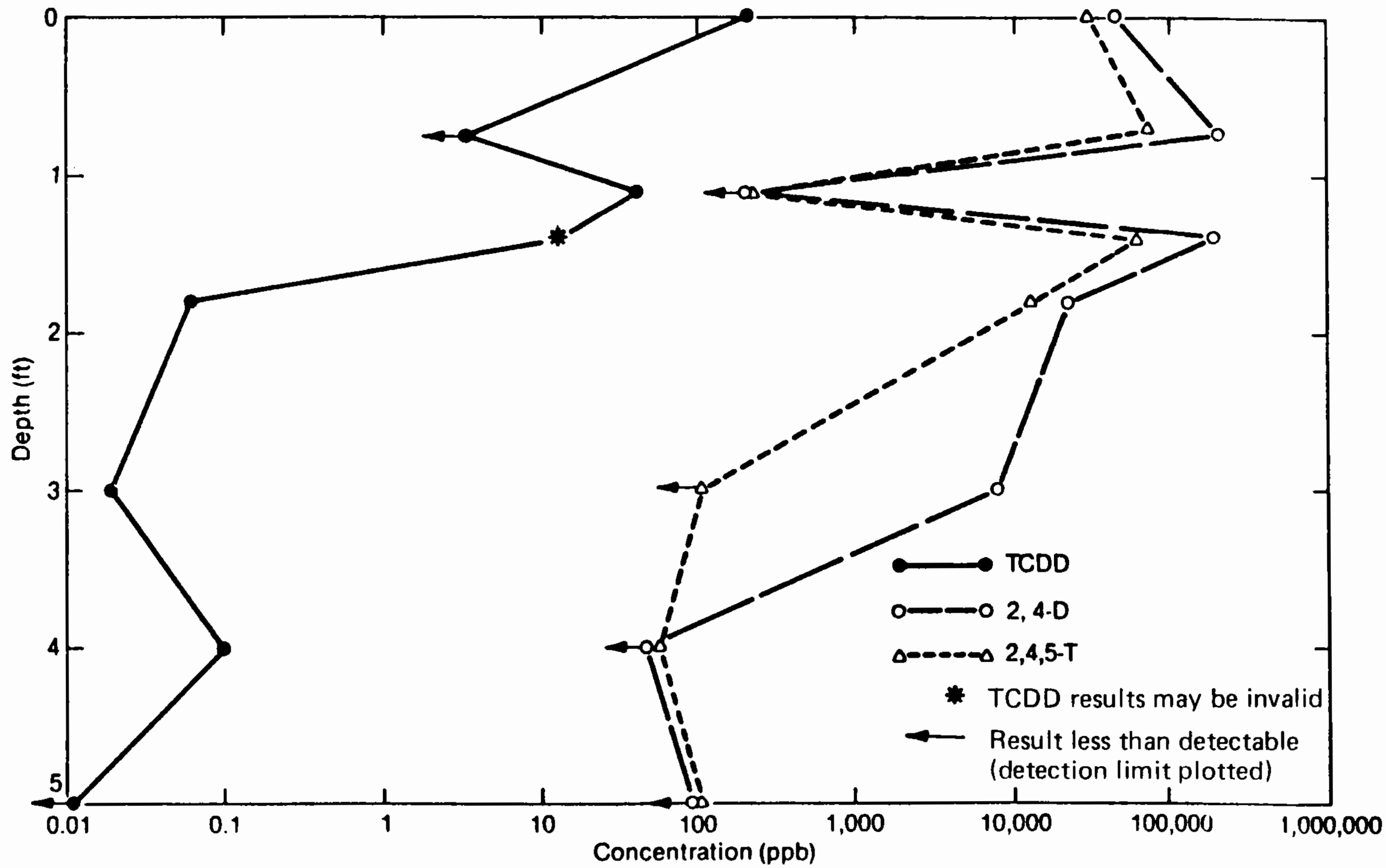


FIGURE 2-69
NCBC HO DEPTH PROFILE, LOCATION 2428

Source: Crockett et al., 1987.

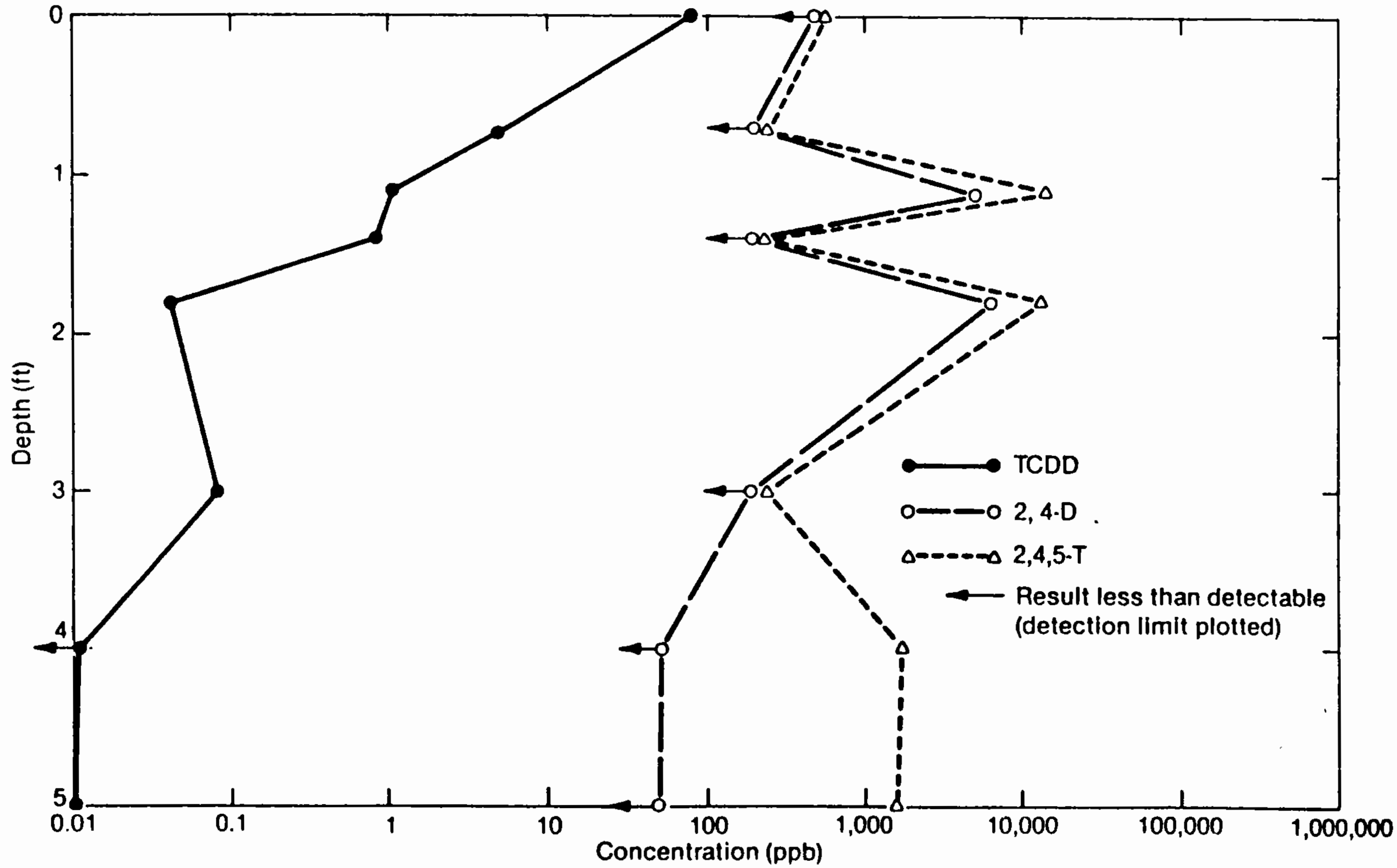


FIGURE 2-70
NCBC HO DEPTH PROFILE, LOCATION 2458

Source: Crockett et al., 1987.

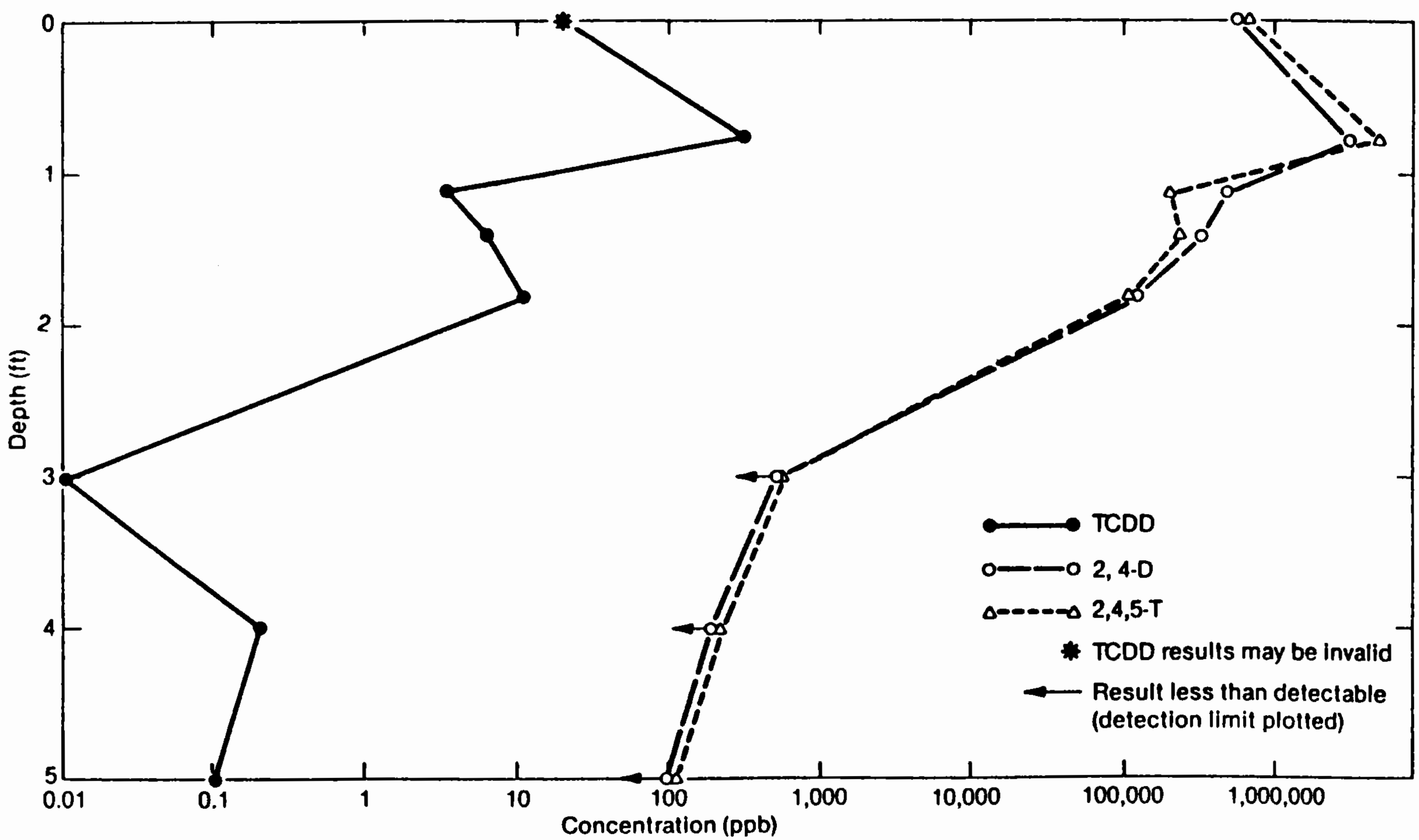


FIGURE 2-71
NCBC HO DEPTH PROFILE, LOCATION 2470

Source: Crockett et al., 1987.

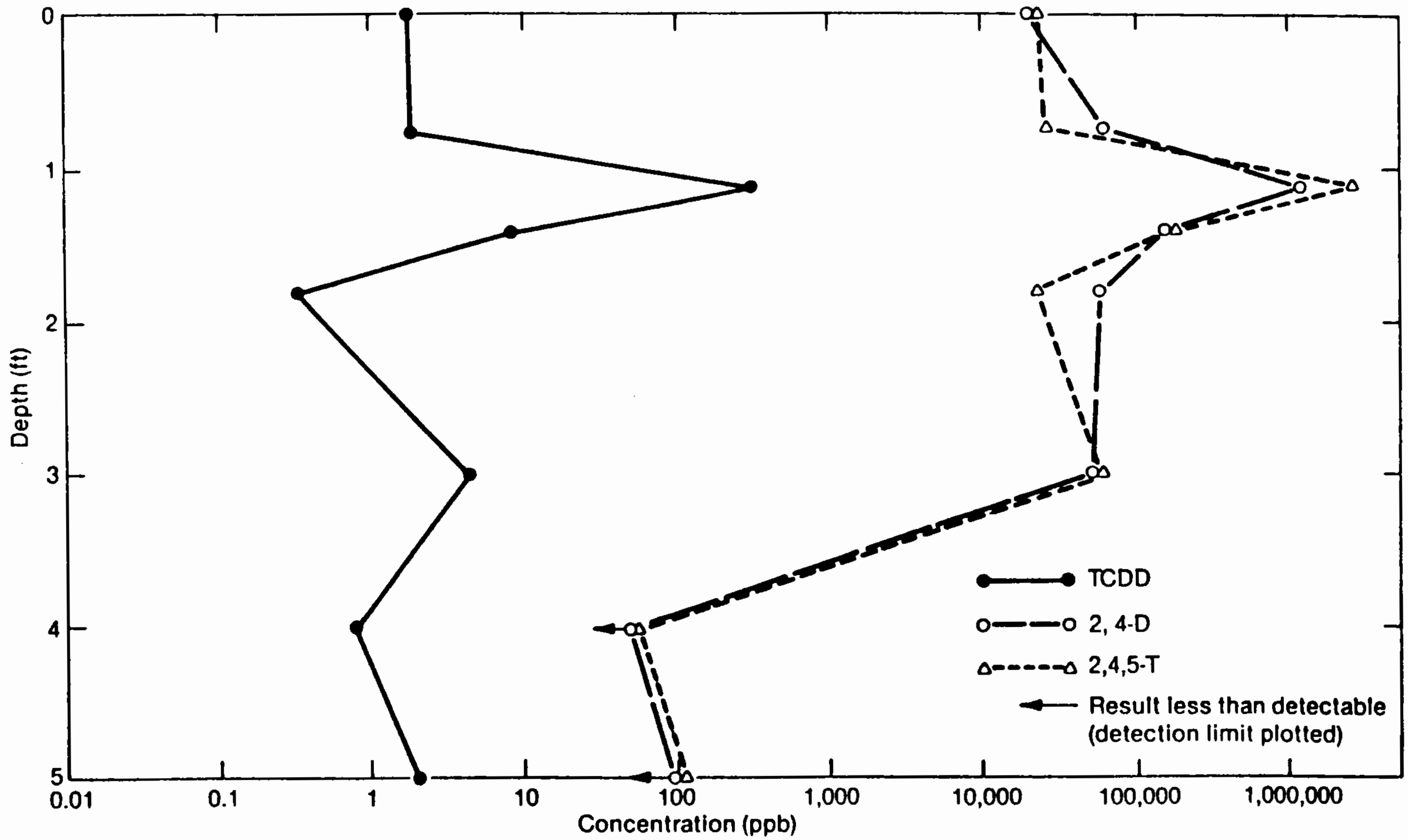


FIGURE 2-72
NCBC HO DEPTH PROFILE, LOCATION 2527

Source: Crockett et al., 1987.

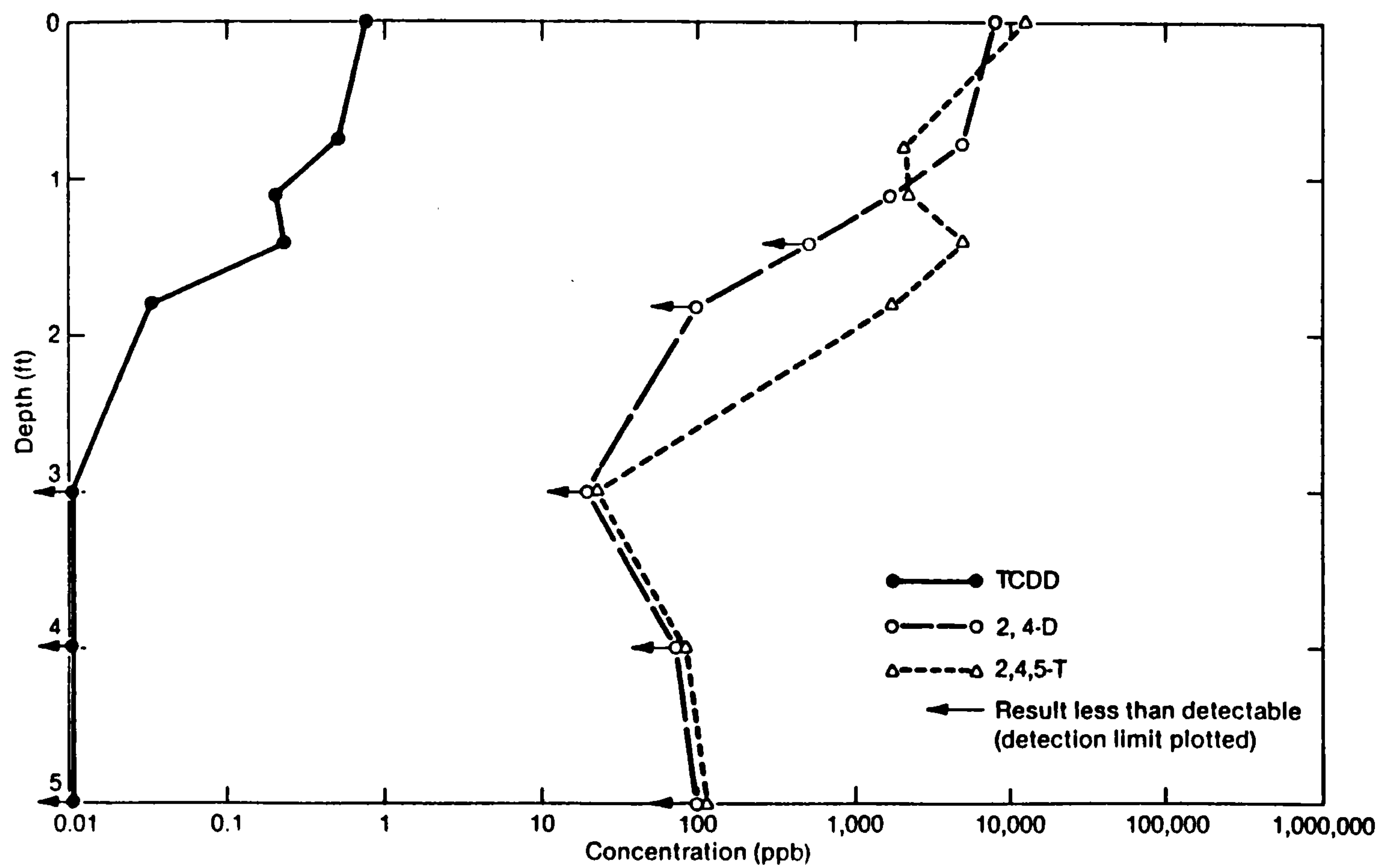


FIGURE 2-73
NCBC HO DEPTH PROFILE, LOCATION 2528

Source: Crockett et al., 1987.

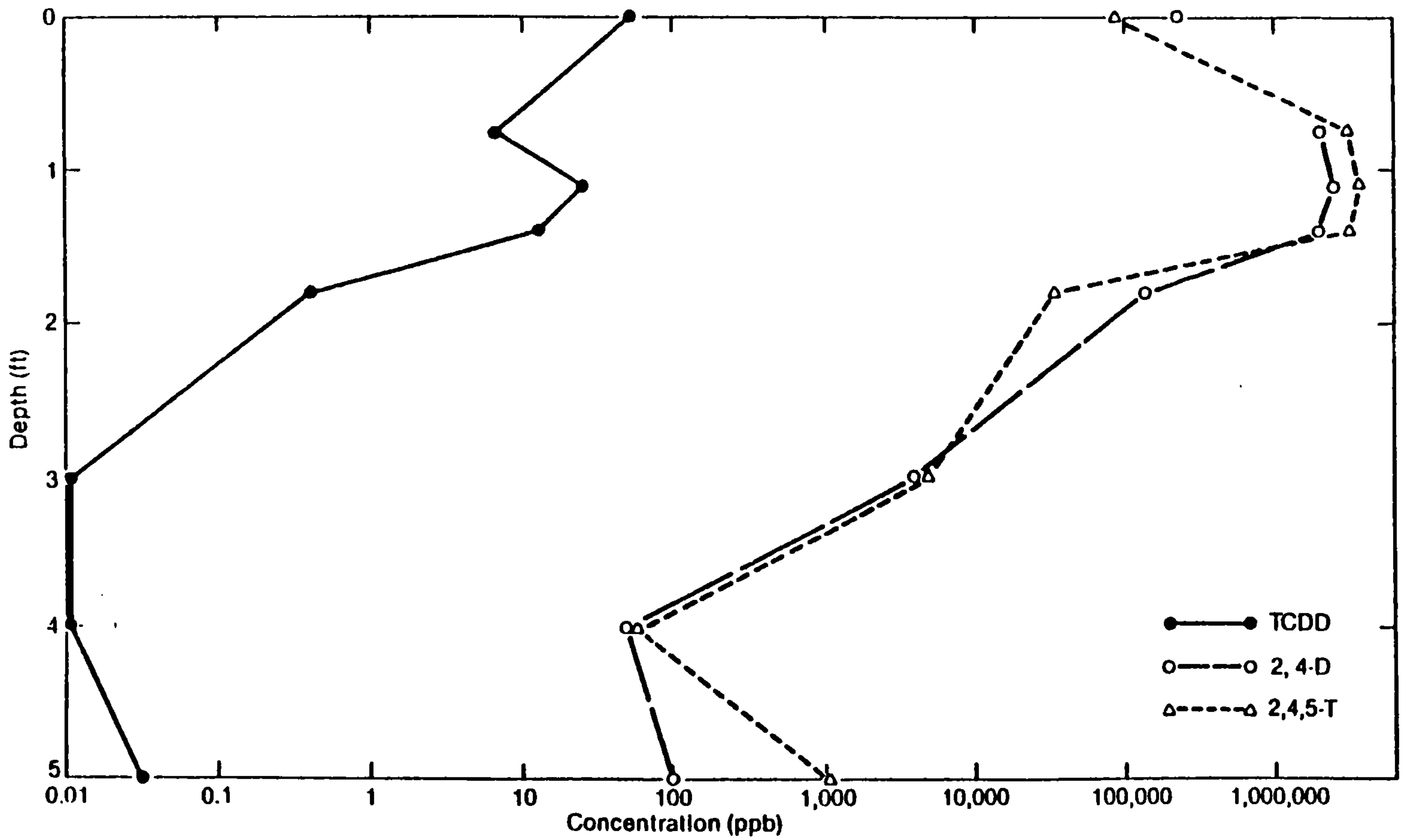


FIGURE 2-74
NCBC HO DEPTH PROFILE, LOCATION 2567

Source: Crockett et al., 1987.

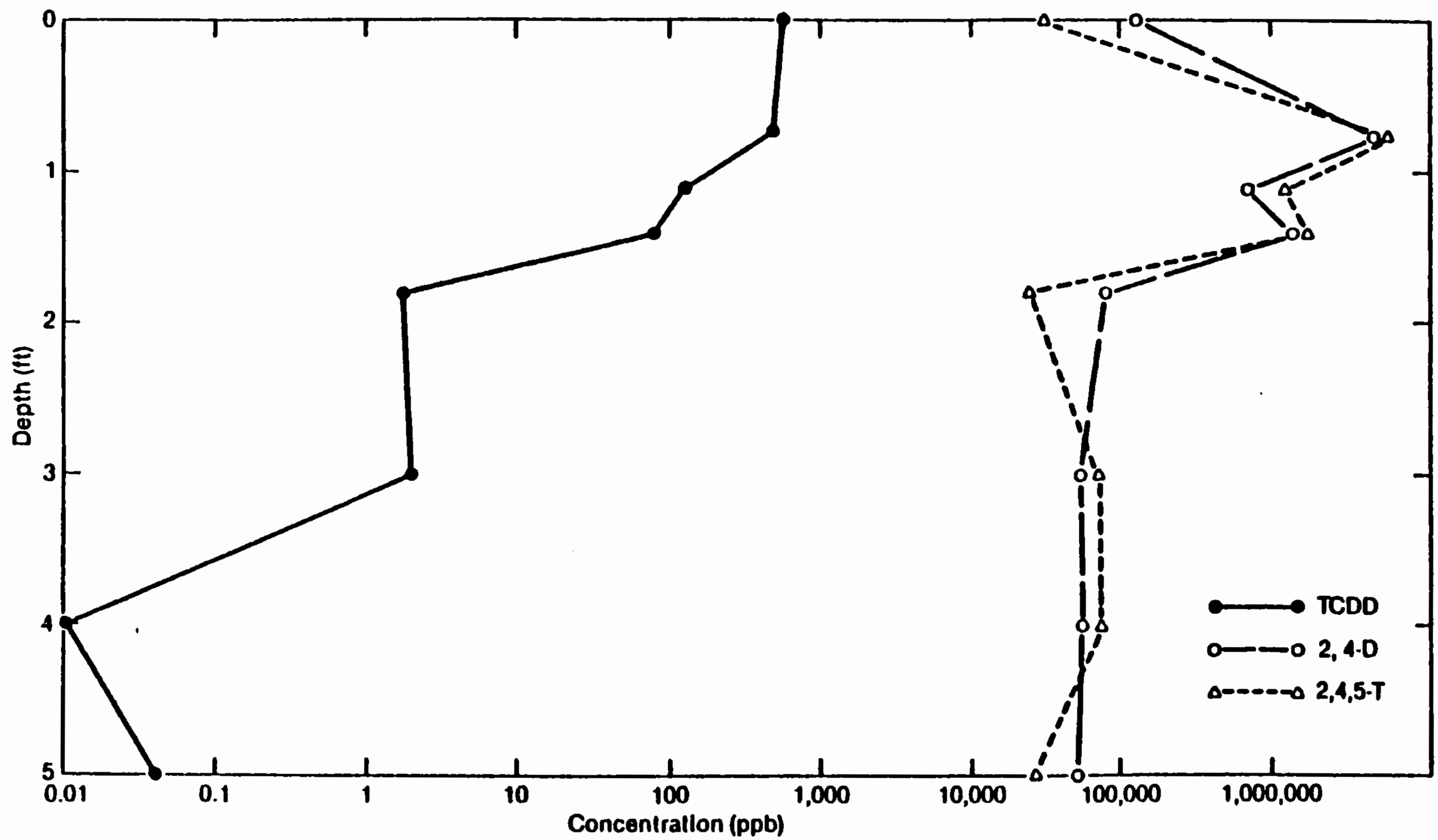


FIGURE 2-75
NCBC HO DEPTH PROFILE, LOCATION 2571

Source: Crockett et al., 1987.

TABLE 2-25

Data Summary--Areas A, B, and C

TCDD Concentration Range (ppb)	Number of Samples[a] Area A	Area B	Area C	Ditches[b]
<1.0	648	528	102	6
1-10	442	150	26	5
11-20	93	17	1	0
21-100	109	26	3	0
>100	139	8	1	0
Total	1331	729	133	11

SOURCE: Friedrich, 1988.

[a]Does not include QA samples.

[b]Sediment samples from ditches in Area B.

TABLE 2-26

Results of the OEHL Potable Groundwater Analysis for TCDD

Sample	TCDD Concentration (ppq)	Surrogate Recovery (%)
2-417	<20	101
3-182	<20	103
Matrix Spike	33[a]	106
Blank	<20	102

SOURCE: Markland, 1986.

[a]Represents a 33-percent recovery of spiked material.

recovery of the surrogate spike in each sample. This ensures validity of the sample analyses.

2.2.2 Geohydrologic Summary to Assess Impacts on Groundwater

Existing data in the literature were used by Barraclough and Wade (1986) to describe the hydrogeological conditions at NCBC and to assess potential impacts on the groundwater resulting from contamination of surficial soils at the former HO storage site. The report on this study is presented in the following sections.

2.2.2.1 Background

2.2.2.1.1 Regional Geologic Setting. NCBC is situated in the Gulf of Mexico Coastal Plain, which consists of unconsolidated sands, gravels, limestones, silts, and clays of Cretaceous to Recent Age. The coastal plain covers Louisiana, Mississippi, Florida, and the southern parts of Alabama, Georgia, and South Carolina. The rocks of the coastal plain are younger than the Appalachian Mountain complex and thicken in a southward direction.

According to Howe (1935), "The Gulf Coast region of the United States is the landward side of the most active geosyncline in North America." "The northern border of the Gulf of Mexico," Howe continues, "drains the earth's second largest degradation tract. These sediments have been concentrated along a narrow zone paralleling the present shore, and, since the beginning of the Eocene, have accumulated to a thickness which probably exceeds 30,000 feet. . . .The conclusion appears inescapable that the region of the present coastline has been depressed under the weight of these deposits to almost three times the present maximum depth of the Gulf of Mexico. The major axis of the Gulf Coast geosyncline approximately parallels the Louisiana coastlines, but a transverse structure, normally referred to as the Mississippi Embayment, extends inland up the valley of the Mississippi. The formations which make up the landward side of the geosyncline are all wedge-shaped, thickening rapidly from the outcrop gulfward."

NCBC lies on the north flank of the Gulf Coast geosyncline and east flank of the Mississippi Embayment. This results in the southwestward dip, characteristic of all formations in the area at least as far down as the base of the Cretaceous deposits.

2.2.2.1.2 Previous Investigations. The first detailed study of the Gulf coastal area in Mississippi was prepared by Brown et al. (1944). This report describes the geology and groundwater resources of the area and provides information concerning the decline in yields of artesian wells and estimated future groundwater supplies. Newcome et al. (1968) published a report on water for the growing needs of Harrison County. Their evaluation indicated little use of surface water resources, but showed that groundwater withdrawls had resulted in average water-level declines of 1 ft/yr. They described freshwater aquifers to a depth of ½ mile. Shows (1970) reported on the water resources of Mississippi. He described the various geologic formations and aquifers, outlined the quality of groundwater, evaluated surface water resources, and discussed future water development. A report on sources for water supplies in Mississippi (Wasson, 1980) is a guide to availability of freshwater in the State, including surface and groundwater. Maps of each aquifer show the areal extent, outcrop areas, thickness and elevation, permeability, and water quality.

2.2.2.2 Geohydrological Environment of NCBC. NCBC is located within the city limits of Gulfport, Harrison County, Mississippi (Figure 1-1, Section 1). The Gulf of Mexico is located less than 2 miles to the south.

NCBC covers about 2 square miles. The land is generally level with gently rolling terrain. Drainage occurs to the south toward the Gulf of Mexico. NCBC is in the Coastal Plain Meadows Region. The elevation of the NCBC ranges from about 25 to 35 feet above sea level. The former HO storage site at NCBC is about 1.5 miles north of the Gulf of Mexico.

2.2.2.2.1 Climate. NCBC has a humid, semitropical climate. Summers are long and warm, and winters are short and mild. The average annual temperature at Gulfport is 68°F. Temperatures seldom exceed 100°F or fall below 25°F. On the average, about 270 frost-free days occur annually (Newcome et al., 1968).

The average annual rainfall along the coast averages more than 60 inches. July is normally the wettest month; October is the driest. Heavy showers can produce up to 12 inches of rain in a day. Floods can follow such rains, although much of the rainfall infiltrates into the ground over the area (Newcome et al., 1968).

2.2.2.2.2 Geology. The Gulf coastal area has been slowly subsiding for millions of years, forming a trough known as the Gulf Coast geosyncline. As the trough sunk, streams emptying into the Gulf of Mexico have kept the trough nearly full by depositing huge quantities of sand, gravel, and mud. These sand and gravel deposits make up the principal aquifers in the Gulfport area (Table 2-27). Limestones, sandstones, and shales are also present at great depths below Gulfport.

Beds of Miocene Age are about 3,500 feet deep near Gulfport (Figure 2-76). They include the Pascagoula Formation, the Hattiesburg Formation, and the Catahoula Sandstone (Table 2-27). The beds have been collectively called the Miocene aquifer system. The Bucatunna Clay Member of the Byram Formation underlies the Miocene beds (Wasson, 1980).

Above the Miocene rocks are beds of the Pliocene Series, which include the Citronelle Formation and Graham Ferry Formation.

Water-bearing beds of the Miocene and Pliocene Series are composed chiefly of clean quartz sand, are tan to light gray, and range in grain size from very fine to very coarse. Both the bed thickness and the grain size vary considerably within short distances, typical effects of deltaic and estuarine deposition. Many beds are more than 100-feet thick (Newcome et al., 1968).

The strike of the beds is east-southeast. The dip of the base of the Miocene rocks is south-southwest at about 90 ft/mi near Gulfport. The dip of the sediments above an elevation of 1,000 feet below sea level on the coast probably is about 30 ft/mi (Newcome et al., 1968). The dip of the beds probably is less in the shallow zone because of normal seaward thickening of the section.

At Gulfport, the top 40 to 200 feet of sediment are composed of alluvial and terrace deposits, beach deposits, and the Citronelle Formation. Some authors place the Citronelle Formation in the Pliocene and others place it in the Pleistocene.

2.2.2.2.3 Aquifers and Aquicludes. Geologic units containing freshwater near Gulfport are of the Miocene or younger age. There are no thick, consistently traceable clay beds (aquicludes). The sand-and-gravel beds (aquifers) are irregular in thickness and extent. However, some sandy zones can be traced for reasonable distances. All rocks from the base of the Miocene to within 200 feet of the land surface are Miocene and Pliocene rocks (Table 2-28). The rocks from near the land surface to about 200 feet in depth are designated Citronelle Formation. On the

TABLE 2-27

Geologic Units and Major Aquifers in Mississippi

Erathem	System	Series	Group	Geologic unit	Major aquifer
Cenozoic	Quaternary	Holocene and Pleistocene		Undifferentiated alluvium and terrace deposits Mississippi River valley alluvial aquifer	Mississippi River valley alluvial aquifer
		Pleistocene		Loess Terrace deposits, undifferentiated	
		Pliocene		Citronelle Formation Graham Ferry Formation	Citronelle aquifers
		Miocene		Pascagoula Formation Hattiesburg Formation Catahoula Sandstone	Miocene aquifer system
		Oligocene	Vicksburg Group	Byram Formation Bucatunna Clay Member Middle Marl Member Glendon Limestone Member Marianna Limestone Mint Spring Marl Member Forest Hill Sand	Oligocene aquifer system
		Eocene	Jackson Group	Yazoo Clay Moodys Branch Formation	
			Claiborne Group	Cockfield Formation Cook Mountain Formation Sparta Sand Zilpha Clay Winona Sand Tallahatta Formation Neshoba Sand Member Basic City Shale Member Meridian Sand Member	Cockfield aquifer Sparta aquifer system Winona-Tallahatta aquifer
				Hatchetigbee Formation	Meridian-upper Wilcox aquifer
		Paleocene	Wilcox Group	Tuscahoma Formation Nanafalia Formation Fearn Springs Member	Lower Wilcox aquifer
			Midway Group	Naneola Formation Porters Creek Clay Matthews Landing Marl Member Clayton Formation	
Mesozoic	Cretaceous	Upper Cretaceous	Selma Group	Prairie Bluff Chalk and Owl Creek Formation Ripley Formation Demopolis Chalk Coffee Sand Mooreville Chalk Arcola Limestone Member	Ripley aquifer Coffee Sand aquifer
				Eutaw Formation Tombigbee Sand Member McShan Formation	Eutaw-McShan aquifer
			Tuscaloosa Group	Gordo Formation Coker Formation	Gordo aquifer Coker aquifer Tuscaloosa aquifer system
		Lower Cretaceous		Undifferentiated	
Paleozoic	Pennsylvania Mississippian Devonian			Undifferentiated	Paleozoic aquifer system

SOURCE: Wasson, 1980.

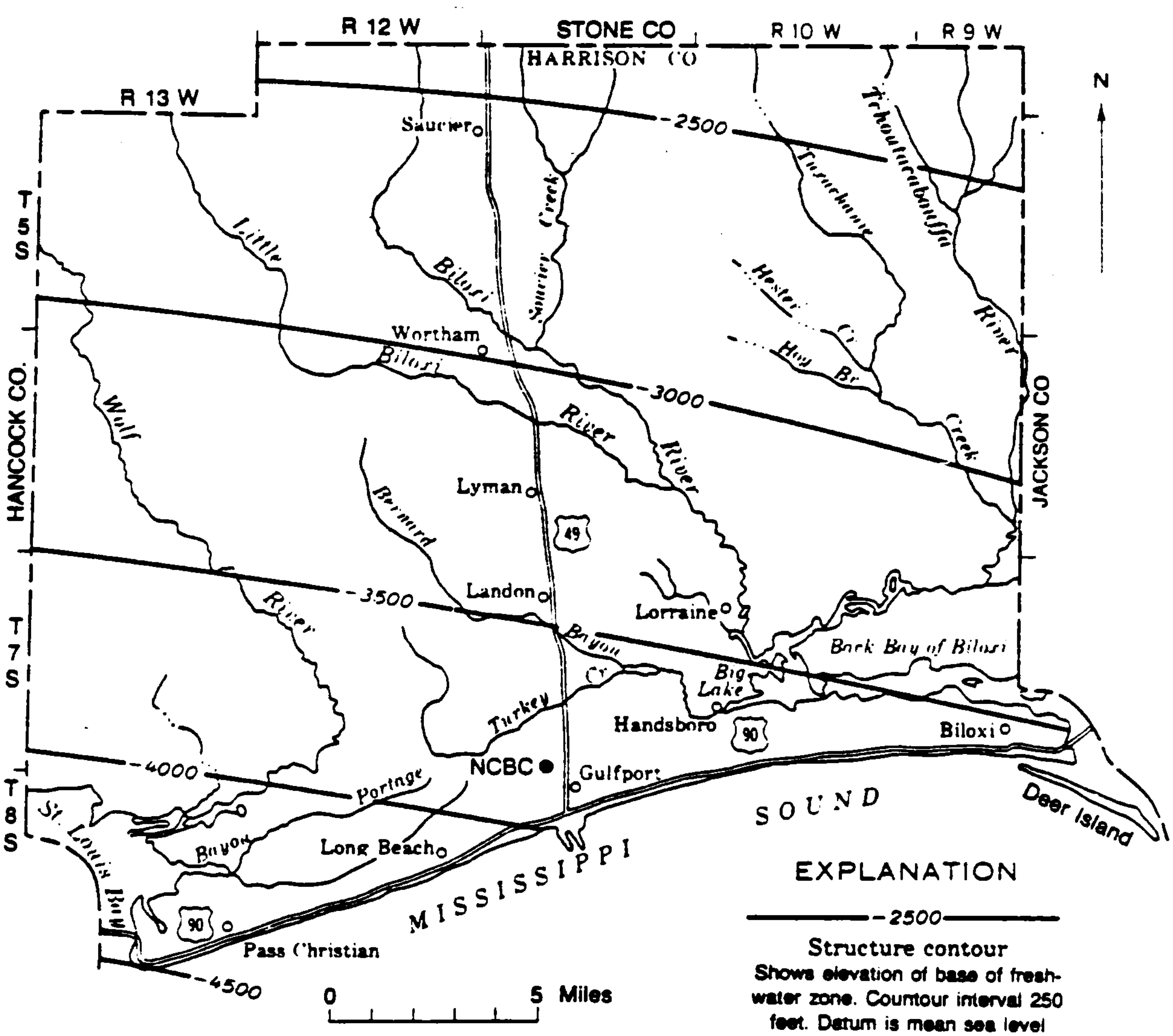


FIGURE 2-76
ELEVATION OF THE BASE OF THE MIOCENE ROCKS
HARRISON COUNTY, MISSISSIPI

Source: Newcome et al., 1968.

TABLE 2-28

Stratigraphic Column and Water Resources in South Mississippi

ERA	System	Series	Group	Stratigraphic Unit	Thickness (feet)	Water Resources
Cenozoic	Quaternary	Holocene		Alluvium	0-80	Not an important aquifer. A few large wells may be possible along some of the major streams in local areas. Salt water has intruded this aquifer adjacent to the Mississippi Sound.
		Pleistocene		Terrace Deposits	0-100	Some local wells tap this aquifer, but is not used over a very extensive area. Large quantities of water may be available in the southern part where a number of these deposits are developed in a staircase fashion. Salty water is present along the coast in some of these deposits.
				Citronelle	0-100	Supplies shallow domestic wells throughout most of the area. A few municipal wells are completed in this aquifer. Quality of water is fair. The water usually contains low dissolved solids and has a low pH.
	Tertiary	Pliocene		Graham Ferry	0-200	Main source of water supply for municipal and industrial wells in the vicinity of Pascagoula A number of wells in western Jackson and eastern Harrison Counties utilize this aquifer. Quality of water is generally good. Water is slightly alkaline and iron is seldom a problem in the wells at Pascagoula.
		Miocene		Pascagoula	0-1000	An important source of water supply for the municipal, industrial and domestic wells in Hancock, Harrison and Jackson Counties. The Pascagoula, Hattiesburg and the Catahoula are difficult to differentiate in the subsurface. Recent publications have placed all of the aquifers into "Miocene aquifers." Quality of water is good from this aquifer. Color is high in a number of wells adjacent to the Mississippi Sound. Hydrogen sulfide content may be a local problem.
				Hattiesburg	0-400	An important source of water supply for the municipal wells at Lucedale. This aquifer has the potential of supplying large volumes of water to wells in Pearl River, Stone and George Counties. Numerous domestic wells tap this aquifer in the central part of the area (southern Forrest, Greene, Perry, Pearl River, Stone and George Counties). The quality of water is generally good.
				Catahoula	500-900	An important source of water in the northern half of the area. The aquifer supplies numerous municipal, industrial, and domestic water supplies as far south as northern Pearl River, Stone and George Counties. The aquifer is fresh farther south but because of the depth and availability of shallower aquifers is not generally used. The quality of water is generally good.

SOURCE: Barraclough and Wade, 1986.

surface are terrace, alluvial, and beach deposits. These deposits range from 10- to about 50-feet thick (Newcome et al., 1968).

Aquifers at depths of more than 500 feet maintain sufficient artesian pressure to support flowing wells, except where nearby pumping has lowered the head. The main recharge areas are several miles north of Gulfport. Recharge occurs by infiltration of rain that falls on sandy outcrops. The beds have high transmissivity in the horizontal direction and low transmissivity in the vertical direction (Newcome et al., 1968).

Deep wells in the Gulfport area had water levels about 100 feet above sea level 100 years ago. Today (1985), the water levels are at or below sea level. However, saltwater intrusion as a result of the lowered groundwater levels is not evident. In fact, freshwater occurs more than 12 miles offshore (south of Gulfport) (Newcome et al., 1968).

Developed sand zones are generally permeable. For example, deep wells at Gulfport can be produced an average of 500 gallons per minute (gpm) with 25 to 70 feet of drawdown. Wells near Gulfport produce large quantities of water if they penetrate a thick section of medium-to-coarse sand and the well screen is developed properly. Table 2-29 gives the drillers' logs of three wells drilled on NCBC to illustrate the various sand and clay layers.

The base of the freshwater zone in the Gulfport area is more than 2,500 feet below sea level (Figure 2-77) (Newcome et al., 1968). Test wells at Gulfport have penetrated the freshwater section at 2,500 feet. The artesian pressure head at this depth is about 100 feet above sea level, with the permeable sand beds more than 100-feet thick (Shows, 1970).

Saltwater occurs naturally in deposits laid down in a deltaic or marine environment. The saltwater can be flushed and replaced by freshwater flowing through the materials.

The chloride content of water from wells near Gulfport does not show an increasing trend over the pumping record. When the freshwater levels are lowered by pumping, saltwater could intrude from the Gulf of Mexico or from beds containing brines that underlie the area. Data from the offshore islands suggest that the freshwater/saltwater interface is distant. Saltwater from long-trapped springs beneath the area seems the most logical derivation of the high chlorides below 2,500 feet (Brown et al., 1944).

TABLE 2-29

Drillers' Logs of Three Deep Wells on NCBC, Mississippi

U.S. Naval Depot 1

Harrison County 160
Altitude: 23.0 feet

Driller: Layne Central Company

	Thickness (feet)	Depth (feet)
Recent and Pamlico deposits		
Topsoil	3	3
Pamlico sand		
Sand and gravel	13	16
Graham Ferry formation		
Clay	56	72
Sand, mucky	20	92
Clay	69	161
Clay, sandy	64	225
Sand, fine	11	236
Clay, sandy	23	259
Sand, fine	25	284
Clay, sandy	52	336
Clay, tough	186	522
Clay, sandy	85	607
Gumbo	46	653
Clay, sandy	13	666
Sand and thin strata of clay	19	685
Sand, mucky	25	710
Sand and thin strata of clay	26	736
Sand	18	754
Clay	16	770
Sand	6	776
Clay	4	780
Shale, sandy	90	870
Sand, fine	21	891
Sand	25	916
Pascagoula (?) formation		
Clay and shale	198	1114
Sand, fine	6	1120
Sand	16	1136
Sand and thin strata of shale	21	1157
Shale, gummy, and sand	16	1173
Sand	21	1194
Clay, tough	36	1230

TABLE 2-29 (cont'd)

U.S. Naval Depot 2

Harrison County 161
Altitude: 31.71 feet

Driller: Layne Central Company

	Thickness (feet)	Depth (feet)
Recent deposits		
Topsoil	5	5
Pamlico sand		
Sand: contains magnetite, kyanite, staurolite, zircon, tourmaline, rutile, epidote, leucoxene, pyrite, limonite, muscovite, and hornblende	20	20
Graham Ferry formation		
Clay, sandy	28	53
Sand	7	60
Clay	41	101
Sand, fine-grained muddy	13	114
Clay, tough	33	147
Muck, sandy	8	155
Clay, tough	15	170
Clay, sandy	31	250
Clay, tough	12	262
Clay, sandy	24	286
Clay	24	310
Sand, fine-grained blue; quartz, abundant, sericitized feldspar, plagioclase feldspar (albite-andesine), minor quantity of orthoclase; 15% of heavy minerals examined in this sample is serrated hornblende, magnetite, kyanite, siderite, zircon, epidote, leucoxene, pink garnet, staurolite, pyrite, rutile, muscovite, tourmaline	18	328
Clay, touch	94	422
Sand, quartz, abundant altered grains of sericite and chalcedony, less abundant microcline and orthoclase, minor sodic plagioclase; pyrite, magnetite, dyanite, epidote, zircon, staurolite, hornblende, tourmaline, rutile, pink garnet, ilmenite, and leucoxene	15	437
Gumbo	51	488

TABLE 2-29 (cont'd)

U.S. Naval Depot 2 (cont'd)

Harrison County 161
Altitude: 31.71 feet

Driller: Layne Central Company

	Thickness (feet)	Depth (feet)
Sand, quartz, abundant microcline and orthoclase; minor sodic plagioclase; magnetite, epidote, kyanite, zircon, pyrite, pink garnet, staurolite, serrated hornblende, leucoxene, tourmaline, muscovite, and ilmenite	21	509
Clay, tough	23	532
Shale, sandy	14	546
Clay, tough	46	592
Shale, sandy	36	628
Clay, tough	7	635
Shale, sandy	20	655
Clay	23	678
Clay, sandy	9	687
Sand, fine-grained loose; quartz, microcline and orthoclase; more plagioclase which is oligoclase-andesine; magnetite, epidote, dyanite, zircon, pink garnet, pale and normal-colored hornblende, leucoxene tourmaline, rutile; pyrite in lower 25 feet	38	725
Sand and shale	48	773
Sand, fine; magnetite, epidote, kyanite, zircon, pink garnet, staurolite, serrated hornblende, leucoxene, pyrite, tourmaline, and rutile	12	785
Shale, sandy	15	800
Shale, gummy	12	812
Sand, fine water-bearing; quartz, microcline abundant, minor orthoclase, sanidine, and oligoclase-andesine; magnetite, zircon, epidote, kyanite, leucoxene, serrated hornblende, pyrite, tourmaline, staurolite, and pink garnet	38	850
Shale, gummy	60	910
Shale, sandy	34	944

TABLE 2-29 (cont'd)

U.S. Naval Depot 2 (cont'd)

Harrison County 161
Altitude: 31.71 feet

Driller: Layne Central Company

	Thickness (feet)	Depth (feet)
Pascagoula (?) formation		
Shale, gummy	281	1162
Sand, quartz, abundant microcline, minor orthoclase, little or no plagioclase; siderite, magnetite, pyrite, zircon, epidote, hornblende, kyanite, staurolite, leucoxene, tourmaline, muxcovite, biotite, green mica, rutile, pink garnet	16	1222
Shale, gummy	66	1288

U.S. Naval Depot 3

Harrison County 162
Altitude: 27.5 feet

Driller: Layne Central Company

	Thickness (feet)	Depth (feet)
Recent and Pamlico deposits		
Sand	45	45
Graham Ferry formation		
Clay and thin strata of sand	45	90
Clay, sandy	152	242
Sand, fine	68	310
Sand	18	328
Clay, tough	128	456
Clay sandy	36	492
Clay	108	600
Sand, fine	38	638
Clay	16	654
Shale, sandy	18	672
Sand	88	760
Shale, sandy	47	807
Sand	33	840
Shale, sandy	15	855
Clay, sandy	33	888
Sand	45	933
Gumbo	49	982
Sand, fine-grained strata	38	1020

TABLE 2-29 (cont'd)

U.S. Naval Depot 3 (cont'd)

Harrison County 162
Altitude: 27.5 feet

Driller: Layne Central Company

	Thickness (feet)	Depth (feet)
Pascagoula (?) formulation		
Gumbo	69	1089
Shale, hard	111	1200
Sand	8	1208
Clay, tough	17	1225
Shale, hard	34	1259
Sand	20	1279
Clay, tough	25	1304

SOURCE: Barraclough and Wade, 1986.

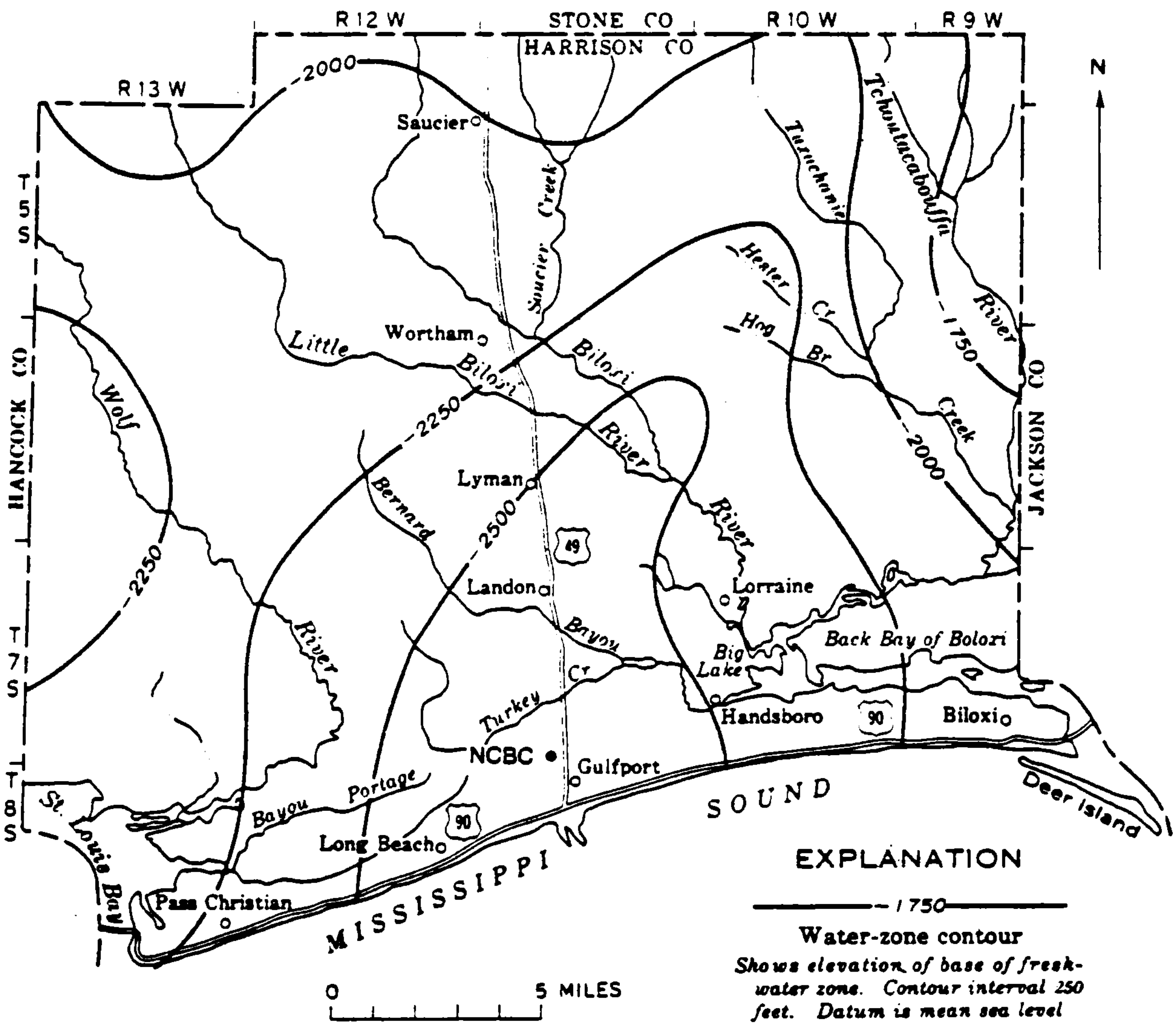


FIGURE 2-77
CONFIGURATION OF THE BASE
OF THE FRESHWATER ZONE IN HARRISON COUNTY,
MISSISSIPI

Source: Newcome et al., 1968.

Groundwater recharge to the Citronelle aquifer was calculated (Wasson, 1980) to be about 12 in/yr. Recharge to the overlying alluvial, terrace, and beach deposits is likely to be greater, with an estimated range of 15 to 20 in/yr.

2.2.2.2.4 Water Quality. The water quality at Gulfport is generally very good for most purposes. The water is of a sodium bicarbonate type. In general, sodium, bicarbonate, and chloride increase with depth; calcium, magnesium, and sulfate remain unchanged (Newcome et al., 1968).

Most groundwaters near Gulfport are soft, containing less than 250 mg/l of dissolved solids. Iron in the groundwater is a problem in some areas near Gulfport. The pH ranges from 6.0 to 9.1. In general, the pH of the water increases with depth and toward the Gulf of Mexico (Newcome et al., 1968).

The temperature of the shallow groundwater (about 50 feet deep) near Gulfport is usually about 68°F. A significant geothermal gradient accounts for a 1°F increase in temperature for every 62 feet in depth (Newcome et al., 1968). For example, water from a well 1,500 feet deep would be expected to be about 92°F.

2.2.2.3 Geohydrology of NCBC--Herbicide Storage Area. The former HO storage area at NCBC covers about 15 acres. It is located in the central portion of NCBC (Figure 2-78) and is bounded by Goodier Avenue, Greenwood Avenue, Seventh Street, and Ninth Street. It is approximately 400 feet wide by 1,500 feet long. The site is very flat. The average elevation of the land surface is 30 feet and ranges from 29 to 32 feet above sea level. The groundwater table is about 3 to 6 feet below the surface.

The storage area is drained by a system of shallow ditches, storm sewers, and culverts in the center of the area. The ditches, which are graded to the west, discharge into a canal in the northwest portion of NCBC.

The drainage culverts on the storage area are 15 to 24 inches in diameter, and the two outlet culverts under Goodier Avenue are 18 inches and 27 inches in diameter. The bottoms of the culverts are 26 and 27 feet above sea level. The culverts and ditches are 2 to 5 feet lower than the land surface. The bottom of the surface drainage system is just above the water table in the uppermost or shallow aquifer system. The shallow groundwater system will rise during rainy periods and discharge into the surface drains. This groundwater discharge could transport contaminants out of the area through the drainage system.

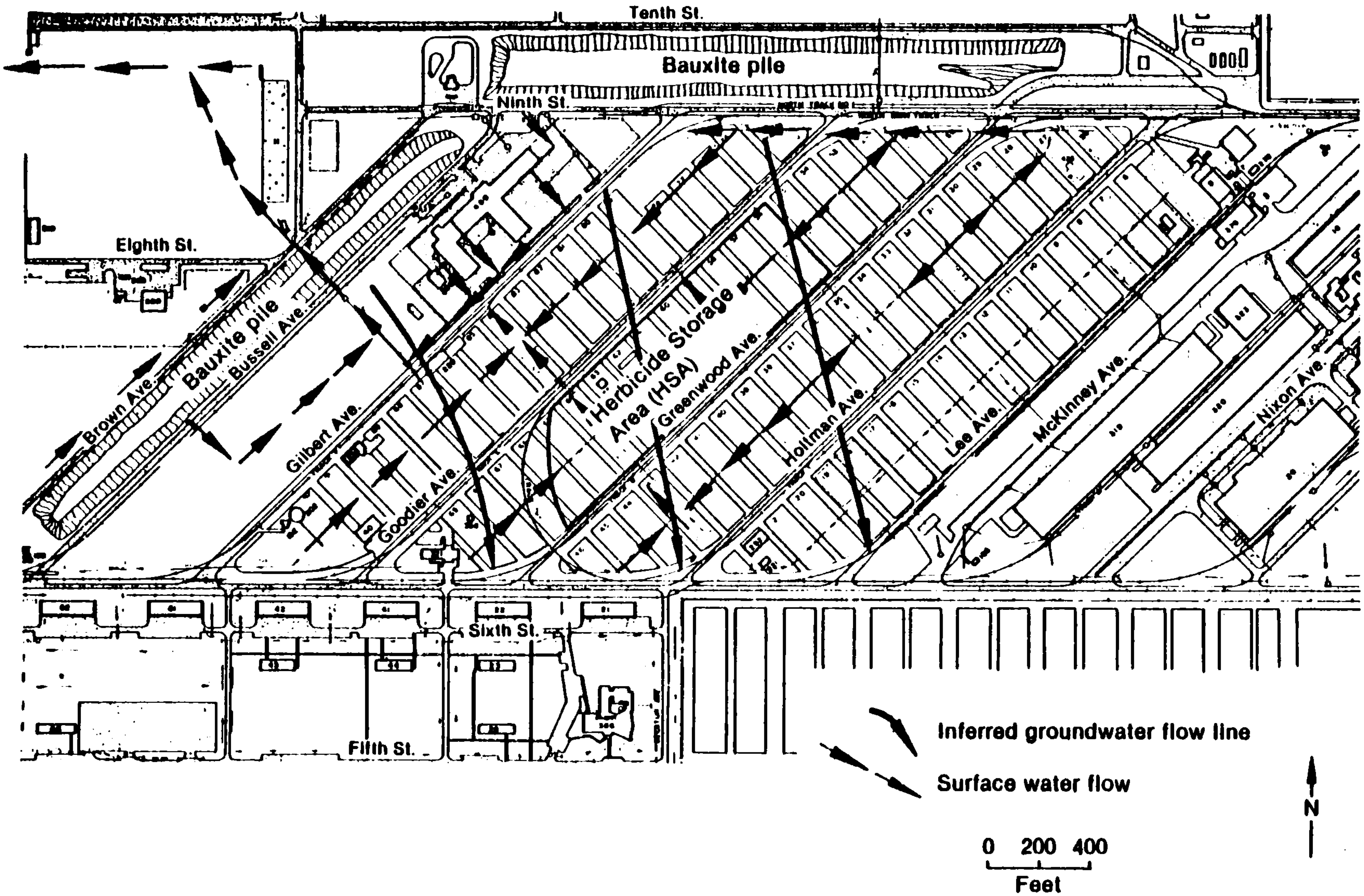


FIGURE 2-78
NCBC HO STORAGE AREA AND INFERRED SHALLOW GROUNDWATER FLOW LINES

Source: Barraclough and Wade, 1986.

The surface of the site was treated about 40 years ago with cement and compacted to make a layer of soil/cement 5 to 14 inches thick. Where the soil/cement is thin, cracks in the soil/cement increase the potential for contaminant migration as surface water infiltrates.

2.2.2.3.1 Aquifers and Aquicludes. The near-surface deposits at NCBC are composed of deposits of quartz sands and gravels, clays, and silts. Organic material has been deposited locally. As shown in Table 2-27, the near-surface deposits may be composed of alluvium, terrace deposits, and the Citronelle Formation (Shows, 1970).

The Miocene and Pliocene deposits furnish most of the water supply for the NCBC area. The thickness and extent of the various beds change with distance. The wells are drilled until a suitable aquifer material is located. A screen is set at the desired depth, and the well is developed. The producing zones are variable. For example, the five public supply wells on NCBC are screened to various depths ranging from 649 feet to 1,196 feet, with 10- to 70-foot well screen intervals. In each well, other zones of sandy material could produce water (Table 2-29).

2.2.2.3.2 Surficial Aquifer. The permeable portion of the near-surface layers has been called the surficial aquifer. This aquifer is recharged by rain that falls in the nearby area. The rain percolates down to the shallow water table, found only a few feet below the surface, and then moves laterally toward a discharge area. The water moves more freely laterally than downward because of the presence of lenses of relatively impermeable clays and silts.

The most permeable portion of the surficial aquifer at the former storage area is the sandy unit just below the soil layer. This sandy unit averages about 24 feet thick, as determined by 14 nearby shallow soil borings.

The hydraulic conductivity of the sand zones in the surficial aquifer is expected to be about 150 ft/day (Wasson, 1980). This value compares well with average values for similar aquifer materials. Groundwater velocities in the surficial aquifer at the site are low because the hydraulic gradient is rather flat, probably about 3 or 4 ft/mi. The porosity ranges from 0.20 to 0.30. The average linear velocity ranges from about 0.3 to 0.6 ft/day or about 100 to 200 ft/yr. The velocity of groundwater in the surficial aquifer would increase near areas of discharge because the hydraulic gradient would increase.

2.2.2.3.3 Movement of Water. The former HO storage site and nearby area are a small topographic high, compared to the surrounding land. The elevation of the high ranges from about 25 feet to about 33 feet above sea level.

The flat area around the site is a recharge area where rainfall recharges the surficial aquifer. Groundwater moves from the center of recharge in four directions, depending on the local conditions. The overall flow direction in all the aquifers at Gulfport is southward, toward the Gulf of Mexico.

During the late 1940's, NCBC was used to store national stockpile material. Bauxite is stored in two large hills. One hill is about 500 feet north of the former HO storage area, and the other hill is about 900 feet northwest of the site (Figure 2-78).

These bauxite hills are likely to be causing the water in the surficial aquifer to rise above the surrounding flat areas. This buildup of water level would act as a barrier to flow northward or westward. Therefore, because of the small groundwater mounds under the bauxite hills and the slightly higher land to the east of the former HO storage area, the flow direction of water in the surficial aquifer is likely to be to the south or the south-southeast.

2.2.2.4 Dioxin Migration Potential. Herbicides stored at NCBC at the former storage area included Herbicides Orange, Blue, White, and Orange II. Herbicides Blue and White were stored for a short time in the late 1960's. HO and HO II were stored until 1977. As discussed previously, HO contained equal amounts of 2,4-D and 2,4,5-T. Diesel fuel was used as a vehicle for application. The 2,4,5-T contained TCDD as a manufacturing impurity, which is estimated to have ranged from less than 0.02 to 15 ppm in HO. Herbicide Blue, containing arsenic, and Herbicide White, containing picloram, were stored only a short time and are not thought to be significant contaminants. HO II contained a different ester of 2,4,5-T in its formulation.

TCDD has a very low solubility in water. Choudhary et al. (1983) have determined solubility values ranging from 0.2 to 0.6 ppb. The hydrophobic nature of TCDD tends to prevent its movement with percolating water. Instead, it accumulates on the soil particles through various soil sorption mechanisms.

It has been reported that some of the drums rusted and some leakage occurred. Sampling/analysis of soil material has indicated contamination by herbicide residues at the site. The primary contaminant of concern is TCDD. As shown in Figures 2-30 through 2-34 and 2-66 through 2-75, concentrations of TCDD; 2,4-D; and 2,4,5-T generally decrease with depth, indicating attenuation of contamination by site soils.

Migration of TCDD from the site can occur by direct volatilization and on grains of sediment moving offsite by wind transport, as well as the hydrological mechanisms described in the following paragraphs.

Direct surface runoff of TCDD-contaminated soil is another source of migration. Where source material is at or near the surface, heavy precipitation can cause enough erosion so that some sedimentary material could be transported by water to the drainage ditches centered in the site. Precipitation associated with hurricanes, where rainfalls of 6 to 12 inches may occur in a day, are an example. The high rainfall and the short distances to drainage ditches within the contaminated area allow direct access of contaminants to the ditches and then to the receiving waters. This process tends to move fewer contaminants with time because the more easily-moved material has been carried away. The sediments in the ditches do show low levels of TCDD contamination.

Most of the rain falling on the site would percolate into the permeable sandy zones or move laterally along the soil/cement until it encounters a crack and then moves downward. Although TCDD is not readily soluble in water, downward percolating waters could transport a small amount dissolved in the water. Some of the rainfall that has infiltrated into the surface sediments would travel short distances and be discharged to the ditches nearby.

Some of the rainfall that percolates into the permeable surficial sediments will move down to the surficial aquifer. Then, groundwater movement in the surficial aquifer is primarily lateral. The direction of local groundwater movement in the surficial aquifer is from topographically high areas to areas of discharge such as ditches and canals. The general direction of movement in the surficial aquifer is toward the Gulf of Mexico. Some of the near-surface sandy beds contain mostly quartz with little clay, silt, or organic material and have permeabilities associated with medium-to-coarse sand. Because quartz sand would not strongly adsorb the TCDD, some TCDD would probably be transported in this medium. At the former HO storage area, this mechanism has the highest potential to transport contaminants over a period of years.

No use is made of water from the surficial aquifer at NCBC. Little use of the surficial aquifer to the south of NCBC has been identified. Some use of the water for lawn and garden irrigation may occur. The nearest small irrigation well may be about ½ mile from the former HO storage area. A well survey of the area south of NCBC would identify potential wells tapping the surficial aquifer.

Contaminant migration from the surficial aquifer downward to underlying aquifers is possible, although no TCDD was detected at levels down to 20 ppq in samples from two deep wells at NCBC (see Section 2.2.1). Most of the permeable beds in the geologic environment at Gulfport are hydraulically connected to some degree. Clay beds pinch out, grade into sandy layers, thin, or become more permeable with distance. Water from different aquifers or zones can migrate upward or downward, depending on different hydraulic heads.

Deeper aquifers along the Gulf coast contain sufficient artesian pressure to flow at the surface, except where withdrawals have lowered the head (Newcome et al., 1968). Pressure in the aquifers is a result of confinement of water-saturated sand between overlying and underlying beds of relatively impermeable clay as the water flows southward down the dip from areas where it enters the ground.

The main recharge areas occur several miles north of the coast. Recharge of the aquifers occurs by infiltration of rain that falls on the outcrops, by percolation that moves through overlying sandy deposits, and by movement between aquifers. Water quality is similar for all aquifers. Individual sand beds are not continuous. The sand beds or lenses are sufficiently interconnected hydraulically to permit interflow but not to create a common pressure head in all aquifers. This is caused by a high transmissivity in a horizontal direction and a low transmissivity in a vertical direction (Newcome et al., 1968).

The hydraulic heads of the aquifer beneath the surficial aquifer are not known. Little use is made of the water in sands at depths of around 50 feet to a few hundred feet below the surface at Gulfport. Most large-capacity wells at Gulfport withdraw water from a depth of 500 to 1,200 feet. Therefore, the hydraulic head in the aquifers below about 100 feet are reported to be above the land surface. If this is so, then downward migration of TCDD is not possible. In addition, if water could eventually move through beds of fine-grained material, any dissolved TCDD would tend to be bound to the material. From the information at hand, downward migration of dioxin is considered to be a remote possibility. In addition, significant movement of dioxin down to the principal pumping zones in the Gulfport area is not considered to be possible under the hydraulic and geochemical conditions.

3. SURFACE WATER AND SEDIMENTS INVESTIGATION RESULTS

3.1 INITIAL HO MONITORING PROGRAM BY ESL

The NCBC drainage system, a series of easement basins and ditches, provides drainage for the former HO storage site and the surrounding area. Previous studies (Young et al., 1979; Young et al., 1982) documented TCDD contamination in this drainage sytem. In the initial HO monitoring program by ESL, sediment samples were collected from locations shown in Figure 1-8, Section 1. These included locations within or in the immediate vicinity of the storage site, although most of the sampling points were offsite and some were off base. The seven on base locations (Sites 1 though 7) along the storage site drainage system are shown in larger scale in Figure 3-1. Locations 8 and 9, in the continuation of the drainage system off base, are shown in Figure 3-2. The mean TCDD concentrations in sediments at sampling Sites 1 through 9 were derived by Channell and Stoddart (1984) from data collected during the period 1980 through 1982 (see Table 3-1). An evaluation of the data indicates a pattern of dilution; samples collected closest to the former storage site show higher concentrations than those collected farther downstream. TCDD concentrations in downstream samples are mostly nondetectable. Results reported by Rhodes (1985) for sediment sampling conducted after 1982 (see Appendix C) show a similar trend.

Results for surface water sampling--conducted in March 1984 at sample Sites 1 through 9 and 11 through 14--also are tabulated in Appendix C. No TCDD was detected in surface water at levels down to DL's in the range of 30 to 99 ppq.

3.2 COMPREHENSIVE SOIL CHARACTERIZATION STUDY

During the investigation of Area A and vicinity by Crockett et al. (1987), 11 sediment samples were obtained from drainage ditches within the study area. These samples were to determine the TCDD levels in the ditches. The results for these samples are presented in Table 2-17, Section 2. The TCDD values for the ditch samples vary from nondetectable to a maximum of 107 ppb. The values show similarity to the more contaminated areas of the site; these results are discussed in Section 2.1.2.

During the follow-on investigation of Areas B and C (Friedrich, 1988), 11 sediment samples were collected from ditches in Area B. The results are

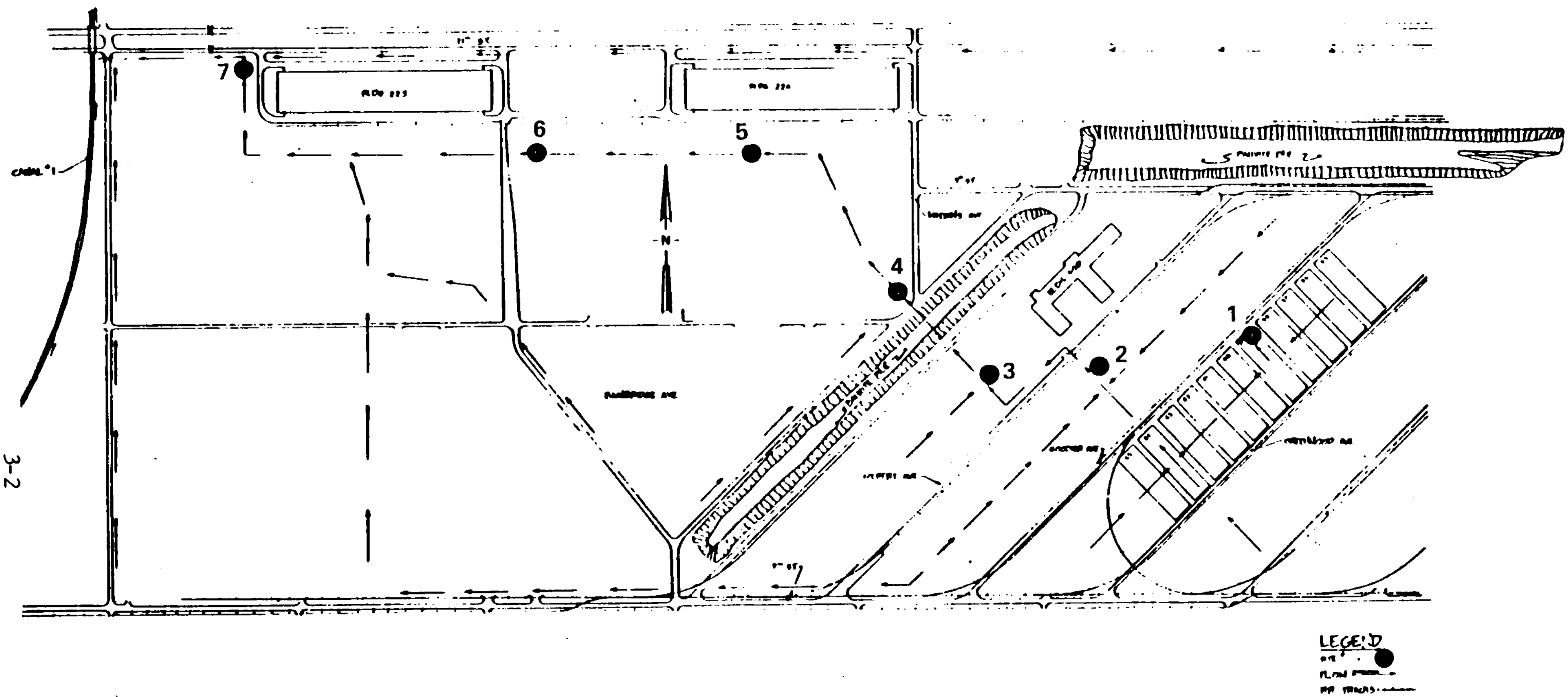


FIGURE 3-1
MAP SHOWING NCBC HO STORAGE SITE DRAINAGE SYSTEM
SAMPLING SITES 1 THROUGH 7, THEIR RELATIONSHIP TO THE HO STORAGE AREA
AND THE DRAINAGE SYSTEM FLOW PATTERN AT NCBC

SOURCE: Channell and Stoddart, 1984.

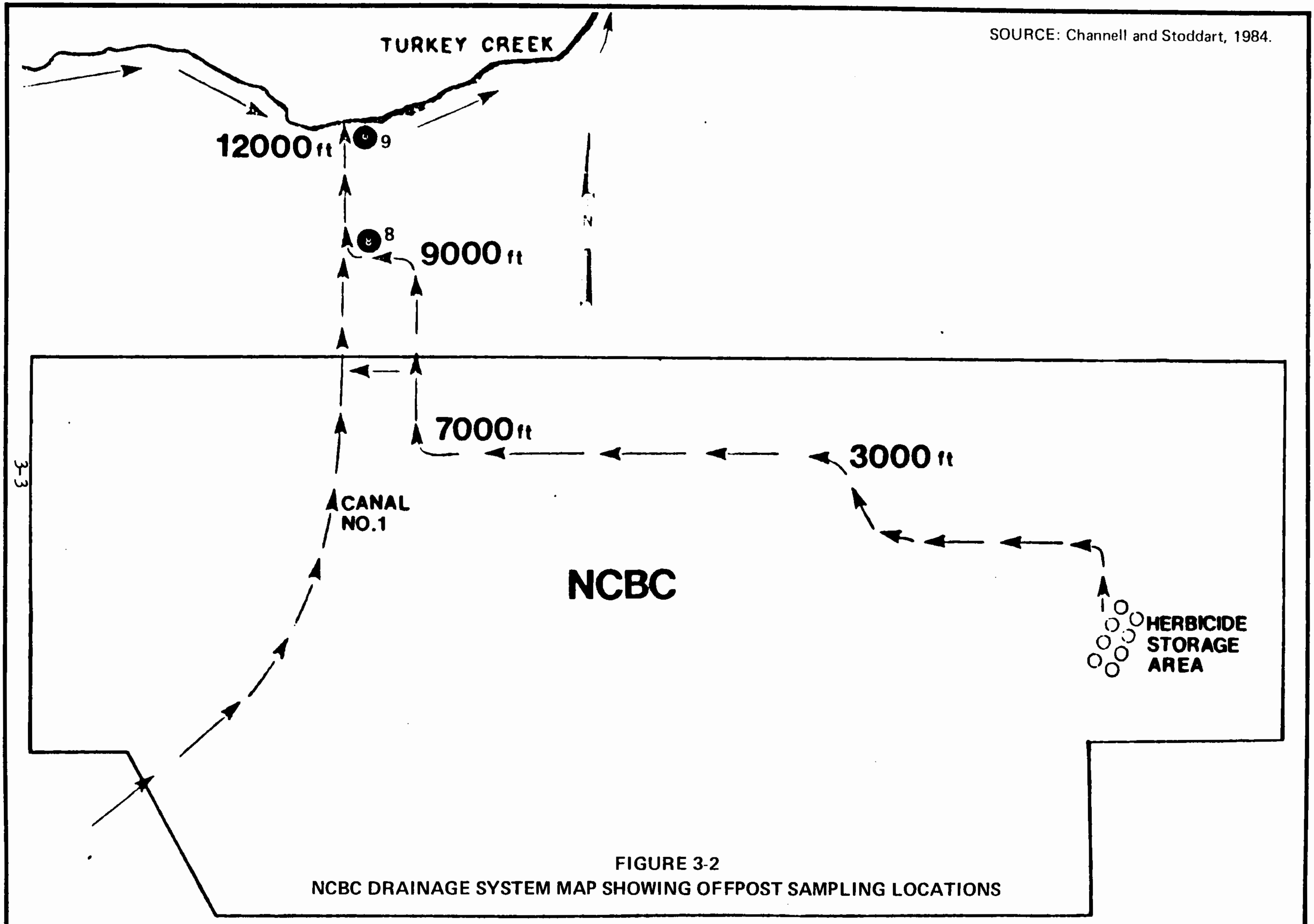


FIGURE 3-2
NCBC DRAINAGE SYSTEM MAP SHOWING OFFPOST SAMPLING LOCATIONS

TABLE 3-1

Average TCDD Levels in the NCBC
HO Storage Area Drainage Ditch System Sediments

Sampling Site	Sampling Period	Average TCDD Concentration (ppb)
1	1980-1982	1.14 ± 0.76
2	1980-1982	0.43 ± 0.44
3	1980-1982	<0.02 ± 0.01
4	1980-1982	<0.03 ± 0.03
5	1980-1981	<0.02 ± 0.01
6	1980-1982	<0.02 ± 0.01
7	1980-1982	<0.08 ± 0.08
8	1980-1982	0.03 ± 0.02
9	1980-1981	<0.03 ± 0.02

SOURCE: Channell and Stoddart, 1984.

tabulated in Appendix C and compared with results for Areas A, B, and C in Table 2-25, Section 2. Again, similar levels of contamination appear to be present in Area B soils and ditch sediments.

3.3 OFFSITE DIOXIN CONTAMINATION SURVEYS

To evaluate potential impacts on personnel involved in renovation of the drainage system, sediment samples were collected in 1985 at locations shown in Figure 1-8, Section 1, and analyzed for TCDD (Markland, 1985). (NOTE: Not all sampling locations are shown in Figure 1-8.) The results are tabulated in Table 3-2, listed in downstream order from the former HO storage area. As shown in Table 3-2, TCDD concentration decreased in sediments with greater distance from the old HO storage site. This observation is similar to that of Channell and Stoddart (1984). These results indicate that there would be no concerns about the health of individuals involved in renovation of the drainage system because of the very low levels of TCDD contamination, combined with the fact that personnel would be working with wet materials not easily inhaled.

The transects of the three samples each at five sites showed reasonably good correlation. Based on these results, it was believed (Markland, 1985) that taking a single sediment sample from each sample site is descriptive of the actual conditions at that site.

There are no established standards for TCDD contamination of aquatic sediments. However, it was indicated (Markland, 1985) that the most appropriate number to use for comparison would be the 1-ppb guideline established by the Centers for Disease Control (CDC) for soil in residential areas (Kimbrough et al., 1984, cited in Kimbrough, 1986). The only sample analysis result that exceeded this guideline was collected from Site 1, which is located within the HO storage area.

Additional sediment sampling conducted in 1986 confirmed the preceding results (Markland, 1986). Table 3-3 presents sediment sample analysis results for the April 14-16, 1986, survey. Very low levels of TCDD were detected in drainage ditch sediments. None of the sample results exceeded the 1-ppb level of concern, and none exceeded the required DL for this study of 0.1 ppb. No TCDD was found above DL's in off base samples. Additional sediment monitoring results from the June 23-24, 1986, survey are presented in Table 3-4. All sample analysis results were below the DL.

TABLE 3-2

Offsite Dioxin Contamination Survey (1985): Sediment Sampling Results (in Downstream Order)

Sampling Site	TCDD Concentration (ppb)
1	4.7
2	0.27
3	ND[a]
4	ND
19	ND,ND,Tr (0.066)[b,c]
5	ND
20	ND,ND,ND
6	ND
21	0.18, Tr (0.057), Tr (0.062)
7	Tr (0.076/0.076)[d]
10	Tr (0.077), ND, ND
8	Tr (0.085)
9	ND
12	ND/0.11
15	ND
16	NA[e]
17	NA

SOURCE: Markland, 1985.

[a]ND = none detected.

[b]Tr = trace.

[c]Replicated sample.

[d]Replicated analysis.

[e]NA = not analyzed (previous sample negative).

TABLE 3-3

Offsite Dioxin Contamination Survey
(April 14-16, 1986):
Sediment Sampling Results

Sample Number/Site	TCDD Concentration (ppT[a])	Percent Recovery, ^{37}Cl-2,3,7,8-TCDD
Blank	< 100	102
S-2	27	95
S-3	NM[b]	NM
S-4	< 100	110
S-6	<100	119
S-7	67	108
S-8	<100	102
S-9	<100	110
S-10	20	104
S-11	<100	95
S-12	<100	88
S-15	< 100	88
S-16	<100	106
S-17	<100	102
S-17 (Duplicate)	<100	98
S-17 (Matrix Spike)	2.37ng[c]	102

SOURCE: Markland, 1986.

[a]ppT = parts per trillion.

[b]NM = not measured.

[c]2.5 nanogram (ng) spike added prior to extraction.

TABLE 3-4

Offsite Dioxin Contamination Survey (June 23-34, 1986):
Sediment Sampling Results

Sample	TCDD Concentration (ppT)	Surrogate Recovery (%)
Sediment Blank	<100	101
101S	<100	85
102S	<100	102
102S Duplicate	<100	99

SOURCE: Markland, 1986.

4. BIOTA INVESTIGATION RESULTS

4.1 INITIAL HO MONITORING PROGRAM BY ESL

In conjunction with the drainage ditch sediment sampling program (see Section 3.1), samples of biological species were collected and analyzed for TCDD. Sampling locations are shown in Figure 1-8, Section 1. The seven on base sampling locations (Sites 1 through 7) along the storage site drainage system are shown in larger scale in Figure 3-1, Section 3. Locations 8 and 9, in the continuation of the drainage system off base, are shown in Figure 3-2. The mean TCDD concentrations in biological specimens at sampling Sites 1 through 9 were derived by Channell and Stoddart (1984) from data collected during the period 1980 through 1982 (see Table 4-1). An evaluation of the data indicates a similar pattern of dilution to that observed for sediments (see Section 3.1); specimens collected closest to the former storage site show higher concentrations of TCDD than those collected farther downstream. Results reported by Rhodes (1985) for sampling conducted after 1982 (see Appendix C) show a similar trend. It appears likely that biological specimens collected from the drainage ditch habitat became contaminated by intimate contact with TCDD-contaminated soils and sediments.

4.2 OFFSITE DIOXIN CONTAMINATION SURVEYS

To evaluate potential impacts on people consuming fish/crayfish caught in the drainage system, biological samples were collected in 1985 at locations shown in Figure 1-8, Section 1, and analyzed for TCDD (Markland, 1985). (NOTE: Not all sampling locations are shown in Figure 1-8.) Sampling sites ranged from within the old HO storage site to a site in Turkey Creek, several miles downstream from its confluence with the base drainage system. As shown in Table 4-2, the TCDD concentration decreases in biological samples (as it does in sediments; see Section 3.3) with greater distance from the old HO storage site.

The FDA established 25 to 50 ppT (0.025 to 0.050 ppb) of TCDD as the action level for edible portions of fish. This guideline was exceeded at Sites 2 and 4 located on NCBC. Both analyses were performed on homogenized samples of crayfish and minnows due to the scarcity of aquatic life. It is expected that the results from such analyses would be higher than results from analyses of only the edible portions of fish (e.g., the fillet from a larger fish). None of the off base samples, which reflect where people might actually catch fish

TABLE 4-1

Average TCDD Levels in Biological Specimens in the NCBC HO Storage Area Drainage Ditch System

Sampling Site	Sampling Period	Average TCDD Concentration (ppb)
1	1980-1982	1.12 ± 0.77
2	1980-1982	1.23 ± 1.65
3	1980-1982	$< 0.04 \pm 0.04$
4	1980-1982	$< 0.11 \pm 0.09$
5	1980-1981	0.02
6	1980-1982	0.11 ± 0.12
7	1980-1982	0.05 ± 0.01
8	1980-1982	0.05
9	1980-1981	< 0.01 ND[a]

SOURCE: Channell and Stoddart, 1984.

[a]ND = not detected at the indicated DL.

TABLE 4-2

Offsite Dioxin Contamination Survey (1985):
Biological Sampling Results (in Downstream Order)

Sampling Site	TCDD Concentration (ppb)
1	NS[a]
2	0.440
3	0.0096
4	0.080
19	NS
5	NS
20	NS
6	0.0032
21	NS
7	NS
10	NS
8	NS
9	0.0024
12	0.014
15	0.016
16	0.012
17	0.0072

SOURCE: Markland, 1985.

[a]NS = not sampled due to scarcity of aquatic life at the sampling location.

or crayfish to eat, exceeded the FDA guideline. In any event, it was observed (Markland, 1985) that the low levels of TCDD contamination, combined with the scarcity of organisms, make it virtually impossible for anyone to consume a TCDD dose of any significance.

Additional biological sampling conducted the following year (Markland, 1986) confirmed the preceding findings. Table 4-3 presents the results for the April 14-16, 1986, survey. As shown in Table 4-3, there were significant levels of TCDD found in biological samples collected at the sites closest to the former HO storage area. Some of them were above the FDA guideline of 25 to 50 ppT. This is similar to the findings of the 1985 sampling survey. None of the off base samples had measurable levels of TCDD above 25 ppT. Additional monitoring results from the June 23-24, 1986, survey are presented in Table 4-4. Although there were measurable levels of TCDD in the biota samples, the levels were well below the 25- to 50-ppT FDA guideline.

The detectable levels of TCDD in sediment and biota of the drainage system show that there have been some TCDD-contaminated soils washed from the HO storage site. This is expected based on the known levels of contamination in the HO storage site (see Section 2) and periodic heavy rainfall that could wash the looser soils from the site.

TABLE 4-3

Offsite Dioxin Contamination Survey
(April 14-16, 1986):
Biological Sampling Results

Sample Number/Site	TCDD Concentration (ppT)	Percent Recovery, ^{37}Cl-2,3,7,8-TCDD
Blank A	<10[a]	99
Blank B	<10[a]	107
B-2	ND[b]	ND
B-3	55	100
B-4	64	ND
B-6	13	98
B-7	19	90
B-8	<10	112
B-9	ND	ND
B-10	<25	128
B-11	<25	101
B-12	<25	105
B-15	<20	102
B-16	ND	ND
B-17	<10	93

SOURCE: Markland, 1986.

[a]Based on a 40-gram sample weight.

[b]ND = none detected.

TABLE 4-4

Offsite Dioxin Contamination Survey (June 23-24, 1986):
Biological Sampling Results

Sample	TCDD Concentration (ppT)	Surrogate Recovery (%)
Biota Blank	<10	103
101B	<10 (6)[a]	89
102B	<10 (4)[a]	89

SOURCE: Markland, 1986.

[a]Actual concentration found is in parentheses. Values less than the DL of 10 ppT are variables and should be considered as estimates only.

5. CONCLUSIONS

This section presents the conclusions of each component study of the RI of the former HO storage site and vicinity at NCBC.

5.1 INITIAL HO MONITORING PROGRAM BY OEHL AND ESL

The following conclusions are modified from information presented by Channell and Stoddart (1984) and Rhodes (1985) regarding initial monitoring efforts for the former storage site and surrounding areas:

- Approximately 2 to 4 acres of the 12-acre former storage site are contaminated with HO and associated TCDD.
- Soil levels of 2,4-D and 2,4,5-T decreased approximately 60 percent over a 6-month period between 1981 and 1982.
- Based on available data, no accurate estimate of TCDD persistence is possible.
- TCDD levels in the surface water drainage system--in sediment and biological samples--were two orders of magnitude below those found in soils of the former storage site. The TCDD level decreases significantly with distance from the former storage site and was nondetectable at most locations to a DL of 10 ppT. No TCDD was detected in surface water of the drainage system. Low levels of TCDD (50 ppT) were detected 2,000 feet offsite in sediment and biological specimens. Sediment and biological contamination were comparable for each sampling site.
- The movement of dioxin from the storage site seems to occur primarily through soil erosion, caused by water, wind, or human activity.

5.2 COMPREHENSIVE SOIL CHARACTERIZATION STUDY (AREA A AND VICINITY)

Conclusions arising from the comprehensive soil characterization study of Area A and vicinity conducted by EG&G Idaho, Inc. (Crockett et al., 1986), are presented in the following paragraphs. Because no data analyses have been performed for the follow-on investigation of Areas B and C (Friedrich, 1988), no conclusions have been reached. The EG&G study expanded on the delineation of the vertical and horizontal extent of contamination in soils begun in the initial HO monitoring programs by OEHL and ESL through the collection and analysis of 1,767 soil samples from Area A (and another 740 and 133 samples from Areas B and C, respectively). It provides the basis for determining the quantity of site soil and specific site areas requiring remediation.

The results of the validation process for Area A indicate that the laboratory analysis has been performed in accordance with all laboratory protocols, providing a valid data set. The QA data show that analytical variation becomes more significant as TCDD concentrations approach the DL or typically below 1 ppb. This inherent variation in low concentration samples should not have a significant impact on remedial action, because the cleanup level will likely be based on a criterion of 1 ppb or greater.

The horizontal extent of TCDD contamination in surface soils of Area A has been adequately delineated, with the exception of an area southeast of Greenwood Avenue and the railroad tracks (outside the fenced area), where a plot on Column 70 had a TCDD concentration of 31 ppb. EG&G Idaho, Inc., recommended additional sampling to determine the horizontal extent of TCDD contamination, and this is under consideration. Any further results will become an addendum to this report. The expansion east area and the northwest portion of the expansion west area have not been impacted by HO storage at the site and should be eliminated from inclusion in any remedial action plan.

Of the 1,300 plots sampled and analyzed for TCDD, 86.5 percent had concentrations less than 25 ppb. Forty-seven percent of all surface plots had concentrations less than 1 ppb. There are a few random, isolated "hot spots" with TCDD concentrations less than 100 ppb. The major contamination occurs where drums were stored along Greenwood Avenue and where drums were emptied and crushed onsite. The leakage followed the site drainage to the ditches, with resultant contamination of the ditches in these areas to a maximum TCDD concentration of 107 ppb. The contaminated ditches would need to be included in any remedial action.

The vertical extent of TCDD contamination was determined to a depth of approximately 2 feet at 35 locations and to a depth of 5 feet at another 15 locations. In all, 50 location samples were taken from the current stabilized soil layer. Three of the 15 subsurface samples show contamination >1.0 ppb at 5 feet, with a maximum of 5.1 ppb. However, there is a definite trend of decreasing concentration with depth. A significant break is seen at the 1.5- to 2-foot depth below ground surface. At 1.5 feet, 42 percent of the data show contamination >1 ppb, with a maximum of 315 ppb. At 2 feet, only 13 percent of the data show contamination >1 ppb, with a maximum of 12 ppb.

Very high concentrations of 2,4-D and 2,4,5-T were found in the subsurface samples. Up to 20,800,000 ppb (2 percent) of 2,4-D and up to 27,700,000 ppb (2.8 percent) 2,4,5-T were reported. The highest concentrations of these compounds were found in the soil/cement layer, in contrast to TCDD, which did not appear to concentrate in the soil/cement.

It appears that the soil/cement layer provided some restriction to the vertical downward transport of TCDD, even though data show contamination to 5 feet. This rationale is based on the periods of time involved. Storage of HO on the site began in 1968, and the HO was not removed until 1977, with sampling by EG&G in 1985. Thus, leakage lasted for 9 years, and data discussed here were obtained 8 years later; yet, contamination is basically in the top 3 feet.

To estimate the volume of soil to be removed in any cleanup effort, it is necessary to determine an overall depth. Surface values were evaluated at 65-, 80-, 90-, and 95-percent confidence levels, because excavation of a plot would be dependent on the surface value. Results show contamination of 5.1 ppb at a depth of 5 feet in one subsurface sample that had a surface value of 95 ppb. The other extreme is the highest reading of all results, 1,000 ppb in the soil/cement, which had decreased to 4 ppb at 6 inches below the soil/cement. Because a definite break point can be shown at 1.5 to 2 feet below surface, the estimate will use 2 feet, which is highly conservative when applied to the entire site.

Table 5-1 shows soil volumes requiring cleanup at the 65- and 95-percent confidence levels for cleanup criteria ranging from 1 to 50 ppb.

Realistically, the entire site would not be excavated to a depth of 2 feet. Twenty-six of the 50 near-surface and subsurface results show TCDD contamination at 1 ppb or less immediately underneath the soil/cement layer. Therefore, the values in Table 5-1 could be decreased by 50 percent. In addition, the actual distance from the surface to the bottom of the soil/cement layer is only 6 inches in

TABLE 5-1

Soil Volume Required For Cleanup (ft^3) as a Function of Confidence Level

Cleanup Criteria (ppb)	Confidence Level	
	65-Percent	95-Percent
1	497,600	728,800
10	218,400	388,000
25	121,600	260,800
50	68,000	188,800

SOURCE: Crockett et al., 1987.

excavations performed in adjacent areas. Another 50 percent decrease would result. If these factors are applied to the 1-ppb cleanup at the 95-percent confidence level, the soil volume requiring cleanup is reduced to 182,200 ft^3.

Based on the preceding considerations, it is recommended that excavation of the soil take place in 6-inch intervals. Following excavation, the bottom of the hole should be sampled and the TCDD level obtained to determine if additional excavation is required to meet whatever cleanup level is established.

Regulations to be finalized by EPA on November 8, 1988 (40 CFR Parts 268.31 and 268.41), will require that all material with a level higher than 1 ppb TCDD be treated with the best demonstrated available technology before disposal in an approved landfill or delisting. This would affect the final choice of remedial action and the ultimate fate of the treated material.

CDC has also established a "level of concern" of 1 ppb TCDD in soil for residential areas (Kimbrough, 1986; Kimbrough et al., in press). However, this level of concern was established because of the possibility that children may ingest soil when playing outside. For adults, contact with soil would be negligible (except, perhaps, when gardening), particularly at commercial sites and industrial sites such as NCBC. The areas at NCBC contaminated with varying concentrations of TCDD above 1 ppb would be frequented only by adults; it would not be used for residential purposes. Results of chemical analyses indicate that approximately three-fourths of the soil samples showed TCDD levels of less than 10 ppb. The median value of all samples was less than 1 ppb. For another TCDD-contaminated site (JI), Dr. Kimbrough showed that TCDD concentrations of 10 ppb or below would not result in any exposure that would be of concern. Furthermore, because less than 25 percent of all samples at JI (as well as at NCBC) exceeded the 10-ppb TCDD concentration, the frequency with which contact to higher levels would occur is greatly reduced, and unacceptable levels of exposure would not result. The fact that there are occasional areas with levels above 10 ppb TCDD in soil does not increase the overall dose, which could theoretically be absorbed through the skin. For all of these reasons, Dr. Kimbrough concluded that cleanup of the entire JI contaminated site, from a human health perspective, is not necessary. However, it was recommended that the area exceeding 50 ppb be paved or made inaccessible by some other means (Kimbrough, 1986). This conclusion can be extrapolated to the HO storage site at NCBC.

However, it was pointed out by Dr. Kimbrough (1986) that inhaling dust could be a problem during construction activities. To avoid such inhalation, wearing dust masks (but not respirators, because of the heat) was recommended, and it was pointed out that workers should not eat, drink, or smoke at the construction site. Shower facilities should be available as construction workers leave the site. Clothing should be wetted before it is removed and washed at the site so that no dust aerosols are formed. Specific instructions should be developed for construction workers by an occupational hygienist. Some of these precautions may not be necessary if inhalation of dust is not a problem (e.g., in working on wet materials in the drainage system).

5.3 OFFSITE DIOXIN CONTAMINATION SURVEYS

The following conclusions are modified from those presented in the offsite dioxin contamination surveys by OEHL (Markland, 1985; 1986):

- No TCDD was detected in potable water samples from two NCBC well heads, indicating that there may be no TCDD contamination of potable groundwaters in the NCBC area.
- Detectable levels of TCDD in the sediments and biota of the NCBC HO storage site drainage system show that there have been some TCDD-contaminated soils washed from the HO storage site. TCDD levels decrease significantly in both sediments and biota with greater distance from the storage site. The CDC 1-ppb level of concern was exceeded for only sediment samples collected from a ditch within the HO storage area. The FDA guideline of 25 to 50 ppT was exceeded in fish/crayfish samples from locations close to the storage site; none of the off base samples, which reflect where people might actually catch fish or crayfish to eat, exceeded the FDA guideline.
- There would be no concerns about the health of individuals involved in renovation of the drainage system at the time of the surveys (1985-1986). This conclusion was based on the very low levels of TCDD contamination in drainage ditch sediments, combined with the fact that personnel would be working with wet materials not easily inhaled.
- Similarly, there would be no concerns regarding people consuming fish/crayfish caught in the drainage system. The low levels of TCDD

contamination, combined with the scarcity of organisms, would make it virtually impossible for anyone to consume a TCDD dose of any significance.

This study supported associated conclusions of the initial HO monitoring by ESL, as presented in Section 5.1.

5.4 GEOHYDROLOGIC SUMMARY TO ASSESS IMPACTS ON GROUNDWATER

Barraclough and Wade (1986) summarized available information on the geology, hydrogeology, and water quality of NCBC to assess the potential impacts on groundwater from handling and storage of HO. Their geohydrologic summary provides an evaluation of the probability of HO residues being transported in the shallow groundwater system or into deep aquifers.

NCBC has several geohydrologic units, based on lithology and permeability. From the land surface downward, they are beach, alluvial, and terrace deposits (part of which form the surficial aquifer); the Citronelle Formation; the Graham Ferry Formation; the Pascagoula Formation; the Hattiesburg Formation; and the Catahoula Sandstone. The beds from the Citronelle downward have been called the Pliocene and Miocene aquifer system. Beneath the Miocene rocks is the Bucatunna Clay Member of the Byram Formation. The beds of Miocene age are as deep as about 3,500 feet near Gulfport. The beds consist of sand, clay, gravel, and silt. The grain size and bed thickness vary considerably within short distances.

The aquifers at moderate depths contain sufficient artesian pressure to flow at the surface, except where pumping has lowered the head. Recharge areas are several miles to the north. Recharge is from rainfall. The beds have high transmissivity horizontally and low transmissivity vertically. Water levels have dropped about 1 ft/yr for the past 100 years. Saltwater encroachment as a result of the declining heads is not evident. The base of the freshwater zone at Gulfport is about 2,500 feet below sea level. Groundwaters are soft, of good quality, and contain less than 250 mg/l of dissolved solids. The aquifer contains a large proportion of relatively insoluble quartz sand, which explains the low mineralization. The water is a sodium bicarbonate type.

The near-surface deposits at the former HO storage site are sedimentary sand, gravel, clay, and silt. The upper permeable part is the surficial aquifer, an unconfined (water table) aquifer. The water table is shallow--from 4 to 6 feet below the land surface. The hydraulic conductivity of clean, medium-to-coarse sands is about 150 ft/day. The groundwater velocity in the surficial aquifer at the site is estimated to be 100 to 200 ft/yr. The flat area around the site is a recharge area. The overall flow direction is south to south-southeast.

Contamination of the surficial water table aquifer is possible. Because of its shallow depth, it can saturate zones of contaminated soil at the site. However, the primary mode of contamination would be from contaminant leaching and infiltration due to heavy rainfall in the area and subsequent groundwater recharge. Rapid migration of contamination in the surficial aquifer is possible. Of course, the degree of contamination and contaminant migration would be limited by the low solubility of TCDD in water and its high sorption potential in soils. The possibility of deeper migration of TCDD is very remote because of the low solubility of TCDD, the depths to be traversed over which significant sorption by soils is likely, and the apparent upward movement of deep water-bearing zones that would inhibit downward migration of contaminants.

6. REFERENCES

Barraclough, J. T., and K. S. Wade, January 1986. Geohydrologic Summary and Proposed Monitoring Wells for Herbicide Residues at Eglin Air Force Base, Florida, and the Naval Construction Battalion Center, Mississippi, EG&G Idaho, Inc., Idaho Falls, Idaho.

Brown, G. F., V. M. Foster, R. W. Adams, E. W. Reed, and H. D. Padgett, Jr., 1944. Geology and Groundwater Resources of the Coastal Area in Mississippi, Mississippi State Geological Survey, Bulletin 60, University, Mississippi.

Channell, R. E., and T. L. Stoddart, April 1984. Herbicide Orange Monitoring Program, Interim Report, January 1980-December 1982, ESL-TR-83-56, Engineering & Services Laboratory, Air Force Engineering & Services Center, Tyndall Air Force Base, Florida.

Choudhary, G., L. H. Keith, and C. Rappe, 1983. Chlorinated Dioxins and Dibenzofurans in the Total Environment, Butterworth Publishers.

Crockett, A. B., A. Propp, and T. Kimes, EG&G Idaho, Inc., Idaho Falls, Idaho, January 1987. Herbicide Orange Site Characterization Study, Naval Construction Battalion Center, Final Report, April 1984-September 1986, ESL-TR-86-21, Engineering & Services Laboratory, Air Force Engineering & Services Center, Tyndall Air Force Base, Florida.

Friedrich, C. E., EG&G Idaho, Inc., Idaho Falls, Idaho, May 23, 1988. Final NCBC Site Characterization Data - CEF-29-88, Letter to Captain C. R. Howell, HQ USAF/LEEVO, Bolling Air Force Base, Washington, DC.

Hahn, G. J., and S. S. Shapiro, 1967. Statistical Models in Engineering, John Wiley & Sons, Inc., New York, pp. 295-302.

Harris, D. J., December 1983. Report on TCDD Sampling Methods, unpublished, Environmental Sciences Division, Region VII, U.S. Environmental Protection Agency, Cincinnati, Ohio.

Howe, H. V., 1935. "1936 Stratigraphic Evidence of Gulf Coast Geosyncline," Proceedings Geological Society of America, p. 82.

Kimbrough, R., M.D., Medical Officer, Center for Environmental Health, May 29, 1986. Letter to Maj. Gen. Alexander D. Sloan, Deputy Surgeon General, HQ USAF, Bolling Air Force Base, Washington, DC.

Kimbrough, R. D., H. P. Stehr, and G. Fries, "Health Implications of 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) Contamination of Residential Soil," Journal of Toxicology and Environmental Health (in press).

Markland, Col. Darryl T., December 18, 1985. Dioxin Contamination at Naval Construction Battalion Center (NCBC), Gulfport, MS, Consultative Letter 85-185EQ1001MBC, to Commanding Officer, NCBC, Gulfport, Mississippi.

Markland, Col. Darryl T., September 12, 1986. Dioxin Contamination Surveys, Naval Construction Battalion Center (NCBC), Gulfport, MS, Consultative Letter 86-076EQ1001HBC, to Commanding Officer, NCBC, Gulfport, Mississippi.

Miller, R. A., P. A. Shafts, S. F. Stieritz, and B. J. Termena, January 1980. The Disposal of Herbicide Orange, 1971-1979. Office of History, Air Force Logistics Command, Wright-Patterson Air Force Base, Ohio.

Newcome, Roy, Jr., D. E. Shattles, and C. P. Humphreys, Jr., 1968. Water for the Growing Needs of Harrison County, Mississippi, U.S. Geological Survey Water-Supply Paper 1856, Washington, DC.

Rhodes, A. N., May 1985. Herbicide Orange Monitoring Program, Addendum I: January 1980-February 1985, ESL-TR-83-56, Engineering & Services Laboratory, Air Force Engineering & Services Center, Tyndall Air Force Base, Florida.

Shows, T. N., 1970. Water Resources of Mississippi, Mississippi Geological, Economic and Topographical Survey, Bulletin 113, Jackson, Mississippi.

Wasson, B. E., 1980. Sources for Water Supplies in Mississippi, Mississippi Research and Development Center, Jackson, Mississippi.

Williams, H. D., February 9, 1987. Status Report Equipment Decontamination and Sampling at NCBC, Gulfport, MS, Letter to Captain C. R. Howell, HQ USAF/LEEVO, Bolling Air Force Base, Washington, DC.

Young, A. L., Ed., 1974. Ecological Studies on Herbicide-Equipment Test Area (TA C-52A), Eglin AFB Reservation, Florida, AFATL Technical Report 74-12, Air Force Armament Laboratory, Eglin Air Force Base, Florida.

Young, A. L., J. A. Calcagni, C. E. Thalken, and J. W. Tremblay, 1978. The Toxicology, Environmental Fate, and Human Risk of Herbicide Orange and its Associated Dioxin, OEHL Technical Report 78-92, USAF Occupational and Environmental Health Laboratory, Brooks Air Force Base, Texas.

Young, A. L., C. E. Thalken, and W. J. Cairney, 1979. Herbicide Orange Site Treatment and Environmental Monitoring: Summary Report and Recommendations for Naval Construction Battalion Center, Gulfport, MS, OEHL Technical Report 79-169, USAF Occupational and Environmental Health Laboratory, Brooks Air Force Base, Texas.

Young, A. L., W. J. Cairney, and C. E. Thalken, 1982. "Persistence, Movement and Decontamination Studies of TCDD in Storage Sites Massively Contaminated with Phenoxy Herbicides," Third International Symposium on Chlorinated Dioxins and Related Compounds.

Young, A. L., W. J. Cairney, and C. E. Thalken, 1983. "Persistence, Movement and Decontamination Studies of TCDD in Storage Sites Massively Contaminated with Phenoxy Herbicides," Chemosphere, Vol. 4/5, Pergamon Press, pp. 713-726.

APPENDIX A

Sampling and Analytical Procedures

APPENDIX A

Sampling and Analytical Procedures

This appendix presents additional details on the procedures employed for sampling and chemical analysis (including laboratory QA), where available, for the initial HO monitoring program by ESL (Section A.1) and the comprehensive soil characterization study by EG&G Idaho, Inc. (Section A.2).

A.1 INITIAL HO MONITORING PROGRAM BY ESL

All available information on sampling procedures used for this program was presented in Section 1.3.2. Presented in the following sections are discussions of the chemical analysis and QA protocols employed (Channell and Stoddart, 1984).

A.1.1 Chemical Analyses

Each soil sample consisted of approximately 100 grams and was placed into new glass jars, appropriately labeled, and transported to the contract laboratories for analysis. The Brehm Laboratory at Wright State University (WSU), Dayton, Ohio, performed analyses of soil and biological samples for TCDD to a DL of 10 picograms/gram (parts per trillion) using either high-resolution gas chromatography/high-resolution mass spectrometry or low-resolution gas chromatography/high-resolution mass spectrometry. California Analytical Laboratories, Inc. (CAL), Sacramento, California, performed analyses of soil samples for TCDD to a DL of 100 ppT using high-resolution gas chromatography/low-resolution mass spectrometry. CAL also performed all 2,4-D and 2,4,5-T analyses, at DL's of 100 ppT. CAL or WSU performed all analyses for samples collected by ESL for the duration of the program.

A.1.2 Quality Assurance

To verify the sample precision and accuracy, ESL obtained a series of "known-value" soil specimens from Dr. Robert Harless of EPA. These samples were submitted "blind" to WSU and CAL. The samples supplied to the two laboratories contained interfering substances that would be encountered in the analysis of "real-world" specimens. The results of the QA programs are shown in Table A-1. Although the two laboratories contracted to provide analyses at different DL's, an evaluation of the QA data reveals that laboratory precision of

TABLE A-1

QA Program Results--Analysis of EPA Standards[a]

Sample ID	As Prepared (ppb[b])			Laboratory	As Analyzed (ppb)		
	2,3,7,8-TCDD	2,4-D	2,4,5-T	Contractor	2,3,7,8-TCDD	2,4-D	2,4,5-T
EPA-1	0	0	0	WSU	0		
EPA-2	0	50	50	CAL	<0.10	<1,000	<1,000
EPA-3	0.15	50	50	CAL	<0.10	<1,000	<100
EPA-4	0.15	0	0	WSU	0.26		
EPA-5	0.15	0	0	WSU	0.17		
EPA-6	0.25	0	0	CAL	0.14	80	240
EPA-7	0.25	0	0	WSU	0.39		
EPA-8	0.25	0	0				
EPA-9	0.10	0	0	WSU	0.06		
EPA-10	0.10	50	50	CAL	0.11	<20	6
EPA-11	0.40	50	50	CAL	0.35	<1,000	<100
EPA-12	0.40	0	0	WSU	0.23		

SOURCE: Channell and Stoddart, 1984.

[a]Samples consisted of 10 grams of soil prepared and spiked as indicated by Robert Harless, EPA, Research Triangle Park, North Carolina.

[b]ppb = parts per billion.

duplicate specimens is within a factor of two or better in all cases. A statistical comparison of the results of representative soil specimen analyses, generated by the two contract laboratories, is presented in the following paragraph. A review of these data indicates that laboratory precision on "real-world" specimens parallels the performance on the EPA-supplied "known-value" specimens.

As discussed previously, QC was checked by submitting identical samples to both contract laboratories and performing a statistical evaluation of the resultant data, to evaluate the performance of the laboratories prior to contract award. In addition, these samples were resubmitted for analysis with different sample numbers. Table A-2 illustrates these data for NCBC. These data are presented as a function of spill site number, date that the sample was collected, contractor performing the analysis, and individual and average values for the data. When two contractors are given for a single sampling date, this indicates that identical samples were submitted to the contractors for analysis. Values appearing for 2,4-D; 2,4,5-T; or dioxin, and performed by a single contractor for a single sampling date, indicate that identical samples were submitted to the contractors under different sample numbers. The very wide fluctuations in 2,4-D; 2,4,5-T; and dioxin between analyses for identical samples by a laboratory and between laboratories are noted by examining the sample deviations listed under laboratory average and date average in Table A-2. Again, in most cases, the individual values are within a factor of two of the mean value. This very large variability in the data, the very slow rate of natural degradation of dioxin, and the limited quantity of data available make it impossible to determine a meaningful half-life for natural degradation of dioxin.

A.2 COMPREHENSIVE SOIL CHARACTERIZATION STUDY (AREA A AND VICINITY)

This section discusses the procedures employed for sample collection, sample handling, chemical analysis, and laboratory QA for the EG&G Idaho, Inc., study of Area A and vicinity of the former HO storage site (Crockett et al., 1987). The procedures employed for the follow-on study of Areas B and C have not yet been reported. EG&G Idaho, Inc., specified the procedures to be used for the dioxin survey and validated the data obtained from the analytical laboratory.

TABLE A-2

QC Summary of Representative Data on HO Contamination at NCBC

Spill Site	Date	Laboratory Contractor	2,4-D (ppm)	2,4-D (ppm) Lab Average	2,4,5-T (ppm)	2,4,5-T (ppm) Lab Average	TCDD (ppb)	TCDD (ppb) Lab Average	TCDD (ppb) Date Average
1	May 81	WSU					123;134	129±8	154±31
		CAL	290;760	525±332	200;1100	650±636	190;170	180±14	
	Nov 81	WSU					154	154	197±61
		CAL	130	130	200	200	240	240	
	Apr 82	WSU					130	130	153±33
		CAL	22	22	74	74	176	176	
17	May 81	WSU					160;227	194±47	171±56
		CAL	5600;4400	5000±849	3200±4200	3700±707	97;200	149±73	
	Nov 81	WSU					168	168	214±65
		CAL	1200	1200	1700	260	260	260	
	Apr 82	WSU					337	337	304±47
		CAL	796	796	2770	2770	271	271	
41	May 81	WSU					80;180	130±71	120±62
		CAL	3400;2700	3050±495	2100;1600	1850±354	54;165	110±78	
	Nov 81	WSU					123	123	132±12
		CAL	600	600	1100	1100	140	140	
	Apr 82	WSU					249	249	200±70
		CAL	110	110	570	570	150	150	

SOURCE: Channell and Stoddart, 1984.

A.2.1 Sampling Procedures

Sampling sites in the former storage area and adjacent boneyard were laid out parallel to fence lines, using a level and steel tape. Sampling site centers were marked using a 2-foot steel stake and stainless steel disk stamped with the site identification number. A washer was placed on the top of the stake, elevated at least 6 inches aboveground to permit easy relocation of the sampling lot. Plots outside the storage area were surveyed in the same manner, but were marked using a 3-inch-diameter plywood disk nailed into the soil with a 6-inch galvanized spike. The stainless steel identification disk was fastened to the wooden disk using a smaller nail.

Field sampling was prioritized according to anticipated contamination levels, starting with surface soil on the former storage area (Rows 23, 24, and 25), followed by surface soils on the present heavy equipment boneyard, samples outside the storage area, the remainder of the storage area, and then near-surface and subsurface sampling. This procedure is contrary to the usual approach of sampling cleaner areas first. In this case, analytical results were desired to guide the collection of additional samples. However, because of time lag in receiving analytical results, only a few surface soil results were available to assist in near-surface and subsurface site selection.

Surface soils were sampled from the surface to the soil cement layer, a depth ranging from 0 to 6 inches, using a new stainless steel tablespoon. The five subsamples from a plot were sieved through a disposable piece of 10-mesh (2.0-mm opening) stainless steel screen into a disposable aluminum pan. The fines were thoroughly mixed with the spoon and placed in new 8-ounce wide-mouth glass jars (two-thirds full, approximately 200 grams) with aluminum foil-lined caps. This operation took place on the sample plot. The coarse soil remaining was poured into one of the subsample holes.

Near-surface samples were collected using a jackhammer to break up the soil cement layer, then a shovel to enlarge the hole. Samples then were taken using new spoons, starting at the bottom and working up. All nondisposable sampling equipment was decontaminated between sites.

Subsurface samples were collected using a truck-mounted drill rig with hollow-stem augers and a split-spoon drive sampler. Augers were advanced to the top of the sampling interval; then the split spoon was driven for 10 inches using a drop weight. The sampler was retrieved and opened, the outside soil scraped away, and the sample scooped out of the center using a new spoon. Augers, drill bit, and other drilling equipment were decontaminated between each hole. Split spoons were decontaminated between each sample.

A.2.2 Sample Handling

Preprinted form labels were used for all samples. Labels included provisions for information on location (four digits, two for row, two for column), sample type, depth, date and time of collection, and type of analyses required. Labels were placed on bottles before sampling with location, sample type, and required analyses filled in. Date and time were filled in as samples passed the "hot line." All samples were recorded in a sample log that contained all of these data plus the name of the team leader, sample logger, and shipping case number.

Sample jars were placed in plastic bags before they entered the contaminated area and were rebagged and sealed with twist ties at the "hot line." The jars then were placed in labeled 1-quart paint cans (½ gallon for rinsates) that had been lined with plastic bags. Vermiculite was placed between two bags, the outer bag was sealed with a twist tie, and the paint can lid was secured with three clips. Labels on each paint can contained the identical information as the sample jars plus warning labels--FLAMMABLE SOLID N.O.S. UN 1325 and DANGER DO NOT LOAD ON PASSENGER AIRCRAFT.

Cans were packed in metal ice chests lined with a plastic bag and padded by vermiculite. Up to 34 cans were routinely placed in a cooler. The cooler had the same warning labels as the paint cans. Commercial express package service completed delivery to the laboratories.

A.2.3 Analytical Procedures

The analytical procedures for the program were adapted from appropriate existing EPA analytical procedures. The TCDD procedure was adapted from the December 1983 revision of the protocol developed by EPA Region VII (1983). The DL for the analytical procedure as adapted was 0.1 ppb for surface samples. For the routine analytical laboratory to achieve the 0.01-ppb DL for subsurface samples, it was necessary to increase the effective concentration of TCDD in the final sample extract by a factor of 10. This tenfold increase in concentration was achieved by one of two methods. Either a 50-gram sample aliquot was utilized and the final volume of the sample extract was adjusted to 5 microliters (ul) rather than the 50 ul called for in the procedure or, alternatively, a 50-gram sample aliquot was utilized and the final volume of the sample extract was adjusted to 25 ul. The choice of option used to obtain the 0.01-ppb DL was operational based on the availability of personnel and equipment. The use of the smaller final volume (5 ul) for the sample extract required close supervision during the final volume reduction step to prevent evaporating the extract to dryness. Conversely, use of the larger sample aliquot (50 grams) resulted in larger aliquot volumes and required larger initial extract volumes, which made the various preparative manipulations more difficult. Both procedural modifications provided the required tenfold increase in TCDD concentration in the final extract, permitting the lower DL.

The method used for 2,4-D and 2,4,5-T was EPA Method 8150 (EPA, 1982). The target DL was 1.0 ppb for each of the herbicides. However, the DL actually achieved for each of the herbicides was considerably higher than this, ranging from 20 ppb to 5,000 ppb (5 ppm), because of the dilution factor required during preparation of the samples for analysis. In addition, a modification to the procedure was required as follows. The sample aliquot taken for analysis was 0.5 gram rather than the 50 grams specified in the procedure. Analysis of dilute extracts was necessary because large amounts of materials present in the samples, either the compounds of interest or contaminants, caused chromatographic interferences in the analyses. Dilution and reduction of the sample aliquot size were required to minimize the effect of the interferences.

A.2.4 Laboratory QA

The laboratory QA program consisted of two parts. The internal QA program was carried out within the analytical laboratory. This consisted, at a minimum, of performing certain specified analyses such as the analysis of method blanks (reagent blanks), matrix spikes, and duplicate sample aliquots on a regular basis, as required by the analytical protocols. These specific analyses are discussed in more detail in the following paragraphs. The second part of the QA program was carried out independently of the analytical laboratory. It consisted of several subparts, including analytical data review/validation, the use of samples submitted to the analytical laboratory as performance audit (PA) samples, analysis by the analytical laboratory of performance evaluation (PE) samples, and analysis of samples split between the analytical laboratory and the QA/QC laboratory. These latter samples are subsequently referred to as split samples. The external phase of the QA program is discussed in detail in the following paragraphs.

Each of the analytical procedures outlines specific QA requirements. The herbicide procedure (EPA Method 8150) addresses only the internal laboratory QA requirements, which consist of analyzing matrix spike samples and laboratory replicates (duplicates) at unspecified frequencies. In addition, the procedure requires that a method blank be run with each set of samples. The general definitions of each of these samples and their purpose follow:

- Method blank--This consists of determining the analytical response when analysis is performed in the absence of a sample aliquot but including all reagents and all steps of the analysis. The purpose of this analysis is to demonstrate that all reagents and glassware used are free of contamination and interference.

- Matrix spike--This consists of adding a known amount of the compound of interest to a sample aliquot before analysis. This analysis is performed to determine the accuracy of the analytical procedure.

- Duplicates--These consist of two subsamples or aliquots of a sample considered to be homogeneous. The aliquots are taken by the laboratory, and each is submitted for analysis using the same procedure. Duplicate analyses are performed to provide a measure of the precision of the analysis.

These analyses were performed as required by the herbicide procedure.

The QA requirements outlined in the TCDD procedure are more extensive than those of the herbicide procedure. The internal laboratory QA requirements consist not only of analyzing method blanks, matrix spikes, and duplicates at regular intervals, but also including the use of a surrogate standard in every analysis. A surrogate standard is a pure compound that is an isotopically labeled version of the compound of interest. It is added in known amounts to the sample aliquot before the aliquot is subjected to the analytical procedure. For the TCDD procedure, the surrogate is added in amounts equivalent to 1.0 ppb. The accuracy of the result for the analysis of the surrogate standard is indicative of the accuracy of the analytical result for the unlabeled compound of interest. Thus, the use of a surrogate standard provides additional information about the accuracy of the analysis at the 1.0-ppb level. The TCDD used as a surrogate has been labeled by replacing the four chlorines of the compound with chlorine-37, which is a specific isotope of chlorine.

In addition to the internal laboratory QA requirements, the TCDD procedure also addresses specific QA requirements to be carried out external to the laboratory. These requirements include submission of the following blind samples to the analytical laboratory on a routine basis:

- Field blank--This is a sample known to be free of contamination by the compound of interest. Analysis of the sample is used to demonstrate that there has been no contamination of the samples during sampling, transportation, storage, or analysis.
- Field PA sample--This consists of a sample that contains a known amount of the compound of interest. This sample provides a routine check on the performance of the analytical laboratory in the form of analytical accuracy, precision, and bias compared with the QA/QC laboratory.

The TCDD procedure also calls for submitting to the analytical laboratory, on a nonroutine basis, a set of PE samples. Each set consists of several samples, each of which contains a known level of TCDD. The concentration of TCDD in these samples is unknown to the analytical laboratory. The purpose of these samples is to determine the quality of the laboratory performance in terms of accuracy compared with the QA/QC laboratory. As an additional part of the external QA requirements, the procedure calls for split samples to be collected at specified intervals. Each of these samples is split or divided in the field. A separate portion of each sample is sent to both the analytical laboratory and the QA/QC laboratory and is analyzed independently by each.

Various QA elements of the TCDD procedure, as noted previously, were addressed as required during the analysis of the NCBC samples. However, the frequency of analysis varied from that required by the procedure, because the number of samples in each extraction batch run by the laboratory could sometimes vary from the 24 samples per batch specified in the procedure. The breakdown, by type, of total field samples submitted to the analytical laboratory is as follows:

- Field Soil Samples (includes samples from surface, near surface, and subsurface)

    - Regular samples
    - Replicate samples
    - Split samples (portion sent to the analytical laboratory)
- Field Blanks
- PA Samples
- Rinsate Samples.

Table A-3 lists the total number of field samples submitted and summarizes the total number of QA samples of each type analyzed, excluding additional analyses performed because of QA considerations.

All TCDD analytical data were reviewed according to the requirements outlined in the TCDD QA protocol. These requirements are detailed in the EPA document for reviewing TCDD analytical results (EPA, 1984). The latter document was adapted to form the working document used for detailed data review/validation. This data review/validation process formed an integral part of the external QA program, as mentioned previously.

The criteria used to validate the analytical data for the TCDD results, as outlined in the TCDD QA protocol, are as follows:

1. To ensure isomer specificity for chromatographic separation, the TCDD must be separated from interfering isomers with no more than a 50-percent valley relative to the TCDD peak.

2. The charge to mass (m/z) 320/322 and 332/334 ratios must be within the range of 0.67 to 0.87.

3. Ions 320, 322, and 257, which are each monitored separately but concurrently, must all be present; the signals for all three must maximize simultaneously. The signal-to-noise ratio must be 2.5 to 1 or better for all three ions.

4. The signal-to-noise ratio must be 5 to 1 or better for the 332 and 334 ions, which are the ions due to the internal standard.

5. The retention time of the native TCDD must equal (within 3 seconds) the retention time for the isotopically labeled TCDD.

TABLE A-3

NCBC QA Sample Summary

Type of Sample	Number Analyzed[a]
Total field samples	1907[b]
Method blanks	80
Matrix spikes	87
Duplicates	81
Field blanks[c]	53
PA samples[c]	82
Split samples[c]	38
PE samples (sets)	2
Rinsate samples[c]	6

SOURCE: Crockett et al., 1987.

[a]These numbers do not include additional analyses performed because of sample reruns necessitated by the QA criteria of the data review/validation process.

[b]This total does not include the split samples sent to the QA laboratory.

[c]These samples are included as part of the total field samples. Some of these samples may have been analyzed and reported more than once.

6. Positive results must be confirmed by obtaining partial scan spectra from mass 150 to mass 350 for selected samples.

7. The surrogate standard results must be within ± 40 percent of the true value.

8. TCDD must be absent from the blank (both method blanks and field blanks).

9. Overall, a minimum of 80 percent of the reported values must be certified as valid.

10. The analytical laboratory must obtain satisfactory results for the PA and PE samples.

The preceding validation criteria that refer specifically to native TCDD (the species potentially present as the soil contaminant) only applied to sample results reported with positive TCDD values. These criteria refer to the 320/322 mass ratio value; the simultaneous presence of the 322, 320, and 247 ions; and the TCDD retention time. For samples in which TCDD was absent, these criteria did not apply.

Analytical data meeting all the applicable validation criteria were considered valid. Failure of the data to meet all applicable criteria resulted in the data being considered questionable. If the data were questionable because any of the associated blanks (field blank or method blank) were reported as being contaminated, or because the result for the associated PA sample was not acceptable, the sample was rerun by the laboratory in an effort to provide valid data. Data that were questionable for other reasons were reported as probable results if the departure from the requirements of the validation criteria were considered relatively minor. Data were reported as invalid if there were major departures from the requirements of the validation criteria.

One analytical laboratory analyzed all routine NCBC field samples. An independent QA/QC laboratory performed the following QA functions:

- Analysis of the matrix material used to prepare the PA samples to confirm that it was uncontaminated with TCDD.
- Preparation of the field PA samples and analysis of the prepared material to determine the TCDD levels. For NCBC, three different

series of PA samples were utilized. The TCDD concentrations of the three series of PA samples, as established by analysis in triplicate for each series, were as follows--0.080 ppb, 0.85 ppb, and 8.34 ppb.

- Preparation of a series of PE samples and establishment of the concentration of TCDD in each level of the series by replicate analysis. The PE samples were prepared using clean (uncontaminated) Eglin Air Force Base soil as the matrix.
- Analysis of the NCBC split samples.

The results of the work performed by the QA/QC laboratory have been summarized in various separate reports submitted by that laboratory. The reports from the QA/QC laboratory have not been appended to this document. However, pertinent data have been excerpted from them and are presented in the following discussion, as appropriate, to compare the performance of the analytical laboratory to the QA/AC laboratory. The QA/QC laboratory also analyzed the NCBC split samples for 2,4-D and 2,4,5-T, where appropriate. These analyses have supplied external QA for the herbicide analyses performed by the routine analytical laboratory.

A.3 REFERENCES FOR APPENDIX A

Channell, R. E., and T. L. Stoddart, April 1984. Herbicide Orange Monitoring Program, Interim Report, January 1980-December 1982, ESL-TR-83-56, Engineering & Services Laboratory, Air Force Engineering & Services Center, Tyndall Air Force Base, Florida.

Crockett, A. B., A. Propp, and T. Kimes, January 1987. Herbicide Orange Site Characterization, Naval Construction Battalion Center, Final Report, April 1984-September 1986, ESL-TR-86-21, Engineering & Services Laboratory, Air Force Engineering & Services Center, Tyndall Air Force Base, Florida.

U.S. Environmental Protection Agency (EPA), July 1982. Test Methods for Evaluating Solid Water: Physical Chemical Methods, SW-846, second edition.

U.S. Environmental Protection Agency (EPA) Region VII, December 1983. 2,3,7,8-Tetrachlorodibenzo-p-dioxin in Soil and Sediment by High-Resolution Gas Chromatography/Low-Resolution Mass Spectrometry.

U.S. Environmental Protection Agency (EPA), November 20, 1984. Review of Contractor Data from the IFB WA 84-A002 Chemical Analytical Services for 2,3,7,8-Tetrachlorodibenzo-p-dioxin.

APPENDIX B
Safety Procedures
Comprehensive Soil Characterization Study
by EG&G Idaho, Inc.*

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*Crockett, A. B., A. Propp, and T. Kimes, EG&G, Idaho, Inc., Idaho Falls, Idaho, January 1987. Herbicide Orange Site Characterization Study, Naval Construction Battalion Center, Final Report, April 1984-September 1986, ESL-TR-86-21, Engineering & Services Laboratory, Air Force Engineering & Services Center, Tyndall Air Force Base, Florida.

APPENDIX B

Safety Procedures
Comprehensive Soil Characterization Study
by EG&G Idaho, Inc.

All personnel collecting samples at NCBC were given physicals before and after sampling was completed. The results of the physicals have been reviewed by a physician, and no significant effects due to the project were observable.

A "hot line" was established at the site where personnel were decontaminated upon leaving the contaminated area. Within the contaminated sampling area, all personnel were equipped with Level C protective gear, including Tyvek® suits and hoods, steel-toed neoprene boots and latex boot covers, surgical inner gloves and neoprene/viton outer gloves (and sometimes an outer cotton glove), and positive pressure respirators equipped with combination pesticide and particulate cartridges. Boots and gloves were taped to the Tyvek® suits. Boots, respirators, and viton gloves were decontaminated as personnel left the contaminated area; all other protective gear was discarded. Decontamination usually consisted of a soap and water wash, water rinse, and an alcohol rinse. At least one person was always on the clean side of the "hot line" to provide assistance, as needed. Personnel were always within sight of each other.

APPENDIX C

Listing of Sample Analysis Results for Initial HO Monitoring Program by OEHL and ESL[a] and Comprehensive Soil Characterization Study by EG&G Idaho, Inc.[b,c]

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[a]Rhodes, A. N., May 1985. Herbicide Orange Monitoring Program, Addendum I: January 1980-February 1985, ESL-TR-83-56, Engineering & Services Laboratory, Air Force Engineering & Services Center, Tyndall Air Force Base, Florida.

[b]Crockett, A. B., A. Propp, and T. Kimes, EG&G Idaho, Inc., Idaho Falls, Idaho, January 1987. Herbicide Orange Site Characterization Study, Naval Construction Battalion Center, Final Report, April 1984-September 1986, ESL-TR-86-21, Engineering & Services Laboratory, Air Force Engineering & Services Center, Tyndall Air Force Base, Florida.

[c]Friedrich, C. E., EG&G Idaho, Inc., Idaho Falls, Idaho, May 23, 1988. Final NCBC Site Characterization Data - CEF-29-88, Letter to Captain C. R. Howell, HQ USAF/LEEVO, Bolling Air Force Base, Washington, DC.

C.1 INITIAL HO MONITORING PROGRAM BY OEHL AND ESL

TABLE C-1
OEHL and ESL HO Data

LOCATION & DATE	SAMPLING LAB	SAMPLE DESCRIPTION	2,4-D (ppm)	2,4,5-T (ppm)	2,3,7,8-TCDD (ppb)	ANALYT. LAB
NCBC SS 1						
JUL 77	OEHL	SOIL	10500	6120	109	UOU
JAN 78	OEHL	SOIL	5920	6460	328	UOU
NOV 78	OEHL	SOIL	4050	19600	198	UOU
SEP 80	OEHL	SOIL			178	WSU
MAY 81	ESL	SOIL			123	WSU
		SOIL			134	WSU
		SOIL	280	200	190	CAL
		SOIL	760	1100	170	CAL
NOV 81	ESL	SOIL	130	200	240	CAL
		SOIL			154	WSU
APR 82	ESL	SOIL			130	WSU
		SOIL	22	74	176	CAL
NOV 82	ESL	SOIL			176	WSU
NCBC SS 2						
JUL 77	OEHL	SOIL	8.2	20.3	NO DATA	UOU
JAN 78	OEHL	SOIL	0.8	0.4	NO DATA	UOU
NOV 78	OEHL	SOIL	1.4	2.8	NO DATA	UOU
NCBC SS 3						
JUL 77	OEHL	SOIL	13100	13900	631	UOU
JAN 78	OEHL	SOIL	ND-0.1	0.6	4.8	UOU
NOV 78	OEHL	SOIL	1.5	0.3	2.2	UOU
NCBC SS 4						
JUL 77	OEHL	SOIL	7.4	6.6	NO DATA	UOU
JAN 78	OEHL	SOIL	0.1	0.8	NO DATA	UOU
NOV 78	OEHL	SOIL	1.2	4.8	NO DATA	UOU
NCBC SS 5						
JUL 77	OEHL	SOIL	7810	3600	ND-8.4	UOU
JAN 78	OEHL	SOIL	6120	18500	ND-2.0	UOU
NOV 78	OEHL	SOIL	805	2340	ND-38.7	UOU
SEP 80	OEHL	SOIL			2.6	UOU
NOV 81	ESL	SOIL	600	2000	0.1	CAL
		SOIL			1.5	WSU
APR 82	ESL	SOIL			2.5	WSU
		SOIL	330	1640	2.4	CAL
NOV 82	ESL	SOIL			2	WSU
NCBC SS 6						
JUL 77	OEHL	SOIL	0.3	0.4	NO DATA	UOU
JAN 78	OEHL	SOIL	2.7	3.4	NO DATA	UOU
NOV 78	OEHL	SOIL	3.6	1.4	NO DATA	UOU
NCBC SS 7						
JUL 77	OEHL	SOIL	9	11.5	NO DATA	UOU
JAN 78	OEHL	SOIL	570	1110	ND-5.0	UOU
NOV 78	OEHL	SOIL	3.1	4.8	NO DATA	UOU
NCBC SS 8						
JUL 77	OEHL	SOIL	674	369	190	UOU
JAN 78	OEHL	SOIL	0.2	0.5	4.6	UOU
NOV 78	OEHL	SOIL	0.6	0.4	5.2	UOU

TABLE C-1 (cont'd.)

NCBC SS 9						
JUL 77	OEHL	SOIL	2.9	5.4	NO DATA	UOU
JAN 78	OEHL	SOIL	0.3	0.2	NO DATA	UOU
NOV 78	OEHL	SOIL	0.4	0.4	NO DATA	UOU
NCBC SS 10						
JUL 77	OEHL	SOIL	2140	1420	18.5	UOU
JAN 78	OEHL	SOIL	4370	1730	42	UOU
NOV 78	OEHL	SOIL	719	2860	24.2	UOU
NCBC SS 11						
JAN 78	OEHL	SOIL	8.8	19.6	NO DATA	UOU
NOV 78	OEHL	SOIL	0.9	2.6	NO DATA	UOU
NCBC SS 12						
JUL 77	OEHL	SOIL	2.0	2.2	NO DATA	UOU
JAN 78	OEHL	SOIL	0.6	0.4	ND-.2	UOU
NOV 78	OEHL	SOIL	0.2	0.6	NO DATA	UOU
SEP 80	ESL	SOIL			0.65	WSU
MAY 81	ESL	SOIL	ND-.01	ND-.013	0.067	CAL
		SOIL	ND-1.0	ND-.1	ND-.01	CAL
		SOIL			0.05	WSU
		SOIL			0.04	WSU
NOV 81	ESL	SOIL			0.09	WSU
APR 82	ESL	SOIL			0.14	WSU
		SOIL			ND-.1	WSU
NOV 82	ESL	SOIL			0.25	WSU
NCBC SS 13						
JAN 78	OEHL	SOIL	7.2	6.4	NO DATA	UOU
NOV 78	OEHL	SOIL	2.6	4.2	NO DATA	UOU
NCBC SS 14						
JAN 78	OEHL	SOIL	1420	3790	100	UOU
NOV 78	OEHL	SOIL	29.6	40.2	105	UOU
NCBC SS 15						
JAN 78	OEHL	SOIL	0.9	1.2	NO DATA	UOU
NOV 78	OEHL	SOIL	0.2	0.3	NO DATA	UOU
NCBC SS 16						
JAN 78	OEHL	SOIL	6950	11800	442	UOU
NOV 78	OEHL	SOIL	7920	20300	198	UOU
NCBC SS 17						
JAN 78	OEHL	SOIL	31000	22500	510	UOU
NOV 78	OEHL	SOIL	29100	50300	508	UOU
JUN 79	OEHL	SOIL	27000	32900	325	UOU
SEP 80	ESL	SOIL			421	WSU
MAY 81	ESL	SOIL			160	WSU
		SOIL			227	WSU
		SOIL	5600	3200	97	CAL
		SOIL	4400	4200	200	CAL
NOV 81	ESL	SOIL			168	WSU

		SOIL	1200	1700	260	CAL
APR 82	ESL	SOIL			337	WSU
		SOIL	796	2770	271	CAL
NOV 82	ESL	SOIL			184	CAL
NCBC SS 18						
JAN 78	OEHL	SOIL	112	0.5	ND-.02	UOU
NOV 78	OEHL	SOIL	1.8	2.6	NO DATA	UOU
NCBC SS 19						
JAN 78	OEHL	SOIL	7530	14400	130	UOU
NOV 78	OEHL	SOIL	6760	13000	119	UOU
NCBC SS 20						
JAN 78	OEHL	SOIL	21000	53000	1	UOU
NOV 78	OEHL	SOIL	45200	3.7	NO DATA	UOU
NCBC SS 21						
JAN 78	OEHL	SOIL	0.8	2.7	NO DATA	UOU
NOV 78	OEHL	SOIL	1	2.6	NO DATA	UOU
NCBC SS 22						
JAN 78	OEHL	SOIL	2680	10300	ND-2.0	UOU
NOV 78	OEHL	SOIL	6690	33700	ND-18	UOU
NCBC SS 23						
JAN 78	OEHL	SOIL	0.3	0.1	NO DATA	UOU
NOV 78	OEHL	SOIL	0.4	1	NO DATA	UOU
NCBC SS 24						
JAN 78	OEHL	SOIL	4010	ND-2.0	NO DATA	UOU
NOV 78	OEHL	SOIL	1690	1840	ND-12.8	UOU
NCBC SS 25						
JAN 78	OEHL	SOIL	0.7	0.5	NO DATA	UOU
NOV 78	OEHL	SOIL	1.1	3.5	NO DATA	UOU
NCBC SS 26						
JAN 78	OEHL	SOIL	11400	30500	11	UOU
NOV 78	OEHL	SOIL	8840	2970	14	UOU
NCBC SS 27						
JAN 78	OEHL	SOIL	871	660	130	UOU
NOV 78	OEHL	SOIL	359	266	29	UOU
NCBC SS 28						
JAN 78	OEHL	SOIL	0.5	0.6	NO DATA	UOU
NOV 78	OEHL	SOIL	0.3	0.6	NO DATA	UOU
NCBC SS 29						
JAN 78	OEHL	SOIL	46.4	79.8	ND-4.0	UOU
NOV 78	OEHL	SOIL	0.7	2	NO DATA	UOU

TABLE C-1 (cont'd.)

NCBC SS 30						
JAN 78	OEHL	SOIL	3530	8790	240	UOU
NOV 78	OEHL	SOIL	2610	8770	222	UOU
NCBC SS 31						
JAN 78	OEHL	SOIL	200	698	ND-2.0	UOU
NOV 78	OEHL	SOIL	384	504	NO DATA	UOU
NCBC SS 32						
JAN 78	OEHL	SOIL	1.3	6.2	NO DATA	UOU
NOV 78	OEHL	SOIL	6.7	34.9	NO DATA	UOU
NCBC SS 33						
JAN 78	OEHL	SOIL	5.7	3.4	NO DATA	UOU
NOV 78	OEHL	SOIL	0.3	0.7	NO DATA	UOU
NCBC SS 34						
JAN 78	OEHL	SOIL	117	494	ND-8.0	UOU
NOV 78	OEHL	SOIL	3.3	6	NO DATA	UOU
NCBC SS 35						
JAN 78	OEHL	SOIL	50.6	175	ND-340	UOU
NOV 78	OEHL	SOIL	5	15.6	NO DATA	UOU
NCBC SS 36						
JAN 78	OEHL	SOIL	23.1	55.8	ND-10	UOU
NOV 78	OEHL	SOIL	1.1	3.9	NO DATA	UOU
NCBC SS 37						
JAN 78	OEHL	SOIL	1490	7850	ND-8.0	UOU
NOV 78	OEHL	SOIL	1470	5820	21.8	UOU
NCBC SS 38						
JAN 78	OEHL	SOIL	1320	6120	ND-11	UOU
NOV 78	OEHL	SOIL	859	4160	24.2	UOU
NCBC SS 39						
JAN 78	OEHL	SOIL	6.1	15.6	ND-40	UOU
NOV 78	OEHL	SOIL	0.5	2.2	NO DATA	UOU
NCBC SS 40						
JAN 78	OEHL	SOIL	40.8	128	ND-3.0	UOU
NOV 78	OEHL	SOIL	0.3	0.7	NO DATA	UOU
NCBC SS 41						
JAN 78	OEHL	SOIL	5030	6800	230	UOU
NOV 78	OEHL	SOIL	5790	13900	251	UOU
SEP 80	ESL	SOIL			193	WSU
MAY 81	ESL	SOIL	3400	2100	80	CAL
		SOIL	2700	1600	180	CAL
		SOIL			54	WSU
		SOIL			165	WSU
NOV 81	ESL	SOIL	600	1100	140	CAL
		SOIL			123	WSU
APR 82	ESL	SOIL	110	570	150	CAL

TABLE C-1 (cont'd.)

		SOIL			249	WSU
NOV 82	ESL	SOIL			164	WSU
NCBC SS 42						
JAN 78	OEHL	SOIL	0.6	2.5	NO DATA	UOU
NOV 78	OEHL	SOIL	0.3	NO DATA	NO DATA	UOU
NCBC SS 43						
JAN 78	OEHL	SOIL	9.2	15.7	ND-43	UOU
NOV 78	OEHL	SOIL	2270	6860	5.9	UOU
NCBC SS 44						
JAN 78	OEHL	SOIL	12	30.5	NO DATA	UOU
NOV 78	OEHL	SOIL	3510	7470	9.1	UOU
NCBC DS 1						
SEP 80	ESL	SEDIMENT			0.74	WSU
		BIOLOGICAL(FISH)			2.17	WSU
MAY 81	ESL	SEDIMENT			1.15	WSU
		BIOLOGICAL(COMPOSITE)			1.2	WSU
NOV 81	ESL	SEDIMENT			2.2	WSU
		BIOLOGICAL(FROG)			0.53	WSU
APR 82	ESL	SEDIMENT			0.48	WSU
		BIOLOGICAL(NOT SPECIFIED)			0.57	WSU
		BIOLOGICAL(TURTLE LIVER)			0.57	WSU
		BIOLOGICAL(TURTLE VISCERA)			0.24	WSU
		BIOLOGICAL(TURTLE MUSCLE)			0.08	WSU
NOV 82	ESL	SEDIMENT			1.5	WSU
		BIOLOGICAL(COMPOSITE)			0.9	WSU
APR 83	ESL	BIOLOGICAL(FISH)			2	WSU
MAR 84	ESL	SUSPENDED SEDIMENT			10.6	WSU
		WATER			ND-30ppq	WSU
NCBC DS 2						
SEP 80	ESL	SEDIMENT			0.31	WSU
		SEDIMENT			0.34	WSU
		BIOLOGICAL(TADPOLE)			0.37	WSU
		BIOLOGICAL(FISH)			11.6	WSU
		BIOLOGICAL(TURTLE LIVER)			2.49	WSU
		BIOLOGICAL(TURTLE MUSCLE&BONE)			0.36	WSU
MAY 81	ESL	SEDIMENT			0.16	WSU
		BIOLOGICAL(FISH)			0.6	WSU
NOV 81	ESL	SEDIMENT			1.2	WSU
		BIOLOGICAL(TADPOLE)			0.26	WSU
		BIOLOGICAL(CRAYFISH)			0.07	WSU
		BIOLOGICAL(FISH)			0.52	WSU
APR 82	ESL	SEDIMENT			0.14	WSU
		BIOLOGICAL(TADPOLE)			0.06	WSU
		BIOLOGICAL(NOT SPECIFIED)			0.62	WSU
NOV 82	ESL	SEDIMENT			0.18	WSU
		BIOLOGICAL(COMPOSITE)			0.41	WSU
		BIOLOGICAL(TURTLE LIVER)			0.61	WSU
		BIOLOGICAL(TURTLE ADIPOSE)			0.07	WSU
		BIOLOGICAL(TURTLE MUSCLE)			0.05	WSU

TABLE C-1 (cont'd.)

APR 83	ESL	BIOLOGICAL(COMPOSITE)	0.4	WSU
MAR 84	ESL	SEDIMENT	0.15	WSU
		WATER	ND-50ppq	WSU
		BIOLOGICAL(COMPOSITE)	0.39	WSU
NCBC DS 3				
SEP 80	ESL	SEDIMENT	0.02	WSU
		BIOLOGICAL(FROG)	0.01	WSU
APR 82	ESL	SEDIMENT	ND	WSU
		BIOLOGICAL(NOT SPECIFIED)	ND	WSU
NOV 82	ESL	SEDIMENT	ND	WSU
		BIOLOGICAL(TURTLE LIVER)	1.32	WSU
		BIOLOGICAL(TURTLE ADIPOSE)	4.4	WSU
		BIOLOGICAL(MUSCLE)	0.06	WSU
APR 83	ESL	BIOLOGICAL(CRAYFISH)	0.23	WSU
MAR 84	ESL	SEDIMENT	0.07	WSU
		WATER	ND-80ppq	WSU
		BIOLOGICAL(FISH)	0.9	WSU
NCBC DS 4				
SEP 80	ESL	SEDIMENT	0.07	WSU
		BIOLOGICAL(TURTLE LIVER)	0.06	WSU
		BIOLOGICAL(TURTLE ADIPOSE)	0.32	WSU
		BIOLOGICAL(TURTLE MUSCLE)	0.02	WSU
MAY 81	ESL	SEDIMENT	ND	WSU
NOV 81	ESL	SEDIMENT	ND	WSU
		BIOLOGICAL(FISH)	ND	WSU
APR 82	ESL	SEDIMENT	ND	WSU
		BIOLOGICAL(FISH)	0.07	WSU
		BIOLOGICAL(CRAYFISH)	0.29	WSU
NOV 82	ESL	SEDIMENT	ND	WSU
		BIOLOGICAL(FISH)	0.04	WSU
APR 83	ESL	BIOLOGICAL(FISH)	0.18	WSU
MAR 84	ESL	SEDIMENT	ND	WSU
		WATER	ND-50ppq	WSU
		BIOLOGICAL(CRAYFISH)	0.11	WSU
NCBC DS 5				
SEP 80	ESL	SEDIMENT	0.01	WSU
MAY 81	ESL	SEDIMENT	ND	WSU
NOV 81	ESL	SEDIMENT	0.03	WSU
		BIOLOGICAL(FISH)	0.02	WSU
NOV 82	ESL	SEDIMENT	ND	WSU
		BIOLOGICAL(COMPOSITE)	0.05	WSU
APR 83	ESL	BIOLOGICAL(COMPOSITE)	0.1	WSU
MAR 84	ESL	SEDIMENT	ND	WSU
		WATER	ND-55ppq	WSU
		BIOLOGICAL(CRAYFISH)	0.05	WSU
NCBC DS 6				
SEP 80	ESL	SEDIMENT	ND	WSU
		BIOLOGICAL(FISH)	0.11	WSU
		BIOLOGICAL(TURTLE LIVER)	0.12	WSU
		BIOLOGICAL(TURTLE ADIPOSE)	0.88	WSU

TABLE C-1 (cont'd.)

		BIOLOGICAL(TURTLE MUSCLE)	0.03	WSU
MAY 81	ESL	SEDIMENT	0.03	WSU
		SEDIMENT	0.02	WSU
		BIOLOGICAL(FISH)	0.09	WSU
NOV 81	ESL	SEDIMENT	0.04	WSU
		BIOLOGICAL(CRAYFISH)	0.04	WSU
APR 82	ESL	SEDIMENT	ND	WSU
		BIOLOGICAL(NOT SPECIFIED)	0.02	WSU
NOV 82	ESL	SEDIMENT	0.12	WSU
		BIOLOGICAL(COMPOSITE)	0.1	WSU
		BIOLOGICAL(FISH)	0.24	WSU
APR 83	ESL	BILOGICAL(CRAYFISH)	0.02	WSU
MAR 84	ESL	SEDIMENT	0.08	WSU
		WATER	ND-90ppq	WSU
NCBC DS 7				
SEP 80	ESL	SEDIMENT	0.19	WSU
		BIOLOGICAL(FISH)	0.05	WSU
MAY 81	ESL	SEDIMENT	0.08	WSU
		SEDIMENT	0.09	WSU
		BIOLOGICAL(FISH)	0.05	WSU
NOV 81	ESL	SEDIMENT	ND	WSU
		BIOLOGICAL(FISH)	0.07	WSU
APR 82	ESL	SEDIMENT	ND	WSU
		BIOLOGICAL(CRAYFISH)	0.04	WSU
		BIOLOGICAL(FISH)	0.04	WSU
NOV 82	ESL	SEDIMENT	0.03	WSU
		BIOLOGICAL(FISH)	0.13	WSU
		BIOLOGICAL(FISH)	0.07	WSU
APR 83	ESL	BIOLOGICAL(FISH)	0.03	WSU
MAR 84	ESL	SEDIMENT	0.01	WSU
		WATER	ND-40ppq	WSU
		SUSPENDED SEDIMENT	0.15	WSU
		BIOLOGICAL(FISH)	0.07	WSU
NCBC DS 8				
SEP 80	ESL	SEDIMENT	0.01	WSU
APR 82	ESL	SEDIMENT	0.04	WSU
		BIOLOGICAL(CRAYFISH)	0.05	WSU
NOV 82	ESL	SEDIMENT	0.02	WSU
		BIOLOGICAL(CRAYFISH)	0.03	WSU
APR 83	ESL	BIOLOGICAL(CRAYFISH)	0.3	WSU
MAR 84	ESL	SEDIMENT	ND	WSU
		SUSPENDED SEDIMENT	0.15	WSU
		WATER	ND-50ppq	WSU
		BILOGICAL(CRAYFISH)	0.02	WSU

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TABLE C-1 (cont'd.)

NCBC DS 9				
SEP 80	ESL	SEDIMENT	0.04	WSU
NOV 81	ESL	SEDIMENT	ND	WSU
		BIOLOGICAL((FISH)	ND	WSU
NOV 82	ESL	SEDIMENT	ND	WSU
		BIOLOGICAL(COMPOSITE)	ND	WSU
APR 83	ESL	BIOLOGICAL(FISH)	ND	WSU
MAR 84	ESL	SEDIMENT	ND	WSU
		SEDIMENT	ND	WSU
		SUSPENDED SEDIMENT	0.8	WSU
		WATER	ND-30ppq	WSU
NCBC DS 10				
		NO DATA		
NCBC DS 11				
MAR 84	ESL	SEDIMENT	ND	WSU
		SEDIMENT	ND	WSU
		WATER	ND-30ppq	WSU
NCBC DS 12				
MAR 84	ESL	SEDIMENT	ND	WSU
		SEDIMENT	ND	WSU
		WATER	ND-30ppq	WSU
NCBC DS 13				
MAR 84	ESL	SEDIMENT	ND	WSU
		SEDIMENT	0.02	WSU
NCBC DS 14				
MAR 84	ESL	SEDIMENT	ND	WSU
		SEDIMENT	ND	WSU
		SEDIMENT	ND	WSU
		SUSPENDED SEDIMENT	0.45	WSU
		WATER	ND-40ppq	WSU

C.2 COMPREHENSIVE SOIL CHARACTERIZATION STUDY BY EG&G IDAHO, INC.

C.2.1 Area A and Vicinity

TABLE C-2

Legend for NCBC Final Sample Summary

Symbol	Explanation
Status	Validation status for the sample TCDD result; refers only to the TCDD result. The various validation categories are defined below.
V	Valid; sample result is valid; all validation criteria have been met.
P	Probably; sample results interpreted as a probable concentration; not all validation criteria have been met but the discrepancies are minor.
I	Invalid; sample result is valid; there are major departures from the requirements of the validation criteria. No statement can be made about the results.
M	Missing; sample results are missing; the sample was either not received by the laboratory or for some reason could not be analyzed by the laboratory.
RL	Reporting limit; this term is used for the TCDD results instead of detection limit (DL) or maximum possible concentration (MPC) because the latter terms have specific definitions according to the analytical protocol. The RL is a term applied after the interpretation of the results; in some cases, it will be numerically equal to a true DL, and in other cases, it will be numerically equal to an MPC.
DL	Detection limit.

TABLE C-3

NCBC TCDD Results Status Summary

Status Category	Number of Results	Percent of Total
Missing	5	0.3
Invalid	109	6.2
Probable	179	10.1
Valid	1473	83.4
Total	1766[a]	100.0

[a]The total does not include results for rinsate, field blank, or PA samples.

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-0540.01000	21.80	--[a]	V	--	--	--	--
NC-0546.01000	3.06	--	I	--	--	--	--
NC-0551.01000	7.40	--	V	--	--	--	--
NC-0555.01000	8.80	--	V	--	--	--	--
NC-0556.01000	46.80	--	V	--	--	--	--
NC-0562.01000	0.80	--	V	--	--	--	--
NC-0568.01000	0.00	0.04	V	--	--	--	--
NC-0572.01000	0.00	0.10	V	--	--	--	--
NC-0574.01000	0.10	--	I	--	--	--	--
NC-0583.01000	0.00	0.01	V	--	--	--	--
NC-0586.01000	0.00	0.10	V	--	--	--	--
NC-0588.01000	0.00	0.10	V	--	--	--	--
NC-0590.01000	0.00	0.03	V	--	--	--	--
NC-0635.01000	0.00	1.90	V	--	--	--	--
NC-0636.01000	0.50	--	V	--	--	--	--
NC-0637.01000	0.80	--	P	--	--	--	--
NC-0638.01000	0.00	1.56	P	--	--	--	--
NC-0639.01000	242.00	--	V	--	--	--	--
NC-0639.03000	--	--	M	8209453	--	15111586	--
NC-0639.63001	259.00	--	I	8024098	--	14078859	--
NC-0639.03004	0.00	0.99	P	582993	--	873532	--
NC-0639.03008	1.20	--	V	0	100	9664	--
NC-0639.03020	0.02	--	V	0	50	0	50
NC-0639.03030	0.02	--	V	336	--	2301	--
NC-0639.03040	0.00	0.01	V	236	--	0	50
NC-0639.04000	438.00	--	P	20793097	--	27744082	--
NC-0640.01000	4.70	--	V	--	--	--	--
NC-0641.01000	3.00	--	V	--	--	--	--
NC-0642.01000	18.00	--	V	--	--	--	--
NC-0642.02000	365.50	--	V	--	--	--	--
NC-0642.02001	145.00	--	V	--	--	--	--
NC-0642.02004	95.50	--	P	--	--	--	--
NC-0642.04000	123.00	--	V	--	--	--	--
NC-0643.01000	148.00	--	V	--	--	--	--
NC-0643.03000	646.00	--	V	11834	--	21678	--
NC-0643.03001	0.00	0.01	I	4064541	--	2283542	--
NC-0643.03004	93.20	--	V	837274	--	834695	--
NC-0643.03008	0.25	--	V	326674	--	60652	--
NC-0643.03020	0.03	--	V	0	50	571	--
NC-0643.03030	0.02	--	V	0	100	0	100
NC-0643.03040	1.90	--	P	0	100	9604	--
NC-0643.04000	6.00	--	V	2252245	--	3397848	--
NC-0644.01000	18.90	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

Sample Number	TCDD (ppb) Reporting Conc.	TCDD (ppb) Reporting Limit	Status	2,4-D (ppb) Conc.	2,4-D (ppb) Detection Limit	2,4,5-T (ppb) Conc.	2,4,5-T (ppb) Detection Limit
NC-0645.01000	13.90	--	V	--	--	--	--
NC-0646.01000	6.90	--	V	--	--	--	--
NC-0647.01000	7.30	--	V	--	--	--	--
NC-0648.01000	26.80	--	V	--	--	--	--
NC-0649.01000	12.30	--	V	--	--	--	--
NC-0650.01000	46.50	--	V	--	--	--	--
NC-0651.01000	9.70	--	V	--	--	--	--
NC-0652.01000	6.70	--	V	--	--	--	--
NC-0653.01000	5.65	--	V	--	--	--	--
NC-0654.01000	17.10	--	V	--	--	--	--
NC-0655.01000	17.80	--	V	--	--	--	--
NC-0656.01000	90.30	--	V	--	--	--	--
NC-0657.01000	3.60	--	V	--	--	--	--
NC-0658.01000	3.20	--	V	--	--	--	--
NC-0659.01000	1.00	--	V	--	--	--	--
NC-0660.01000	1.60	--	V	--	--	--	--
NC-0661.01000	2.40	--	V	--	--	--	--
NC-0662.01000	2.40	--	V	--	--	--	--
NC-0663.01000	78.10	--	V	--	--	--	--
NC-0664.11000	45.60	--	P	--	--	--	--
NC-0664.21000	9.66	--	V	--	--	--	--
NC-0664.31000	50.00	--	V	--	--	--	--
NC-0664.41000	2.18	--	V	--	--	--	--
NC-0664.51000	4.20	--	P	--	--	--	--
NC-0665.01000	60.00	--	V	--	--	--	--
NC-0666.01000	0.00	0.04	V	--	--	--	--
NC-0667.01000	0.40	--	V	--	--	--	--
NC-0668.01000	0.00	0.18	V	--	--	--	--
NC-0669.01000	0.00	0.48	V	--	--	--	--
NC-0670.01000	0.00	0.02	V	--	--	--	--
NC-0671.01000	0.30	--	V	--	--	--	--
NC-0672.01000	0.30	--	P	--	--	--	--
NC-0673.01000	0.00	0.01	I	--	--	--	--
NC-0674.01000	0.00	0.10	V	--	--	--	--
NC-0675.01000	0.00	0.02	V	--	--	--	--
NC-0676.01000	0.00	0.34	V	--	--	--	--
NC-0677.01000	0.00	0.10	V	--	--	--	--
NC-0678.01000	0.18	--	V	--	--	--	--
NC-0679.01000	4.20	--	V	--	--	--	--
NC-0680.01000	--	--	M	--	--	--	--
NC-0681.01000	0.00	0.10	V	--	--	--	--
NC-0682.01000	17.90	--	V	--	--	--	--
NC-0683.01000	3.50	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-0684.01000	0.60	--	V	--	--	--	--
NC-0685.01000	1.20	--	V	--	--	--	--
NC-0686.01000	11.60	--	V	--	--	--	--
NC-0687.01000	0.40	--	V	--	--	--	--
NC-06A0.01000	0.00	0.10	I	--	--	--	--
NC-06A6.01000	0.00	0.01	I	--	--	--	--
NC-0719.01000	0.00	1.01	V	--	--	--	--
NC-0724.01000	0.00	0.10	V	--	--	--	--
NC-0729.01000	0.70	--	V	--	--	--	--
NC-0732.01000	0.00	0.39	V	--	--	--	--
NC-0735.01000	0.60	--	V	--	--	--	--
NC-0736.01000	0.70	--	V	--	--	--	--
NC-0737.01000	0.78	--	V	--	--	--	--
NC-0738.01000	3.50	--	V	--	--	--	--
NC-0739.01000	16.80	--	P	--	--	--	--
NC-0740.01000	4.70	--	V	--	--	--	--
NC-0741.01000	1.80	--	V	--	--	--	--
NC-0742.01000	13.20	--	V	--	--	--	--
NC-0743.01000	73.80	--	V	--	--	--	--
NC-0744.11000	160.00	--	V	--	--	--	--
NC-0744.21000	0.12	--	P	--	--	--	--
NC-0744.31000	0.37	--	V	--	--	--	--
NC-0744.41000	169.00	--	V	--	--	--	--
NC-0744.51000	114.00	--	V	--	--	--	--
NC-0745.01000	386.00	--	V	--	--	--	--
NC-0746.01000	98.10	--	V	--	--	--	--
NC-0747.01000	12.00	--	V	--	--	--	--
NC-0748.01000	5.21	--	V	--	--	--	--
NC-0749.01000	13.20	--	V	--	--	--	--
NC-0750.01000	20.10	--	V	--	--	--	--
NC-0751.01000	55.50	--	V	--	--	--	--
NC-0752.01000	28.00	--	V	--	--	--	--
NC-0753.01000	9.10	--	V	--	--	--	--
NC-0754.01000	13.50	--	V	--	--	--	--
NC-0755.01000	6.50	--	V	--	--	--	--
NC-0756.01000	16.70	--	V	--	--	--	--
NC-0757.01000	5.06	--	V	--	--	--	--
NC-0758.01000	4.90	--	P	--	--	--	--
NC-0759.01000	4.90	--	P	--	--	--	--
NC-0760.01000	7.00	--	V	--	--	--	--
NC-0761.01000	3.20	--	I	--	--	--	--
NC-0762.01000	3.40	--	V	--	--	--	--
NC-0763.61000	22.10	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-0764.01000	8.40	--	V	--	--	--	--
NC-0765.01000	4.41	--	V	--	--	--	--
NC-0767.01000	0.00	0.10	V	--	--	--	--
NC-0768.01000	0.00	0.10	V	--	--	--	--
NC-0769.01000	1.20	--	V	--	--	--	--
NC-0770.01000	0.80	--	V	--	--	--	--
NC-0771.01000	3.60	--	V	--	--	--	--
NC-0772.01000	0.00	0.29	V	--	--	--	--
NC-0773.01000	61.40	--	V	--	--	--	--
NC-0774.11000	0.50	--	V	--	--	--	--
NC-0774.21000	57.40	--	V	--	--	--	--
NC-0774.31000	99.60	--	V	--	--	--	--
NC-0774.41000	0.97	--	V	--	--	--	--
NC-0774.51000	0.00	0.11	V	--	--	--	--
NC-0775.01000	0.98	--	V	--	--	--	--
NC-0776.01000	0.00	0.02	V	--	--	--	--
NC-0777.01000	0.10	--	P	--	--	--	--
NC-0778.01000	0.00	1.03	V	--	--	--	--
NC-0779.01000	2.70	--	V	--	--	--	--
NC-0780.01000	4.46	--	V	--	--	--	--
NC-0781.01000	0.40	--	V	--	--	--	--
NC-0782.01000	24.20	--	V	--	--	--	--
NC-0783.01000	1.90	--	V	--	--	--	--
NC-0784.01000	0.00	0.19	V	--	--	--	--
NC-0785.01000	2.60	--	V	--	--	--	--
NC-0786.01000	5.30	--	V	--	--	--	--
NC-0787.01000	1.30	--	V	--	--	--	--
NC-0796.61000	0.00	0.10	V	--	--	--	--
NC-0822.01000	0.00	0.10	V	--	--	--	--
NC-0835.01000	0.20	--	I	--	--	--	--
NC-0836.01000	0.90	--	I	--	--	--	--
NC-0837.01000	0.90	--	I	--	--	--	--
NC-0838.01000	3.40	--	V	--	--	--	--
NC-0839.01000	3.50	--	I	--	--	--	--
NC-0840.01000	1.30	--	I	--	--	--	--
NC-0841.01000	2.00	--	V	--	--	--	--
NC-0842.01000	10.80	--	V	--	--	--	--
NC-0843.01000	44.10	--	V	--	--	--	--
NC-0844.01000	98.50	--	V	--	--	--	--
NC-0845.01000	234.00	--	V	--	--	--	--
NC-0846.01000	96.70	--	V	--	--	--	--
NC-0847.01000	12.30	--	V	--	--	--	--
NC-0848.01000	2.60	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-0849.01000	2.50	--	V	--	--	--	--
NC-0850.01000	18.40	--	I	--	--	--	--
NC-0851.01000	37.00	--	V	--	--	--	--
NC-0852.01000	36.40	--	V	--	--	--	--
NC-0853.61000	6.70	--	V	--	--	--	--
NC-0854.11000	3.60	--	V	--	--	--	--
NC-0854.21000	2.90	--	V	--	--	--	--
NC-0854.31000	4.80	--	P	--	--	--	--
NC-0854.41000	4.60	--	V	--	--	--	--
NC-0854.51000	0.00	3.19	V	--	--	--	--
NC-0855.01000	6.50	--	V	--	--	--	--
NC-0856.01000	9.21	--	V	--	--	--	--
NC-0857.01000	15.00	--	V	--	--	--	--
NC-0858.01000	6.60	--	V	--	--	--	--
NC-0859.01000	24.40	--	V	--	--	--	--
NC-0860.01000	24.60	--	V	--	--	--	--
NC-0861.01000	0.77	--	V	--	--	--	--
NC-0862.01000	2.60	--	V	--	--	--	--
NC-0863.01000	3.24	--	V	--	--	--	--
NC-0864.01000	2.50	--	P	--	--	--	--
NC-0865.01000	2.91	--	P	--	--	--	--
NC-0867.01000	1.80	--	V	--	--	--	--
NC-0868.01000	0.50	--	V	--	--	--	--
NC-0869.01000	1.00	--	V	--	--	--	--
NC-0870.01000	0.60	--	V	--	--	--	--
NC-0871.01000	0.77	--	V	--	--	--	--
NC-0872.01000	43.90	--	V	--	--	--	--
NC-0873.01000	45.30	--	V	--	--	--	--
NC-0874.01000	0.79	--	V	--	--	--	--
NC-0875.01000	0.08	--	V	--	--	--	--
NC-0876.01000	0.21	--	V	--	--	--	--
NC-0877.01000	0.00	0.58	I	--	--	--	--
NC-0878.01000	0.00	0.16	V	--	--	--	--
NC-0879.01000	2.60	--	V	--	--	--	--
NC-0880.01000	1.90	--	V	--	--	--	--
NC-0881.01000	0.40	--	V	--	--	--	--
NC-0882.01000	2.80	--	P	--	--	--	--
NC-0883.01000	1.08	--	V	--	--	--	--
NC-0884.11000	0.00	0.67	V	--	--	--	--
NC-0884.21000	1.10	--	V	--	--	--	--
NC-0884.31000	0.00	0.33	V	--	--	--	--
NC-0884.41000	0.40	--	P	--	--	--	--
NC-0884.51000	0.34	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-0885.01000	1.90	--	V	--	--	--	--
NC-0886.01000	8.46	--	I	--	--	--	--
NC-0887.01000	0.60	--	V	--	--	--	--
NC-0924.01000	0.00	0.10	V	--	--	--	--
NC-0928.01000	0.00	0.10	V	--	--	--	--
NC-0935.01000	0.40	--	I	--	--	--	--
NC-0936.01000	1.30	--	I	--	--	--	--
NC-0937.01000	2.70	--	I	--	--	--	--
NC-0938.01000	11.50	--	V	--	--	--	--
NC-0939.01000	6.60	--	V	--	--	--	--
NC-0940.01000	4.10	--	V	--	--	--	--
NC-0941.01000	6.20	--	V	--	--	--	--
NC-0942.01000	19.00	--	V	--	--	--	--
NC-0943.01000	17.00	--	V	--	--	--	--
NC-0944.61000	41.50	--	V	--	--	--	--
NC-0945.01000	44.40	--	V	--	--	--	--
NC-0946.01000	35.60	--	V	--	--	--	--
NC-0947.01000	6.90	--	V	--	--	--	--
NC-0948.01000	5.50	--	V	--	--	--	--
NC-0949.01000	2.20	--	V	--	--	--	--
NC-0950.01000	17.60	--	V	--	--	--	--
NC-0951.01000	35.70	--	V	--	--	--	--
NC-0952.01000	12.50	--	V	--	--	--	--
NC-0953.01000	3.90	--	I	--	--	--	--
NC-0954.01000	2.80	--	I	--	--	--	--
NC-0955.01000	2.60	--	I	--	--	--	--
NC-0956.01000	5.00	--	V	--	--	--	--
NC-0957.01000	22.20	--	I	--	--	--	--
NC-0958.01000	25.50	--	I	--	--	--	--
NC-0959.01000	275.00	--	I	--	--	--	--
NC-0960.01000	37.20	--	I	--	--	--	--
NC-0961.01000	4.40	--	I	--	--	--	--
NC-0962.01000	1.80	--	I	--	--	--	--
NC-0963.01000	2.70	--	I	--	--	--	--
NC-0964.11000	2.33	--	V	--	--	--	--
NC-0964.21000	1.30	--	V	--	--	--	--
NC-0964.31000	3.20	--	V	--	--	--	--
NC-0964.41000	11.70	--	V	--	--	--	--
NC-0964.51000	3.70	--	V	--	--	--	--
NC-0965.01000	6.00	--	V	--	--	--	--
NC-0967.01000	5.00	--	V	--	--	--	--
NC-0968.01000	0.40	--	V	--	--	--	--
NC-0969.01000	0.00	0.12	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-0970.01000	0.87	--	V	--	--	--	--
NC-0971.01000	0.70	--	V	--	--	--	--
NC-0972.01000	4.70	--	I	--	--	--	--
NC-0973.01000	3.30	--	V	--	--	--	--
NC-0974.01000	0.60	--	V	--	--	--	--
NC-0975.01000	0.00	0.11	V	--	--	--	--
NC-0976.01000	0.00	0.50	V	--	--	--	--
NC-0977.01000	0.00	0.20	V	--	--	--	--
NC-0978.01000	0.20	--	V	--	--	--	--
NC-0979.01000	2.20	--	V	--	--	--	--
NC-0980.01000	1.10	--	V	--	--	--	--
NC-0981.01000	0.20	--	V	--	--	--	--
NC-0982.01000	0.50	--	V	--	--	--	--
NC-0983.01000	0.50	--	V	--	--	--	--
NC-0984.61000	0.00	0.40	V	--	--	--	--
NC-0985.01000	1.50	--	V	--	--	--	--
NC-0986.01000	1.60	--	V	--	--	--	--
NC-0987.01000	0.20	--	V	--	--	--	--
NC-0992.01000	0.00	0.10	V	--	--	--	--
NC-0992.11000	0.00	0.02	V	--	--	--	--
NC-0992.21000	0.00	0.20	P	--	--	--	--
NC-0992.31000	0.00	0.01	V	--	--	--	--
NC-0992.41000	0.00	0.10	I	--	--	--	--
NC-0992.51000	0.10	--	V	--	--	--	--
NC-0999.01000	0.00	0.10	V	--	--	--	--
NC-09A3.01000	0.00	0.10	V	--	--	--	--
NC-1023.01000	0.00	0.10	V	--	--	--	--
NC-1025.01000	0.00	0.10	V	--	--	--	--
NC-1028.01000	4.00	--	V	--	--	--	--
NC-1031.01000	0.00	0.10	V	--	--	--	--
NC-1035.01000	0.80	--	P	--	--	--	--
NC-1036.01000	9.80	--	I	--	--	--	--
NC-1037.01000	4.60	--	P	--	--	--	--
NC-1040.01000	9.20	--	V	--	--	--	--
NC-1041.01000	2.80	--	V	--	--	--	--
NC-1042.01000	1.70	--	V	--	--	--	--
NC-1043.01000	1.90	--	V	--	--	--	--
NC-1044.11000	11.20	--	V	--	--	--	--
NC-1044.21000	8.10	--	V	--	--	--	--
NC-1044.31000	13.30	--	V	--	--	--	--
NC-1044.41000	5.65	--	V	--	--	--	--
NC-1044.51000	8.02	--	V	--	--	--	--
NC-1045.01000	34.60	--	V	--	--	--	--

TABLE C-6 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-1046.01000	24.10	--	V	--	--	--	--
NC-1047.01000	2.50	--	V	--	--	--	--
NC-1048.01000	1.90	--	P	--	--	--	--
NC-1049.01000	2.30	--	V	--	--	--	--
NC-1050.01000	8.20	--	V	--	--	--	--
NC-1051.01000	10.80	--	V	--	--	--	--
NC-1052.01000	4.70	--	V	--	--	--	--
NC-1053.01000	2.10	--	V	--	--	--	--
NC-1054.01000	0.00	0.41	V	--	--	--	--
NC-1055.01000	1.50	--	P	--	--	--	--
NC-1056.01000	3.50	--	V	--	--	--	--
NC-1057.01000	10.00	--	V	--	--	--	--
NC-1058.01000	14.60	--	V	--	--	--	--
NC-1059.01000	25.10	--	V	--	--	--	--
NC-1060.01000	8.70	--	V	--	--	--	--
NC-1061.01000	0.23	--	V	--	--	--	--
NC-1062.01000	2.00	--	V	--	--	--	--
NC-1063.01000	7.00	--	V	--	--	--	--
NC-1064.01000	0.80	--	V	--	--	--	--
NC-1067.01000	0.00	0.17	V	--	--	--	--
NC-1068.01000	0.09	--	V	--	--	--	--
NC-1069.01000	0.00	0.16	V	--	--	--	--
NC-1070.01000	0.50	--	P	--	--	--	--
NC-1071.01000	0.80	--	V	--	--	--	--
NC-1072.01000	0.80	--	V	--	--	--	--
NC-1073.61000	0.27	--	V	--	--	--	--
NC-1074.11000	0.00	0.18	V	--	--	--	--
NC-1074.21000	0.00	0.10	V	--	--	--	--
NC-1074.31000	0.00	0.01	V	--	--	--	--
NC-1074.41000	0.00	0.01	V	--	--	--	--
NC-1074.51000	0.00	0.10	V	--	--	--	--
NC-1075.01000	0.00	0.10	V	--	--	--	--
NC-1076.01000	0.10	--	V	--	--	--	--
NC-1077.01000	0.10	--	V	--	--	--	--
NC-1078.01000	0.40	--	V	--	--	--	--
NC-1079.01000	1.50	--	V	--	--	--	--
NC-1080.01000	0.40	--	V	--	--	--	--
NC-1081.01000	0.00	0.40	V	--	--	--	--
NC-1082.01000	0.40	--	V	--	--	--	--
NC-1083.01000	0.63	--	V	--	--	--	--
NC-1084.11000	0.00	0.23	P	--	--	--	--
NC-1084.21000	0.00	0.58	P	--	--	--	--
NC-1084.31000	0.00	0.59	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

Sample Number	TCDD (ppb) Reporting Conc.	TCDD (ppb) Reporting Limit	Status	2,4-D (ppb) Conc.	2,4-D (ppb) Detection Limit	2,4,5-T (ppb) Conc.	2,4,5-T (ppb) Detection Limit
NC-1084.41000	0.00	0.43	V	--	--	--	--
NC-1084.51000	0.00	0.57	V	--	--	--	--
NC-1085.01000	1.70	--	V	--	--	--	--
NC-1086.01000	1.80	--	V	--	--	--	--
NC-1087.01000	0.00	0.10	V	--	--	--	--
NC-1123.01000	0.00	0.10	V	--	--	--	--
NC-1131.01000	0.00	0.29	V	--	--	--	--
NC-1135.01000	1.90	--	V	--	--	--	--
NC-1136.01000	4.40	--	V	--	--	--	--
NC-1137.01000	5.00	--	V	--	--	--	--
NC-1140.01000	28.10	--	V	--	--	--	--
NC-1141.01000	4.60	--	P	--	--	--	--
NC-1142.01000	1.14	--	V	--	--	--	--
NC-1143.01000	0.00	0.85	V	--	--	--	--
NC-1144.01000	10.50	--	V	--	--	--	--
NC-1145.01000	14.20	--	V	--	--	--	--
NC-1146.01000	6.10	--	V	--	--	--	--
NC-1147.01000	2.00	--	I	--	--	--	--
NC-1148.01000	0.30	--	V	--	--	--	--
NC-1149.01000	12.90	--	V	--	--	--	--
NC-1150.01000	20.40	--	V	--	--	--	--
NC-1151.01000	7.10	--	V	--	--	--	--
NC-1152.01000	3.40	--	V	--	--	--	--
NC-1153.01000	4.60	--	V	--	--	--	--
NC-1154.01000	1.40	--	V	--	--	--	--
NC-1155.01000	3.90	--	V	--	--	--	--
NC-1156.01000	24.80	--	V	--	--	--	--
NC-1157.01000	27.00	--	P	--	--	--	--
NC-1158.01000	104.00	--	P	--	--	--	--
NC-1159.01000	11.50	--	V	--	--	--	--
NC-1160.01000	1.80	--	P	--	--	--	--
NC-1161.01000	0.30	--	P	--	--	--	--
NC-1162.01000	2.30	--	V	--	--	--	--
NC-1163.61000	35.00	--	V	--	--	--	--
NC-1164.11000	0.84	--	V	--	--	--	--
NC-1164.21000	1.10	--	V	--	--	--	--
NC-1164.31000	0.30	--	V	--	--	--	--
NC-1164.41000	1.10	--	V	--	--	--	--
NC-1164.51000	0.30	--	V	--	--	--	--
NC-1167.01000	0.20	--	V	--	--	--	--
NC-1168.01000	0.07	--	V	--	--	--	--
NC-1169.01000	0.10	--	P	--	--	--	--
NC-1170.01000	0.30	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-1171.01000	0.00	0.52	V	--	--	--	--
NC-1172.01000	0.00	0.09	V	--	--	--	--
NC-1173.01000	0.08	--	V	--	--	--	--
NC-1174.01000	0.07	--	V	--	--	--	--
NC-1175.01000	0.00	0.09	V	--	--	--	--
NC-1176.01000	0.00	0.06	V	--	--	--	--
NC-1177.01000	0.00	0.34	V	--	--	--	--
NC-1178.01000	0.30	--	V	--	--	--	--
NC-1179.01000	0.00	0.95	V	--	--	--	--
NC-1180.01000	0.27	--	V	--	--	--	--
NC-1181.01000	0.00	0.03	V	--	--	--	--
NC-1182.01000	1.20	--	V	--	--	--	--
NC-1183.01000	1.78	--	V	--	--	--	--
NC-1185.01000	1.55	--	V	--	--	--	--
NC-1186.01000	0.40	--	V	--	--	--	--
NC-1187.01000	0.00	0.10	V	--	--	--	--
NC-1229.01000	0.20	--	V	--	--	--	--
NC-1231.01000	0.00	0.10	V	--	--	--	--
NC-1235.01000	0.36	--	V	--	--	--	--
NC-1236.01000	1.20	--	V	--	--	--	--
NC-1237.01000	4.70	--	V	--	--	--	--
NC-1238.01000	8.80	--	V	--	--	--	--
NC-1239.01000	11.60	--	V	--	--	--	--
NC-1240.01000	13.70	--	V	--	--	--	--
NC-1241.01000	5.10	--	V	--	--	--	--
NC-1242.01000	1.80	--	V	--	--	--	--
NC-1243.01000	4.00	--	V	--	--	--	--
NC-1244.11000	8.30	--	V	--	--	--	--
NC-1244.21000	6.60	--	V	--	--	--	--
NC-1244.31000	49.30	--	V	--	--	--	--
NC-1244.41000	8.80	--	V	--	--	--	--
NC-1244.51000	44.40	--	V	--	--	--	--
NC-1245.01000	15.60	--	V	--	--	--	--
NC-1246.01000	6.18	--	I	--	--	--	--
NC-1247.01000	3.30	--	V	--	--	--	--
NC-1248.01000	0.70	--	V	--	--	--	--
NC-1249.01000	1.20	--	V	--	--	--	--
NC-1250.01000	8.80	--	P	--	--	--	--
NC-1251.01000	11.20	--	V	--	--	--	--
NC-1252.01000	3.40	--	V	--	--	--	--
NC-1253.01000	2.40	--	V	--	--	--	--
NC-1254.61000	0.90	--	V	--	--	--	--
NC-1255.01000	0.10	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-1256.01000	36.80	--	V	--	--	--	--
NC-1257.01000	17.90	--	V	--	--	--	--
NC-1258.01000	30.80	--	V	--	--	--	--
NC-1259.01000	9.80	--	V	--	--	--	--
NC-1260.01000	26.90	--	V	--	--	--	--
NC-1261.01000	102.00	--	I	--	--	--	--
NC-1264.01000	1.50	--	V	--	--	--	--
NC-1265.01000	0.34	--	V	--	--	--	--
NC-1267.01000	0.00	0.10	V	--	--	--	--
NC-1268.01000	0.00	0.05	V	--	--	--	--
NC-1269.01000	0.00	0.10	V	--	--	--	--
NC-1270.01000	0.00	0.53	V	--	--	--	--
NC-1271.01000	0.80	--	V	--	--	--	--
NC-1272.01000	0.00	0.39	V	--	--	--	--
NC-1273.01000	0.20	--	V	--	--	--	--
NC-1274.11000	0.10	--	P	--	--	--	--
NC-1274.21000	0.10	--	P	--	--	--	--
NC-1274.31000	0.00	0.06	V	--	--	--	--
NC-1274.41000	0.00	0.07	V	--	--	--	--
NC-1274.51000	0.00	0.04	V	--	--	--	--
NC-1275.01000	0.07	--	V	--	--	--	--
NC-1276.01000	0.00	0.10	V	--	--	--	--
NC-1277.01000	0.00	0.32	V	--	--	--	--
NC-1278.01000	0.50	--	V	--	--	--	--
NC-1279.01000	1.10	--	V	--	--	--	--
NC-1280.01000	0.00	0.07	V	--	--	--	--
NC-1281.01000	0.00	0.07	V	--	--	--	--
NC-1282.01000	0.00	0.09	P	--	--	--	--
NC-1283.01000	0.00	0.90	V	--	--	--	--
NC-1284.01000	0.50	--	V	--	--	--	--
NC-1285.01000	0.26	--	V	--	--	--	--
NC-1286.01000	0.10	--	V	--	--	--	--
NC-1287.01000	0.00	0.01	V	--	--	--	--
NC-1292.01000	0.00	0.10	V	--	--	--	--
NC-1295.01000	0.00	0.10	V	--	--	--	--
NC-1312.01000	0.00	0.10	V	--	--	--	--
NC-1317.01000	0.00	0.10	V	--	--	--	--
NC-1319.01000	0.00	0.10	V	--	--	--	--
NC-1323.01000	0.00	0.10	I	--	--	--	--
NC-1326.01000	0.00	0.06	V	--	--	--	--
NC-1335.01000	0.40	--	V	--	--	--	--
NC-1336.01000	5.30	--	V	--	--	--	--
NC-1337.01000	7.17	--	I	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-1338.01000	27.60	--	V	--	--	--	--
NC-1339.01000	3.10	--	V	--	--	--	--
NC-1340.01000	17.90	--	V	--	--	--	--
NC-1341.01000	2.00	--	V	--	--	--	--
NC-1342.01000	1.40	--	V	--	--	--	--
NC-1343.61000	5.80	--	V	--	--	--	--
NC-1344.01000	8.95	--	I	--	--	--	--
NC-1345.01000	0.00	0.04	V	--	--	--	--
NC-1346.01000	13.70	--	V	--	--	--	--
NC-1347.01000	116.00	--	V	--	--	--	--
NC-1348.01000	0.00	0.10	I	--	--	--	--
NC-1349.01000	0.00	0.19	P	--	--	--	--
NC-1350.01000	24.20	--	V	--	--	--	--
NC-1351.01000	37.40	--	V	--	--	--	--
NC-1352.01000	2.60	--	P	--	--	--	--
NC-1353.01000	2.40	--	V	--	--	--	--
NC-1354.11000	4.00	--	V	--	--	--	--
NC-1354.21000	7.35	--	V	--	--	--	--
NC-1354.31000	1.30	--	V	--	--	--	--
NC-1354.41000	0.40	--	V	--	--	--	--
NC-1354.51000	0.45	--	V	--	--	--	--
NC-1355.01000	0.06	--	V	--	--	--	--
NC-1356.01000	0.40	--	V	--	--	--	--
NC-1357.01000	145.00	--	V	--	--	--	--
NC-1358.01000	5.80	--	V	--	--	--	--
NC-1359.01000	2.40	--	V	--	--	--	--
NC-1360.01000	11.10	--	V	--	--	--	--
NC-1361.01000	0.40	--	V	--	--	--	--
NC-1364.01000	2.70	--	V	--	--	--	--
NC-1365.01000	0.70	--	V	--	--	--	--
NC-1367.01000	0.11	--	P	--	--	--	--
NC-1368.01000	0.10	--	V	--	--	--	--
NC-1369.01000	0.07	--	V	--	--	--	--
NC-1370.01000	0.40	--	V	--	--	--	--
NC-1371.01000	0.50	--	V	--	--	--	--
NC-1372.01000	0.50	--	P	--	--	--	--
NC-1373.01000	0.90	--	V	--	--	--	--
NC-1374.01000	0.23	--	V	--	--	--	--
NC-1375.01000	0.03	--	V	--	--	--	--
NC-1376.01000	0.00	0.08	V	--	--	--	--
NC-1377.01000	0.20	--	V	--	--	--	--
NC-1378.01000	0.23	--	V	--	--	--	--
NC-1379.01000	0.55	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-1380.01000	0.30	--	V	--	--	--	--
NC-1381.01000	0.00	0.02	V	--	--	--	--
NC-1382.01000	0.10	--	V	--	--	--	--
NC-1383.01000	0.92	--	V	--	--	--	--
NC-1384.11000	1.60	--	V	--	--	--	--
NC-1384.21000	0.55	--	V	--	--	--	--
NC-1384.31000	0.51	--	V	--	--	--	--
NC-1384.41000	0.70	--	V	--	--	--	--
NC-1384.51000	0.50	--	V	--	--	--	--
NC-1385.61000	0.59	--	V	--	--	--	--
NC-1386.01000	0.11	--	P	--	--	--	--
NC-1387.01000	0.00	0.10	V	--	--	--	--
NC-1390.01000	0.00	0.10	V	--	--	--	--
NC-1397.01000	0.00	0.10	V	--	--	--	--
NC-13A4.01000	0.00	0.50	V	--	--	--	--
NC-13A6.61000	0.00	0.10	V	--	--	--	--
NC-1426.11000	0.00	0.10	V	--	--	--	--
NC-1426.21000	0.00	0.10	V	--	--	--	--
NC-1426.31000	0.00	0.08	V	--	--	--	--
NC-1426.41000	0.00	0.10	V	--	--	--	--
NC-1426.51000	0.00	0.40	I	--	--	--	--
NC-1427.01000	0.00	0.10	V	--	--	--	--
NC-1431.01000	0.00	0.10	V	--	--	--	--
NC-1435.01000	0.00	0.36	V	--	--	--	--
NC-1436.01000	1.50	--	V	--	--	--	--
NC-1437.01000	3.45	--	V	--	--	--	--
NC-1438.01000	6.70	--	V	--	--	--	--
NC-1439.01000	7.10	--	V	--	--	--	--
NC-1440.01000	2.40	--	V	--	--	--	--
NC-1441.01000	1.10	--	V	--	--	--	--
NC-1442.01000	0.50	--	V	--	--	--	--
NC-1443.01000	1.39	--	V	--	--	--	--
NC-1444.01000	6.23	--	V	--	--	--	--
NC-1445.01000	112.00	--	V	--	--	--	--
NC-1446.01000	18.00	--	V	--	--	--	--
NC-1447.01000	1.90	--	V	--	--	--	--
NC-1448.01000	0.68	--	V	--	--	--	--
NC-1449.01000	0.30	--	V	--	--	--	--
NC-1450.01000	149.00	--	V	--	--	--	--
NC-1451.01000	19.80	--	V	--	--	--	--
NC-1452.01000	2.50	--	V	--	--	--	--
NC-1453.01000	1.70	--	V	--	--	--	--
NC-1454.01000	1.10	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-1455.01000	0.50	--	V	--	--	--	--
NC-1456.01000	0.21	--	V	--	--	--	--
NC-1457.01000	2.60	--	V	--	--	--	--
NC-1458.01000	13.40	--	V	--	--	--	--
NC-1459.01000	5.28	--	V	--	--	--	--
NC-1460.01000	0.00	0.49	V	--	--	--	--
NC-1461.01000	0.00	1.30	V	--	--	--	--
NC-1462.01000	0.14	--	V	--	--	--	--
NC-1463.01000	0.00	0.20	V	--	--	--	--
NC-1464.11000	0.70	--	P	--	--	--	--
NC-1464.21000	0.00	0.88	V	--	--	--	--
NC-1464.31000	0.00	0.46	V	--	--	--	--
NC-1464.41000	0.50	--	V	--	--	--	--
NC-1464.51000	0.70	--	V	--	--	--	--
NC-1467.01000	0.15	--	V	--	--	--	--
NC-1468.01000	0.00	0.10	V	--	--	--	--
NC-1469.01000	0.19	--	V	--	--	--	--
NC-1470.01000	0.56	--	I	--	--	--	--
NC-1471.01000	0.90	--	V	--	--	--	--
NC-1472.01000	3.20	--	V	--	--	--	--
NC-1473.01000	0.17	--	V	--	--	--	--
NC-1474.61000	0.00	0.05	V	--	--	--	--
NC-1475.01000	0.00	0.10	V	--	--	--	--
NC-1476.01000	0.00	0.28	V	--	--	--	--
NC-1477.01000	0.20	--	V	--	--	--	--
NC-1478.01000	0.40	--	P	--	--	--	--
NC-1479.01000	0.60	--	P	--	--	--	--
NC-1480.01000	0.10	--	V	--	--	--	--
NC-1481.01000	0.00	0.08	V	--	--	--	--
NC-1482.01000	0.00	0.12	V	--	--	--	--
NC-1483.01000	0.00	0.77	I	--	--	--	--
NC-1484.01000	0.60	--	V	--	--	--	--
NC-1485.01000	0.56	--	V	--	--	--	--
NC-1486.01000	0.20	--	P	--	--	--	--
NC-1487.01000	0.00	0.10	V	--	--	--	--
NC-14B4.01000	0.00	0.10	V	--	--	--	--
NC-1525.01000	0.00	0.21	V	--	--	--	--
NC-1528.01000	0.00	0.14	V	--	--	--	--
NC-1535.01000	0.10	--	P	--	--	--	--
NC-1536.01000	0.20	--	I	--	--	--	--
NC-1542.01000	1.10	--	P	--	--	--	--
NC-1548.01000	3.80	--	V	--	--	--	--
NC-1555.01000	0.10	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-1561.01000	0.40	--	P	--	--	--	--
NC-1562.01000	0.10	--	V	--	--	--	--
NC-1568.01000	0.00	0.11	V	--	--	--	--
NC-1574.11000	0.00	0.13	V	--	--	--	--
NC-1574.21000	0.09	--	V	--	--	--	--
NC-1574.31000	0.20	--	P	--	--	--	--
NC-1574.41000	0.00	0.06	V	--	--	--	--
NC-1574.51000	0.20	--	V	--	--	--	--
NC-1575.01000	0.00	0.06	V	--	--	--	--
NC-1581.01000	0.00	0.10	I	--	--	--	--
NC-1582.01000	0.00	0.06	V	--	--	--	--
NC-1583.01000	0.00	0.15	V	--	--	--	--
NC-1584.01000	1.70	--	V	--	--	--	--
NC-1585.01000	0.40	--	P	--	--	--	--
NC-1586.01000	0.10	--	V	--	--	--	--
NC-1587.01000	0.00	0.10	V	--	--	--	--
NC-15A0.01000	0.00	0.10	V	--	--	--	--
NC-15B0.01000	0.00	0.10	V	--	--	--	--
NC-15B6.01000	0.00	0.20	I	--	--	--	--
NC-1612.01000	0.31	--	V	--	--	--	--
NC-1613.01000	0.00	0.08	P	--	--	--	--
NC-1614.01000	0.00	0.09	V	--	--	--	--
NC-1615.01000	0.00	0.10	V	--	--	--	--
NC-1616.01000	0.60	--	V	--	--	--	--
NC-1617.01000	0.10	--	V	--	--	--	--
NC-1618.01000	0.00	0.05	V	--	--	--	--
NC-1619.01000	1.60	--	P	--	--	--	--
NC-1620.01000	2.00	--	V	--	--	--	--
NC-1621.01000	0.00	0.40	V	--	--	--	--
NC-1622.01000	0.00	0.10	V	--	--	--	--
NC-1623.01000	0.00	0.10	V	--	--	--	--
NC-1624.01000	0.00	0.80	P	--	--	--	--
NC-1625.01000	0.17	--	V	--	--	--	--
NC-1626.01000	1.00	--	V	--	--	--	--
NC-1627.11000	0.51	--	V	--	--	--	--
NC-1627.21000	0.56	--	V	--	--	--	--
NC-1627.31000	0.00	0.10	V	--	--	--	--
NC-1627.41000	1.24	--	P	--	--	--	--
NC-1627.51000	0.69	--	V	--	--	--	--
NC-1628.01000	0.20	--	V	--	--	--	--
NC-1629.01000	0.00	0.01	V	--	--	--	--
NC-1630.01000	0.09	--	V	--	--	--	--
NC-1631.01000	1.14	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-1632.01000	0.70	--	V	--	--	--	--
NC-1634.01000	0.30	--	I	--	--	--	--
NC-1635.01000	0.00	0.13	V	--	--	--	--
NC-1636.01000	0.20	--	V	--	--	--	--
NC-1642.01000	0.70	--	V	--	--	--	--
NC-1648.01000	0.10	--	V	--	--	--	--
NC-1655.01000	0.10	--	V	--	--	--	--
NC-1661.01000	0.10	--	P	--	--	--	--
NC-1662.01000	0.20	--	V	--	--	--	--
NC-1668.01000	0.10	--	P	--	--	--	--
NC-1674.01000	0.18	--	V	--	--	--	--
NC-1675.01000	0.01	--	V	--	--	--	--
NC-1681.01000	0.00	0.10	V	--	--	--	--
NC-1682.01000	0.19	--	V	--	--	--	--
NC-1683.01000	1.30	--	V	--	--	--	--
NC-1684.01000	0.00	0.90	V	--	--	--	--
NC-1685.01000	0.00	0.18	V	--	--	--	--
NC-1686.01000	0.05	--	V	--	--	--	--
NC-1687.01000	0.03	--	V	--	--	--	--
NC-1691.01000	0.00	0.03	V	--	--	--	--
NC-16A3.01000	0.00	0.10	V	--	--	--	--
NC-1711.01000	0.02	--	V	--	--	--	--
NC-1712.11000	0.00	0.17	V	--	--	--	--
NC-1712.21000	1.51	--	V	--	--	--	--
NC-1712.31000	0.00	0.07	V	--	--	--	--
NC-1712.41000	0.00	0.22	V	--	--	--	--
NC-1712.51000	0.20	--	P	--	--	--	--
NC-1713.01000	0.05	--	V	--	--	--	--
NC-1714.01000	0.09	--	V	--	--	--	--
NC-1715.01000	0.00	0.10	V	--	--	--	--
NC-1716.01000	0.10	--	V	--	--	--	--
NC-1717.01000	0.00	0.03	V	--	--	--	--
NC-1718.61000	0.24	--	V	--	--	--	--
NC-1719.01000	0.00	0.90	V	--	--	--	--
NC-1720.01000	0.90	--	V	--	--	--	--
NC-1721.01000	0.30	--	V	--	--	--	--
NC-1722.01000	0.10	--	P	--	--	--	--
NC-1723.01000	0.00	0.14	V	--	--	--	--
NC-1724.01000	0.00	0.36	V	--	--	--	--
NC-1725.01000	0.80	--	V	--	--	--	--
NC-1726.01000	4.75	--	V	--	--	--	--
NC-1727.01000	2.05	--	V	--	--	--	--
NC-1728.01000	0.18	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-1729.01000	0.00	0.11	V	--	--	--	--
NC-1730.01000	0.20	--	P	--	--	--	--
NC-1731.01000	1.40	--	P	--	--	--	--
NC-1732.01000	1.58	--	V	--	--	--	--
NC-1734.01000	0.60	--	V	--	--	--	--
NC-1735.01000	0.20	--	V	--	--	--	--
NC-1736.01000	0.00	0.11	V	--	--	--	--
NC-1737.01000	33.40	--	V	--	--	--	--
NC-1738.01000	88.70	--	V	--	--	--	--
NC-1739.01000	55.10	--	V	--	--	--	--
NC-1740.11000	4.70	--	P	--	--	--	--
NC-1740.21000	1.50	--	V	--	--	--	--
NC-1740.31000	1.70	--	V	--	--	--	--
NC-1740.41000	1.20	--	P	--	--	--	--
NC-1740.51000	3.10	--	V	--	--	--	--
NC-1741.01000	0.80	--	V	--	--	--	--
NC-1742.01000	0.00	0.09	V	--	--	--	--
NC-1743.01000	0.00	0.45	V	--	--	--	--
NC-1744.01000	2.40	--	V	--	--	--	--
NC-1745.01000	6.20	--	P	--	--	--	--
NC-1746.01000	4.30	--	V	--	--	--	--
NC-1747.01000	3.40	--	V	--	--	--	--
NC-1748.01000	0.00	0.04	V	--	--	--	--
NC-1749.01000	10.20	--	V	--	--	--	--
NC-1750.01000	1.50	--	V	--	--	--	--
NC-1751.01000	3.38	--	V	--	--	--	--
NC-1752.01000	2.50	--	V	--	--	--	--
NC-1753.01000	1.80	--	V	--	--	--	--
NC-1754.01000	8.30	--	V	--	--	--	--
NC-1755.01000	0.00	0.27	V	--	--	--	--
NC-1756.01000	1.60	--	V	--	--	--	--
NC-1757.01000	5.90	--	V	--	--	--	--
NC-1758.61000	5.90	--	V	--	--	--	--
NC-1759.01000	8.10	--	V	--	--	--	--
NC-1760.01000	3.40	--	V	--	--	--	--
NC-1761.01000	0.50	--	V	--	--	--	--
NC-1762.01000	0.10	--	V	--	--	--	--
NC-1763.01000	0.80	--	V	--	--	--	--
NC-1764.01000	0.70	--	V	--	--	--	--
NC-1765.01000	0.00	2.01	V	--	--	--	--
NC-1766.01000	0.44	--	V	--	--	--	--
NC-1767.01000	0.00	0.07	V	--	--	--	--
NC-1768.01000	0.00	0.07	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-1769.01000	0.00	0.04	V	--	--	--	--
NC-1770.11000	0.20	--	V	--	--	--	--
NC-1770.21000	0.20	--	V	--	--	--	--
NC-1770.31000	0.00	0.20	V	--	--	--	--
NC-1770.41000	0.00	0.27	V	--	--	--	--
NC-1770.51000	0.20	--	V	--	--	--	--
NC-1771.01000	1.10	--	P	--	--	--	--
NC-1772.01000	1.40	--	V	--	--	--	--
NC-1773.01000	0.83	--	V	--	--	--	--
NC-1774.01000	0.00	0.16	V	--	--	--	--
NC-1775.01000	0.00	0.10	V	--	--	--	--
NC-1776.01000	0.20	--	V	--	--	--	--
NC-1777.01000	0.60	--	V	--	--	--	--
NC-1778.01000	1.10	--	V	--	--	--	--
NC-1779.01000	1.15	--	V	--	--	--	--
NC-1780.01000	0.00	0.06	V	--	--	--	--
NC-1781.01000	0.00	0.03	V	--	--	--	--
NC-1782.01000	0.00	0.20	P	--	--	--	--
NC-1783.01000	0.00	0.69	V	--	--	--	--
NC-1784.01000	0.00	0.41	V	--	--	--	--
NC-1785.01000	2.40	--	V	--	--	--	--
NC-1786.01000	0.00	0.01	V	--	--	--	--
NC-1787.01000	0.00	0.10	V	--	--	--	--
NC-1790.01000	--	--	M	--	--	--	--
NC-17A7.01000	0.00	0.10	V	--	--	--	--
NC-1811.01000	0.06	--	V	--	--	--	--
NC-1812.01000	0.00	0.10	V	--	--	--	--
NC-1813.01000	0.00	0.26	V	--	--	--	--
NC-1814.01000	0.00	0.40	V	--	--	--	--
NC-1815.01000	0.00	0.10	V	--	--	--	--
NC-1816.01000	0.00	2.30	V	--	--	--	--
NC-1817.01000	0.00	0.24	V	--	--	--	--
NC-1818.01000	0.00	0.60	V	--	--	--	--
NC-1819.01000	0.96	--	V	--	--	--	--
NC-1820.01000	1.20	--	V	--	--	--	--
NC-1821.61000	0.47	--	V	--	--	--	--
NC-1822.01000	0.00	0.05	V	--	--	--	--
NC-1823.11000	0.00	0.04	I	--	--	--	--
NC-1823.21000	0.00	0.10	V	--	--	--	--
NC-1823.31000	0.07	--	V	--	--	--	--
NC-1823.41000	0.00	1.09	V	--	--	--	--
NC-1823.51000	0.00	0.06	V	--	--	--	--
NC-1824.01000	0.20	--	I	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-1825.01000	0.00	1.20	V	--	--	--	--
NC-1826.01000	11.80	--	V	--	--	--	--
NC-1827.01000	0.00	0.03	V	--	--	--	--
NC-1828.01000	0.00	0.30	V	--	--	--	--
NC-1829.01000	0.00	0.10	V	--	--	--	--
NC-1830.01000	0.80	--	V	--	--	--	--
NC-1831.01000	10.40	--	P	--	--	--	--
NC-1832.01000	0.00	2.52	V	--	--	--	--
NC-1834.01000	0.20	--	V	--	--	--	--
NC-1835.01000	0.23	--	V	--	--	--	--
NC-1836.01000	0.15	--	V	--	--	--	--
NC-1837.01000	9.60	--	V	--	--	--	--
NC-1838.01000	10.10	--	V	--	--	--	--
NC-1839.01000	21.70	--	V	--	--	--	--
NC-1840.01000	0.60	--	V	--	--	--	--
NC-1841.01000	0.00	0.35	V	--	--	--	--
NC-1842.01000	0.13	--	V	--	--	--	--
NC-1843.01000	4.04	--	V	--	--	--	--
NC-1844.01000	13.20	--	V	--	--	--	--
NC-1845.01000	1.69	--	V	--	--	--	--
NC-1846.01000	2.30	--	V	--	--	--	--
NC-1847.01000	4.00	--	V	--	--	--	--
NC-1848.01000	0.46	--	V	--	--	--	--
NC-1849.01000	2.20	--	V	--	--	--	--
NC-1850.01000	25.30	--	V	--	--	--	--
NC-1851.01000	3.10	--	V	--	--	--	--
NC-1852.01000	38.60	--	V	--	--	--	--
NC-1853.11000	1.50	--	V	--	--	--	--
NC-1853.21000	0.80	--	P	--	--	--	--
NC-1853.31000	0.70	--	V	--	--	--	--
NC-1853.41000	0.70	--	V	--	--	--	--
NC-1853.51000	0.90	--	V	--	--	--	--
NC-1854.01000	13.30	--	V	--	--	--	--
NC-1855.01000	0.10	--	P	--	--	--	--
NC-1856.01000	0.50	--	V	--	--	--	--
NC-1857.01000	0.80	--	V	--	--	--	--
NC-1858.01000	5.10	--	V	--	--	--	--
NC-1859.01000	11.50	--	V	--	--	--	--
NC-1860.01000	1.70	--	V	--	--	--	--
NC-1861.61000	0.00	0.20	V	--	--	--	--
NC-1862.01000	0.00	0.14	V	--	--	--	--
NC-1863.01000	0.20	--	V	--	--	--	--
NC-1864.01000	0.36	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-1865.01000	0.50	--	V	--	--	--	--
NC-1866.01000	0.43	--	V	--	--	--	--
NC-1867.01000	0.14	--	I	--	--	--	--
NC-1868.01000	0.00	0.04	I	--	--	--	--
NC-1869.01000	0.18	--	V	--	--	--	--
NC-1870.01000	0.00	0.11	V	--	--	--	--
NC-1871.01000	0.30	--	V	--	--	--	--
NC-1872.01000	0.60	--	V	--	--	--	--
NC-1873.01000	1.90	--	P	--	--	--	--
NC-1874.01000	0.00	0.10	V	--	--	--	--
NC-1875.01000	0.00	0.10	V	--	--	--	--
NC-1876.01000	0.00	0.62	V	--	--	--	--
NC-1877.01000	2.30	--	V	--	--	--	--
NC-1878.01000	2.00	--	V	--	--	--	--
NC-1879.01000	0.90	--	I	--	--	--	--
NC-1880.01000	0.00	0.10	V	--	--	--	--
NC-1881.01000	0.10	--	V	--	--	--	--
NC-1882.01000	0.30	--	P	--	--	--	--
NC-1883.11000	0.00	0.71	V	--	--	--	--
NC-1883.21000	0.40	--	P	--	--	--	--
NC-1883.31000	0.50	--	V	--	--	--	--
NC-1883.41000	0.40	--	P	--	--	--	--
NC-1883.51000	1.60	--	V	--	--	--	--
NC-1884.01000	1.40	--	V	--	--	--	--
NC-1885.01000	0.50	--	V	--	--	--	--
NC-1886.01000	0.00	0.07	V	--	--	--	--
NC-1887.01000	0.00	0.10	V	--	--	--	--
NC-1896.01000	0.00	0.10	V	--	--	--	--
NC-18A1.01000	0.00	0.10	V	--	--	--	--
NC-1910.01000	0.00	0.10	V	--	--	--	--
NC-1911.01000	0.00	0.02	V	--	--	--	--
NC-1912.01000	0.00	0.13	V	--	--	--	--
NC-1913.01000	0.30	--	V	--	--	--	--
NC-1914.01000	1.99	--	V	--	--	--	--
NC-1915.01000	0.00	0.07	V	--	--	--	--
NC-1916.01000	0.00	1.85	I	--	--	--	--
NC-1917.01000	0.00	0.33	V	--	--	--	--
NC-1918.01000	0.70	--	V	--	--	--	--
NC-1919.01000	2.40	--	V	--	--	--	--
NC-1920.01000	7.00	--	V	--	--	--	--
NC-1921.01000	0.80	--	V	--	--	--	--
NC-1922.01000	0.00	0.10	V	--	--	--	--
NC-1923.01000	0.10	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-1924.61000	0.80	--	V	--	--	--	--
NC-1925.01000	4.00	--	V	--	--	--	--
NC-1926.01000	22.60	--	V	--	--	--	--
NC-1927.01000	1.40	--	V	--	--	--	--
NC-1928.01000	9.40	--	V	--	--	--	--
NC-1929.01000	0.00	0.30	V	--	--	--	--
NC-1930.01000	1.80	--	V	--	--	--	--
NC-1931.01000	13.00	--	V	--	--	--	--
NC-1932.01000	1.99	--	V	--	--	--	--
NC-1934.01000	0.30	--	V	--	--	--	--
NC-1935.01000	0.00	0.25	I	--	--	--	--
NC-1936.11000	0.00	0.23	I	--	--	--	--
NC-1936.21000	0.60	--	V	--	--	--	--
NC-1936.31000	0.25	--	V	--	--	--	--
NC-1936.41000	0.30	--	V	--	--	--	--
NC-1936.51000	0.10	--	V	--	--	--	--
NC-1937.01000	0.40	--	V	--	--	--	--
NC-1938.01000	0.90	--	V	--	--	--	--
NC-1939.01000	0.40	--	V	--	--	--	--
NC-1940.01000	0.30	--	V	--	--	--	--
NC-1941.01000	6.50	--	V	--	--	--	--
NC-1942.01000	0.20	--	V	--	--	--	--
NC-1943.01000	74.90	--	V	--	--	--	--
NC-1944.01000	14.80	--	V	--	--	--	--
NC-1945.01000	4.70	--	V	--	--	--	--
NC-1946.01000	1.90	--	V	--	--	--	--
NC-1947.01000	64.70	--	V	--	--	--	--
NC-1948.01000	0.90	--	V	--	--	--	--
NC-1949.01000	1.30	--	P	--	--	--	--
NC-1950.01000	1.40	--	V	--	--	--	--
NC-1951.01000	1.20	--	V	--	--	--	--
NC-1952.01000	1.80	--	V	--	--	--	--
NC-1953.01000	0.70	--	V	--	--	--	--
NC-1954.01000	0.70	--	V	--	--	--	--
NC-1955.01000	3.00	--	V	--	--	--	--
NC-1956.01000	0.10	--	V	--	--	--	--
NC-1957.01000	1.20	--	V	--	--	--	--
NC-1958.01000	7.13	--	V	--	--	--	--
NC-1959.01000	35.50	--	V	--	--	--	--
NC-1960.01000	6.30	--	V	--	--	--	--
NC-1961.01000	0.60	--	P	--	--	--	--
NC-1962.01000	0.50	--	V	--	--	--	--
NC-1963.01000	0.50	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-1964.61000	0.37	--	V	--	--	--	--
NC-1965.01000	0.60	--	V	--	--	--	--
NC-1966.11000	0.60	--	V	--	--	--	--
NC-1966.21000	0.20	--	V	--	--	--	--
NC-1966.31000	0.60	--	V	--	--	--	--
NC-1966.41000	0.00	0.14	V	--	--	--	--
NC-1966.51000	0.42	--	V	--	--	--	--
NC-1967.01000	0.00	0.10	V	--	--	--	--
NC-1968.01000	0.00	0.02	V	--	--	--	--
NC-1969.01000	0.00	0.10	V	--	--	--	--
NC-1970.01000	0.00	0.04	V	--	--	--	--
NC-1971.01000	1.00	--	V	--	--	--	--
NC-1972.01000	1.70	--	V	--	--	--	--
NC-1973.01000	0.31	--	V	--	--	--	--
NC-1974.01000	0.00	0.10	V	--	--	--	--
NC-1975.01000	0.00	0.13	V	--	--	--	--
NC-1976.01000	0.50	--	V	--	--	--	--
NC-1977.01000	2.40	--	I	--	--	--	--
NC-1978.01000	4.40	--	V	--	--	--	--
NC-1979.01000	0.50	--	P	--	--	--	--
NC-1980.01000	0.00	0.10	V	--	--	--	--
NC-1981.01000	0.15	--	V	--	--	--	--
NC-1982.01000	0.00	0.05	V	--	--	--	--
NC-1983.01000	0.00	0.31	V	--	--	--	--
NC-1984.01000	0.80	--	V	--	--	--	--
NC-1985.01000	1.10	--	V	--	--	--	--
NC-1986.01000	0.00	0.09	V	--	--	--	--
NC-1987.01000	0.00	0.10	V	--	--	--	--
NC-19A6.01000	0.00	0.10	V	--	--	--	--
NC-19B5.01000	0.00	0.10	V	--	--	--	--
NC-2010.01000	0.00	0.17	V	--	--	--	--
NC-2011.01000	0.35	--	V	--	--	--	--
NC-2012.01000	0.00	0.02	V	--	--	--	--
NC-2013.01000	1.00	--	V	--	--	--	--
NC-2014.01000	3.30	--	V	--	--	--	--
NC-2015.01000	1.09	--	V	--	--	--	--
NC-2016.01000	0.30	--	P	--	--	--	--
NC-2017.01000	0.80	--	V	--	--	--	--
NC-2018.01000	0.60	--	V	--	--	--	--
NC-2019.11000	2.50	--	V	--	--	--	--
NC-2019.21000	2.70	--	P	--	--	--	--
NC-2019.31000	2.80	--	V	--	--	--	--
NC-2019.41000	1.90	--	P	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

Sample Number	TCDD (ppb) Reporting Conc.	TCDD (ppb) Reporting Limit	Status	2,4-D (ppb) Conc.	2,4-D (ppb) Detection Limit	2,4,5-T (ppb) Conc.	2,4,5-T (ppb) Detection Limit
NC-2019.51000	2.70	--	V	--	--	--	--
NC-2020.01000	7.40	--	P	--	--	--	--
NC-2021.01000	0.00	1.46	V	--	--	--	--
NC-2022.01000	0.00	0.14	V	--	--	--	--
NC-2023.01000	0.00	0.15	V	--	--	--	--
NC-2024.01000	0.00	1.20	V	--	--	--	--
NC-2025.01000	6.00	--	V	--	--	--	--
NC-2026.01000	14.80	--	V	--	--	--	--
NC-2027.61000	16.40	--	V	--	--	--	--
NC-2027.02000	11.80	--	V	--	--	--	--
NC-2027.02001	0.08	--	V	--	--	--	--
NC-2027.02004	0.12	--	P	--	--	--	--
NC-2027.04000	5.00	--	V	--	--	--	--
NC-2028.01000	1.50	--	V	--	--	--	--
NC-2029.01000	0.00	0.53	V	--	--	--	--
NC-2030.01000	1.30	--	V	--	--	--	--
NC-2030.03000	2.30	--	V	0	200	0	200
NC-2030.63001	0.41	--	V	17962	--	0	600
NC-2030.03004	0.07	--	V	0	500	0	500
NC-2030.03008	0.00	0.01	V	0	500	0	500
NC-2030.03020	0.01	--	V	0	500	0	500
NC-2030.03030	0.02	--	V	0	500	0	500
NC-2030.03040	0.02	--	P	0	500	0	500
NC-2030.04000	0.03	--	V	67265	--	96982	--
NC-2031.01000	12.70	--	V	--	--	--	--
NC-2032.01000	4.40	--	V	--	--	--	--
NC-2034.01000	0.60	--	V	--	--	--	--
NC-2035.01000	0.20	--	P	--	--	--	--
NC-2036.01000	0.26	--	V	--	--	--	--
NC-2037.01000	0.00	0.41	V	--	--	--	--
NC-2038.01000	0.80	--	V	--	--	--	--
NC-2039.01000	0.68	--	V	--	--	--	--
NC-2040.01000	0.00	0.27	V	--	--	--	--
NC-2041.01000	0.40	--	V	--	--	--	--
NC-2042.01000	0.08	--	V	--	--	--	--
NC-2043.01000	1.90	--	V	--	--	--	--
NC-2044.01000	147.00	--	V	--	--	--	--
NC-2045.01000	1.10	--	V	--	--	--	--
NC-2046.01000	0.80	--	V	--	--	--	--
NC-2047.01000	0.00	1.12	V	--	--	--	--
NC-2048.01000	0.30	--	V	--	--	--	--
NC-2049.11000	0.00	0.10	V	--	--	--	--
NC-2049.21000	0.27	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-2049.31000	0.00	0.92	V	--	--	--	--
NC-2049.41000	0.00	0.24	V	--	--	--	--
NC-2049.51000	0.00	0.30	V	--	--	--	--
NC-2050.01000	0.00	0.65	V	--	--	--	--
NC-2051.01000	0.71	--	V	--	--	--	--
NC-2052.01000	0.80	--	I	--	--	--	--
NC-2053.01000	0.30	--	I	--	--	--	--
NC-2054.01000	0.00	0.20	V	--	--	--	--
NC-2055.01000	0.00	0.01	V	--	--	--	--
NC-2056.01000	0.00	0.30	V	--	--	--	--
NC-2057.01000	0.00	0.63	V	--	--	--	--
NC-2058.01000	1.95	--	V	--	--	--	--
NC-2059.01000	2.10	--	V	--	--	--	--
NC-2060.01000	1.00	--	V	--	--	--	--
NC-2061.01000	0.00	0.02	V	--	--	--	--
NC-2062.01000	0.00	0.12	V	--	--	--	--
NC-2063.01000	0.45	--	P	--	--	--	--
NC-2064.01000	0.00	1.57	V	--	--	--	--
NC-2065.01000	1.07	--	V	--	--	--	--
NC-2066.01000	0.44	--	I	--	--	--	--
NC-2067.61000	0.00	0.15	V	--	--	--	--
NC-2068.01000	0.42	--	V	--	--	--	--
NC-2069.01000	0.60	--	V	--	--	--	--
NC-2070.01000	0.00	0.16	V	--	--	--	--
NC-2071.01000	0.86	--	V	--	--	--	--
NC-2072.01000	5.10	--	V	--	--	--	--
NC-2073.01000	0.00	0.27	V	--	--	--	--
NC-2074.01000	0.00	0.10	V	--	--	--	--
NC-2075.01000	0.00	0.01	V	--	--	--	--
NC-2076.01000	0.00	0.13	V	--	--	--	--
NC-2077.01000	2.51	--	P	--	--	--	--
NC-2078.01000	4.30	--	V	--	--	--	--
NC-2079.11000	1.00	--	V	--	--	--	--
NC-2079.21000	0.00	0.23	V	--	--	--	--
NC-2079.31000	0.40	--	I	--	--	--	--
NC-2079.41000	0.00	0.21	V	--	--	--	--
NC-2079.51000	0.00	0.27	V	--	--	--	--
NC-2080.01000	0.00	0.10	V	--	--	--	--
NC-2081.01000	0.00	0.26	V	--	--	--	--
NC-2082.01000	0.09	--	V	--	--	--	--
NC-2083.01000	0.00	0.96	V	--	--	--	--
NC-2084.01000	2.18	--	V	--	--	--	--
NC-2085.01000	0.87	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-2086.01000	0.16	--	V	--	--	--	--
NC-2087.01000	0.00	0.04	V	--	--	--	--
NC-2096.01000	0.00	0.10	V	--	--	--	--
NC-2098.01000	0.00	0.10	V	--	--	--	--
NC-20A7.61000	0.00	0.10	V	--	--	--	--
NC-2110.01000	0.00	0.10	V	--	--	--	--
NC-2111.01000	0.10	--	P	--	--	--	--
NC-2112.01000	0.20	--	V	--	--	--	--
NC-2113.01000	0.90	--	P	--	--	--	--
NC-2114.01000	4.30	--	V	--	--	--	--
NC-2115.01000	7.60	--	V	--	--	--	--
NC-2115.02000	8.40	--	V	--	--	--	--
NC-2115.02001	7.60	--	V	--	--	--	--
NC-2115.02004	8.50	--	V	--	--	--	--
NC-2115.04000	0.17	--	V	--	--	--	--
NC-2116.01000	0.00	0.40	V	--	--	--	--
NC-2117.01000	1.60	--	V	--	--	--	--
NC-2118.01000	5.00	--	V	--	--	--	--
NC-2119.01000	5.40	--	P	--	--	--	--
NC-2120.01000	4.40	--	V	--	--	--	--
NC-2121.01000	2.80	--	P	--	--	--	--
NC-2122.01000	0.40	--	V	--	--	--	--
NC-2123.01000	0.44	--	V	--	--	--	--
NC-2124.01000	2.00	--	V	--	--	--	--
NC-2125.01000	4.60	--	V	--	--	--	--
NC-2126.01000	10.50	--	V	--	--	--	--
NC-2127.01000	5.60	--	P	--	--	--	--
NC-2128.01000	1.70	--	V	--	--	--	--
NC-2129.01000	0.90	--	V	--	--	--	--
NC-2130.61000	31.90	--	V	--	--	--	--
NC-2131.11000	24.30	--	V	--	--	--	--
NC-2131.21000	15.80	--	V	--	--	--	--
NC-2131.31000	14.80	--	V	--	--	--	--
NC-2131.41000	21.10	--	P	--	--	--	--
NC-2131.51000	13.90	--	I	--	--	--	--
NC-2132.01000	2.90	--	V	--	--	--	--
NC-2134.01000	0.40	--	V	--	--	--	--
NC-2135.01000	0.20	--	V	--	--	--	--
NC-2136.01000	0.00	0.22	V	--	--	--	--
NC-2137.01000	0.60	--	P	--	--	--	--
NC-2138.01000	0.00	0.56	V	--	--	--	--
NC-2139.01000	1.00	--	V	--	--	--	--
NC-2140.01000	0.80	--	P	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-2141.01000	0.40	--	V	--	--	--	--
NC-2142.01000	0.00	0.20	V	--	--	--	--
NC-2143.01000	0.30	--	P	--	--	--	--
NC-2144.01000	0.00	0.86	V	--	--	--	--
NC-2145.01000	0.90	--	P	--	--	--	--
NC-2146.01000	0.70	--	V	--	--	--	--
NC-2147.01000	1.30	--	V	--	--	--	--
NC-2148.01000	0.97	--	V	--	--	--	--
NC-2149.01000	0.00	0.13	V	--	--	--	--
NC-2150.01000	0.00	0.05	V	--	--	--	--
NC-2151.01000	1.10	--	V	--	--	--	--
NC-2152.01000	0.80	--	V	--	--	--	--
NC-2153.01000	0.00	0.26	V	--	--	--	--
NC-2154.01000	0.00	0.05	P	--	--	--	--
NC-2155.01000	0.00	0.10	V	--	--	--	--
NC-2156.01000	0.00	0.10	V	--	--	--	--
NC-2157.01000	0.40	--	I	--	--	--	--
NC-2158.01000	4.13	--	V	--	--	--	--
NC-2159.01000	1.08	--	V	--	--	--	--
NC-2160.01000	0.50	--	V	--	--	--	--
NC-2161.01000	0.00	0.08	V	--	--	--	--
NC-2162.11000	0.21	--	V	--	--	--	--
NC-2162.21000	0.00	0.12	V	--	--	--	--
NC-2162.31000	0.00	0.09	V	--	--	--	--
NC-2162.41000	0.20	--	I	--	--	--	--
NC-2162.51000	0.00	0.05	V	--	--	--	--
NC-2163.01000	1.00	--	V	--	--	--	--
NC-2164.01000	1.80	--	V	--	--	--	--
NC-2165.01000	5.90	--	V	--	--	--	--
NC-2166.01000	1.70	--	V	--	--	--	--
NC-2167.01000	0.37	--	V	--	--	--	--
NC-2168.01000	0.20	--	V	--	--	--	--
NC-2169.01000	0.00	0.19	V	--	--	--	--
NC-2170.61000	0.47	--	V	--	--	--	--
NC-2171.01000	2.00	--	V	--	--	--	--
NC-2172.01000	10.00	--	V	--	--	--	--
NC-2173.01000	1.60	--	V	--	--	--	--
NC-2174.01000	0.00	0.10	V	--	--	--	--
NC-2175.01000	0.00	0.67	V	--	--	--	--
NC-2176.01000	0.00	0.13	V	--	--	--	--
NC-2177.01000	9.95	--	V	--	--	--	--
NC-2178.01000	3.50	--	V	--	--	--	--
NC-2179.01000	0.80	--	I	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-2180.01000	0.00	0.15	V	--	--	--	--
NC-2181.01000	0.48	--	V	--	--	--	--
NC-2182.01000	0.90	--	V	--	--	--	--
NC-2184.01000	4.68	--	V	--	--	--	--
NC-2185.01000	4.02	--	V	--	--	--	--
NC-2186.01000	0.00	1.41	V	--	--	--	--
NC-2187.01000	3.20	--	V	--	--	--	--
NC-21B5.01000	0.00	0.10	I	--	--	--	--
NC-2210.01000	0.00	0.80	I	--	--	--	--
NC-2211.01000	0.00	2.60	P	--	--	--	--
NC-2212.01000	34.60	--	V	--	--	--	--
NC-2213.01000	1.75	--	V	--	--	--	--
NC-2214.01000	7.20	--	P	--	--	--	--
NC-2215.02000	425.00	--	P	--	--	--	--
NC-2215.02001	94.50	--	V	--	--	--	--
NC-2215.02004	74.90	--	V	--	--	--	--
NC-2215.04000	8.70	--	V	--	--	--	--
NC-2215.11000	59.00	--	V	--	--	--	--
NC-2215.21000	69.60	--	V	--	--	--	--
NC-2215.31000	53.90	--	V	--	--	--	--
NC-2215.41000	156.00	--	V	--	--	--	--
NC-2215.51000	95.20	--	V	--	--	--	--
NC-2216.01000	0.40	--	P	--	--	--	--
NC-2217.01000	7.30	--	P	--	--	--	--
NC-2218.01000	13.50	--	V	--	--	--	--
NC-2218.02000	13.50	--	I	--	--	--	--
NC-2218.02001	7.60	--	V	--	--	--	--
NC-2218.02004	0.34	--	V	--	--	--	--
NC-2218.04000	6.20	--	V	--	--	--	--
NC-2219.01000	6.10	--	V	--	--	--	--
NC-2220.01000	2.10	--	V	--	--	--	--
NC-2221.01000	4.80	--	V	--	--	--	--
NC-2222.01000	2.50	--	V	--	--	--	--
NC-2223.01000	1.00	--	V	--	--	--	--
NC-2224.01000	3.90	--	V	--	--	--	--
NC-2225.01000	2.60	--	V	--	--	--	--
NC-2226.01000	10.20	--	P	--	--	--	--
NC-2227.01000	37.20	--	V	--	--	--	--
NC-2227.02000	17.30	--	V	--	--	--	--
NC-2227.02001	0.00	0.02	V	--	--	--	--
NC-2227.02004	0.22	--	V	--	--	--	--
NC-2227.04000	0.85	--	V	--	--	--	--
NC-2228.01000	3.50	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-2229.01000	0.80	--	V	--	--	--	--
NC-2230.01000	63.00	--	P	--	--	--	--
NC-2231.01000	14.30	--	V	--	--	--	--
NC-2232.01000	6.90	--	V	--	--	--	--
NC-2234.01000	0.70	--	V	--	--	--	--
NC-2235.01000	0.00	0.26	V	--	--	--	--
NC-2236.01000	0.00	0.20	V	--	--	--	--
NC-2237.01000	0.40	--	V	--	--	--	--
NC-2238.01000	0.50	--	V	--	--	--	--
NC-2239.01000	1.10	--	V	--	--	--	--
NC-2240.01000	2.10	--	P	--	--	--	--
NC-2241.01000	0.80	--	V	--	--	--	--
NC-2242.01000	0.00	0.21	V	--	--	--	--
NC-2243.01000	0.70	--	V	--	--	--	--
NC-2244.01000	1.90	--	V	--	--	--	--
NC-2245.11000	2.40	--	V	--	--	--	--
NC-2245.21000	4.30	--	V	--	--	--	--
NC-2245.31000	0.00	0.10	V	--	--	--	--
NC-2245.41000	3.45	--	V	--	--	--	--
NC-2245.51000	1.30	--	V	--	--	--	--
NC-2246.01000	3.10	--	V	--	--	--	--
NC-2247.01000	1.60	--	V	--	--	--	--
NC-2248.01000	1.10	--	P	--	--	--	--
NC-2249.01000	1.40	--	P	--	--	--	--
NC-2250.01000	2.00	--	V	--	--	--	--
NC-2251.01000	3.06	--	V	--	--	--	--
NC-2252.01000	5.20	--	V	--	--	--	--
NC-2253.01000	5.50	--	V	--	--	--	--
NC-2254.01000	3.30	--	V	--	--	--	--
NC-2255.01000	0.00	0.18	V	--	--	--	--
NC-2256.01000	3.80	--	V	--	--	--	--
NC-2257.01000	11.30	--	V	--	--	--	--
NC-2258.01000	29.10	--	V	--	--	--	--
NC-2259.01000	9.30	--	V	--	--	--	--
NC-2260.01000	4.00	--	V	--	--	--	--
NC-2261.01000	1.90	--	P	--	--	--	--
NC-2262.01000	0.95	--	P	--	--	--	--
NC-2263.01000	4.70	--	V	--	--	--	--
NC-2264.01000	13.30	--	V	--	--	--	--
NC-2265.01000	19.80	--	V	--	--	--	--
NC-2266.01000	5.70	--	V	--	--	--	--
NC-2267.01000	14.70	--	V	--	--	--	--
NC-2268.01000	1.20	--	P	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

Sample Number	TCDD (ppb) Reporting Conc.	TCDD (ppb) Reporting Limit	Status	2,4-D (ppb) Conc.	2,4-D (ppb) Detection Limit	2,4,5-T (ppb) Conc.	2,4,5-T (ppb) Detection Limit
NC-2269.01000	2.80	--	V	--	--	--	--
NC-2270.01000	9.90	--	V	--	--	--	--
NC-2271.01000	27.50	--	V	--	--	--	--
NC-2272.01000	25.30	--	V	--	--	--	--
NC-2273.61000	--	--	M	--	--	--	--
NC-2274.01000	7.68	--	V	--	--	--	--
NC-2275.11000	2.00	--	V	--	--	--	--
NC-2275.21000	2.20	--	V	--	--	--	--
NC-2275.31000	2.30	--	V	--	--	--	--
NC-2275.41000	1.10	--	V	--	--	--	--
NC-2275.51000	3.80	--	V	--	--	--	--
NC-2276.01000	4.90	--	V	--	--	--	--
NC-2277.01000	9.40	--	V	--	--	--	--
NC-2278.01000	--	--	M	--	--	--	--
NC-2279.01000	5.00	--	V	--	--	--	--
NC-2280.01000	0.70	--	P	--	--	--	--
NC-2281.01000	0.20	--	P	--	--	--	--
NC-2282.01000	7.10	--	P	--	--	--	--
NC-2284.01000	4.58	--	P	--	--	--	--
NC-2285.01000	2.10	--	V	--	--	--	--
NC-2286.01000	0.10	--	V	--	--	--	--
NC-2287.01000	0.00	0.21	V	--	--	--	--
NC-2293.01000	0.00	0.10	V	--	--	--	--
NC-22B5.11000	0.07	--	V	--	--	--	--
NC-22B5.21000	0.40	--	V	--	--	--	--
NC-22B5.31000	0.30	--	V	--	--	--	--
NC-22B5.41000	0.00	0.10	V	--	--	--	--
NC-22B5.51000	0.00	0.10	V	--	--	--	--
NC-22B9.01000	0.00	0.10	V	--	--	--	--
NC-2309.01000	0.06	--	V	--	--	--	--
NC-2310.01000	0.10	--	V	--	--	--	--
NC-2310.01000	0.10	--	V	--	--	--	--
NC-2311.01000	0.20	--	V	--	--	--	--
NC-2312.01000	0.30	--	V	--	--	--	--
NC-2313.01000	0.75	--	V	--	--	--	--
NC-2314.01000	0.40	--	I	--	--	--	--
NC-2315.01000	0.70	--	V	--	--	--	--
NC-2316.01000	0.20	--	I	--	--	--	--
NC-2317.01000	87.80	--	I	--	--	--	--
NC-2317.03000	118.00	--	V	47350	--	138268	--
NC-2317.03001	1.20	--	V	0	1000	15152	--
NC-2317.03004	0.28	--	V	25900	--	13655	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

Sample Number	TCDD (ppb) Reporting Conc.	TCDD (ppb) Reporting Limit	Status	2,4-D (ppb) Conc.	2,4-D (ppb) Detection Limit	2,4,5-T (ppb) Conc.	2,4,5-T (ppb) Detection Limit
NC-2317.03008	0.04	--	V	0	200	0	200
NC-2317.03020	0.07	--	V	0	200	0	200
NC-2317.03030	0.01	--	V	0	200	0	200
NC-2317.03040	0.00	0.01	V	0	200	0	200
NC-2317.04000	2.00	--	V	18135	--	72628	--
NC-2318.01000	4.90	--	P	--	--	--	--
NC-2319.01000	0.40	--	V	--	--	--	--
NC-2320.01000	1.60	--	V	--	--	--	--
NC-2321.01000	38.00	--	V	--	--	--	--
NC-2322.01000	2.50	--	I	--	--	--	--
NC-2323.01000	1.30	--	V	--	--	--	--
NC-2324.01000	7.63	--	V	--	--	--	--
NC-2325.01000	13.90	--	V	--	--	--	--
NC-2326.01000	15.10	--	V	--	--	--	--
NC-2327.01000	59.30	--	V	--	--	--	--
NC-2328.03000	14.40	--	V	12271	--	17958	--
NC-2328.03001	0.00	0.05	I	79595	--	0	1000
NC-2328.03004	0.30	--	P	6341	--	0	200
NC-2328.03008	0.15	--	V	98245	--	238596	--
NC-2328.03020	0.06	--	V	0	50	1916	--
NC-2328.03030	0.01	--	V	401	--	0	50
NC-2328.03040	0.00	0.01	V	2391	--	0	100
NC-2328.04000	13.10	--	V	2037	--	0	100
NC-2328.11000	51.00	--	V	--	--	--	--
NC-2328.21000	13.40	--	V	--	--	--	--
NC-2328.31000	114.00	--	V	--	--	--	--
NC-2328.41000	85.80	--	V	--	--	--	--
NC-2328.51000	75.30	--	V	--	--	--	--
NC-2329.01000	3.90	--	V	--	--	--	--
NC-2330.01000	37.30	--	P	--	--	--	--
NC-2330.02000	3.40	--	V	--	--	--	--
NC-2330.02001	0.00	0.01	V	--	--	--	--
NC-2330.02004	0.00	0.04	V	--	--	--	--
NC-2330.04000	0.26	--	V	--	--	--	--
NC-2331.01000	31.20	--	V	--	--	--	--
NC-2331.02000	36.90	--	V	--	--	--	--
NC-2331.02001	0.66	--	V	--	--	--	--
NC-2331.02004	3.10	--	P	--	--	--	--
NC-2331.04000	2.70	--	V	--	--	--	--
NC-2332.01000	4.70	--	P	--	--	--	--
NC-2334.01000	0.40	--	V	--	--	--	--
NC-2335.01000	0.30	--	P	--	--	--	--
NC-2336.61000	0.00	0.60	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-2337.01000	0.00	0.52	V	--	--	--	--
NC-2338.01000	0.70	--	P	--	--	--	--
NC-2339.01000	1.30	--	V	--	--	--	--
NC-2340.01000	0.90	--	P	--	--	--	--
NC-2341.01000	0.70	--	V	--	--	--	--
NC-2342.01000	0.00	0.42	V	--	--	--	--
NC-2343.01000	1.50	--	V	--	--	--	--
NC-2344.01000	3.30	--	P	--	--	--	--
NC-2345.01000	9.90	--	V	--	--	--	--
NC-2346.01000	1.79	--	V	--	--	--	--
NC-2347.01000	3.60	--	V	--	--	--	--
NC-2348.01000	1.91	--	V	--	--	--	--
NC-2349.01000	3.37	--	V	--	--	--	--
NC-2350.01000	2.24	--	V	--	--	--	--
NC-2351.01000	3.88	--	V	--	--	--	--
NC-2352.01000	3.50	--	V	--	--	--	--
NC-2353.01000	2.34	--	V	--	--	--	--
NC-2354.01000	7.14	--	V	--	--	--	--
NC-2355.01000	5.42	--	V	--	--	--	--
NC-2356.01000	10.80	--	V	--	--	--	--
NC-2357.01000	8.21	--	V	--	--	--	--
NC-2358.11000	35.90	--	V	--	--	--	--
NC-2358.21000	40.60	--	V	--	--	--	--
NC-2358.31000	28.60	--	V	--	--	--	--
NC-2358.41000	37.60	--	V	--	--	--	--
NC-2358.51000	30.60	--	V	--	--	--	--
NC-2359.01000	8.20	--	V	--	--	--	--
NC-2360.01000	6.05	--	V	--	--	--	--
NC-2361.01000	7.31	--	V	--	--	--	--
NC-2362.01000	4.80	--	V	--	--	--	--
NC-2363.01000	6.50	--	V	--	--	--	--
NC-2364.01000	13.40	--	V	--	--	--	--
NC-2364.02000	12.20	--	V	--	--	--	--
NC-2364.02001	0.10	--	V	--	--	--	--
NC-2364.02004	0.08	--	P	--	--	--	--
NC-2364.04000	0.00	0.12	V	--	--	--	--
NC-2365.01000	17.30	--	P	--	--	--	--
NC-2366.01000	9.10	--	V	--	--	--	--
NC-2367.01000	9.40	--	V	--	--	--	--
NC-2368.01000	8.00	--	V	--	--	--	--
NC-2369.01000	100.00	--	V	--	--	--	--
NC-2369.03000	15.80	--	V	0	5000	0	5000
NC-2369.03001	0.19	--	P	0	30	0	30

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-2369.03004	0.20	--	V	0	100	0	100
NC-2369.03008	0.03	--	V	0	100	0	100
NC-2369.03020	0.00	0.01	V	0	100	0	100
NC-2369.03030	0.00	0.01	V	0	200	0	200
NC-2369.03040	0.00	0.01	V	0	50	0	50
NC-2369.04000	0.19	--	V	66061	--	124200	--
NC-2370.01000	36.70	--	V	--	--	--	--
NC-2371.01000	57.80	--	V	--	--	--	--
NC-2371.02000	78.40	--	V	--	--	--	--
NC-2371.02001	17.00	--	P	--	--	--	--
NC-2371.02004	2.60	--	V	--	--	--	--
NC-2371.04000	152.00	--	P	--	--	--	--
NC-2372.01000	94.60	--	V	--	--	--	--
NC-2372.03000	26.20	--	V	3591055	--	5860641	--
NC-2372.03001	7.90	--	V	207792	--	385622	--
NC-2372.03004	2.50	--	V	145805	--	364568	--
NC-2372.03008	8.93	--	P	68684	--	56238	--
NC-2372.03020	8.03	--	P	50523	--	15963	--
NC-2372.03030	3.40	--	V	6734	--	4591	--
NC-2372.03040	5.10	--	V	20615	--	14600	--
NC-2372.04000	21.50	--	V	7705410	--	22174064	--
NC-2373.01000	58.10	--	P	--	--	--	--
NC-2374.01000	47.60	--	P	--	--	--	--
NC-2374.02000	105.00	--	V	--	--	--	--
NC-2374.02001	0.77	--	V	--	--	--	--
NC-2374.02004	0.36	--	V	--	--	--	--
NC-2374.04000	1.90	--	V	--	--	--	--
NC-2375.01000	48.20	--	I	--	--	--	--
NC-2376.61000	179.00	--	V	--	--	--	--
NC-2376.03000	12.80	--	P	122597	--	18168	--
NC-2376.03001	0.56	--	V	1254030	--	1621606	--
NC-2376.03004	0.12	--	V	0	200	0	200
NC-2376.03008	0.03	--	V	22444	--	7426	--
NC-2376.03020	0.03	--	P	0	20	0	20
NC-2376.03030	0.00	0.01	V	0	50	0	50
NC-2376.03040	0.00	0.01	V	961	--	0	100
NC-2376.04000	1.40	--	V	1960502	--	3567426	--
NC-2377.01000	72.60	--	V	--	--	--	--
NC-2377.02000	47.60	--	V	--	--	--	--
NC-2377.62001	1.20	--	V	--	--	--	--
NC-2377.02004	0.20	--	V	--	--	--	--
NC-2377.04000	2.00	--	V	--	--	--	--
NC-2378.01000	31.40	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-2378.02000	12.30	--	P	--	--	--	--
NC-2378.02001	0.13	--	V	--	--	--	--
NC-2378.02004	0.48	--	V	--	--	--	--
NC-2378.04000	1.10	--	V	--	--	--	--
NC-2379.01000	14.80	--	V	--	--	--	--
NC-2379.02000	6.50	--	V	--	--	--	--
NC-2379.02001	5.80	--	V	--	--	--	--
NC-2379.02004	0.27	--	V	--	--	--	--
NC-2379.04000	1.60	--	P	--	--	--	--
NC-2380.01000	7.90	--	I	--	--	--	--
NC-2381.01000	25.70	--	V	--	--	--	--
NC-2381.02000	0.64	--	V	--	--	--	--
NC-2381.02001	0.32	--	V	--	--	--	--
NC-2381.02004	0.00	0.09	V	--	--	--	--
NC-2381.64000	0.22	--	P	--	--	--	--
NC-2382.01000	2.90	--	V	--	--	--	--
NC-2383.01000	25.20	--	V	--	--	--	--
NC-2383.02000	17.90	--	V	--	--	--	--
NC-2383.02001	4.20	--	V	--	--	--	--
NC-2383.02004	0.59	--	V	--	--	--	--
NC-2383.04000	8.00	--	V	--	--	--	--
NC-2384.01000	135.00	--	V	--	--	--	--
NC-2384.02000	12.20	--	V	--	--	--	--
NC-2384.02001	0.19	--	V	--	--	--	--
NC-2384.02004	0.28	--	V	--	--	--	--
NC-2384.04000	0.00	0.17	V	--	--	--	--
NC-2385.01000	7.10	--	V	--	--	--	--
NC-2386.01000	0.10	--	V	--	--	--	--
NC-2387.01000	0.10	--	V	--	--	--	--
NC-2390.01000	0.00	0.10	V	--	--	--	--
NC-2409.01000	0.00	0.30	P	--	--	--	--
NC-2410.11000	0.00	0.20	V	--	--	--	--
NC-2410.21000	0.80	--	V	--	--	--	--
NC-2410.31000	0.30	--	P	--	--	--	--
NC-2410.41000	0.00	0.20	V	--	--	--	--
NC-2410.51000	0.00	0.05	V	--	--	--	--
NC-2411.01000	2.60	--	V	--	--	--	--
NC-2412.01000	1.11	--	V	--	--	--	--
NC-2413.01000	0.40	--	V	--	--	--	--
NC-2414.01000	0.40	--	V	--	--	--	--
NC-2415.01000	1.40	--	V	--	--	--	--
NC-2416.01000	0.90	--	V	--	--	--	--
NC-2417.01000	1.30	--	P	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-2418.01000	0.00	0.78	V	--	--	--	--
NC-2419.01000	0.00	0.50	V	--	--	--	--
NC-2420.01000	28.20	--	V	--	--	--	--
NC-2420.02000	130.80	--	P	--	--	--	--
NC-2420.62001	3.30	--	V	--	--	--	--
NC-2420.02004	0.61	--	V	--	--	--	--
NC-2420.04000	2.20	--	P	--	--	--	--
NC-2421.01000	19.90	--	P	--	--	--	--
NC-2421.02000	5.30	--	V	--	--	--	--
NC-2421.02001	0.41	--	V	--	--	--	--
NC-2421.02004	6.70	--	V	--	--	--	--
NC-2421.04000	0.17	--	V	--	--	--	--
NC-2422.01000	3.10	--	V	--	--	--	--
NC-2423.01000	5.20	--	P	--	--	--	--
NC-2424.01000	26.50	--	V	--	--	--	--
NC-2424.02000	21.10	--	V	--	--	--	--
NC-2424.02001	0.04	--	V	--	--	--	--
NC-2424.02004	0.11	--	V	--	--	--	--
NC-2424.04000	14.80	--	V	--	--	--	--
NC-2425.01000	54.20	--	V	--	--	--	--
NC-2426.01000	66.60	--	V	--	--	--	--
NC-2427.01000	52.10	--	V	--	--	--	--
NC-2428.01000	164.00	--	V	--	--	--	--
NC-2428.03000	200.00	--	V	44299	--	29809	--
NC-2428.03001	46.00	--	V	0	200	0	200
NC-2428.03004	12.20	--	I	201138	--	63888	--
NC-2428.03008	0.06	--	V	23423	--	12275	--
NC-2428.03020	0.02	--	P	7688	--	0	100
NC-2428.03030	0.10	--	V	0	50	0	50
NC-2428.03040	0.00	0.01	V	0	100	0	100
NC-2428.04000	0.00	3.50	P	220168	--	74555	--
NC-2429.01000	56.80	--	V	--	--	--	--
NC-2430.01000	2.30	--	V	--	--	--	--
NC-2431.01000	35.40	--	V	--	--	--	--
NC-2431.02000	192.00	--	V	--	--	--	--
NC-2431.02001	4.20	--	V	--	--	--	--
NC-2431.02004	315.00	--	I	--	--	--	--
NC-2431.04000	124.00	--	V	--	--	--	--
NC-2432.01000	2.10	--	P	--	--	--	--
NC-2434.01000	0.50	--	P	--	--	--	--
NC-2435.01000	0.20	--	V	--	--	--	--
NC-2436.01000	0.20	--	V	--	--	--	--
NC-2437.01000	0.26	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-2438.01000	0.70	--	V	--	--	--	--
NC-2439.61000	3.90	--	V	--	--	--	--
NC-2440.11000	4.20	--	V	--	--	--	--
NC-2440.21000	1.60	--	V	--	--	--	--
NC-2440.31000	6.30	--	V	--	--	--	--
NC-2440.41000	5.60	--	V	--	--	--	--
NC-2440.51000	2.49	--	V	--	--	--	--
NC-2441.01000	0.00	2.25	I	--	--	--	--
NC-2442.01000	1.50	--	V	--	--	--	--
NC-2443.01000	1.20	--	V	--	--	--	--
NC-2444.01000	13.40	--	V	--	--	--	--
NC-2445.01000	7.40	--	V	--	--	--	--
NC-2446.01000	2.90	--	P	--	--	--	--
NC-2447.01000	3.40	--	V	--	--	--	--
NC-2448.01000	3.50	--	P	--	--	--	--
NC-2449.01000	2.70	--	V	--	--	--	--
NC-2450.01000	17.40	--	I	--	--	--	--
NC-2450.02000	48.80	--	V	--	--	--	--
NC-2450.02001	0.21	--	P	--	--	--	--
NC-2450.02004	4.10	--	V	--	--	--	--
NC-2450.04000	0.16	--	V	--	--	--	--
NC-2451.01000	3.90	--	I	--	--	--	--
NC-2452.01000	3.30	--	I	--	--	--	--
NC-2453.01000	1.90	--	I	--	--	--	--
NC-2454.01000	0.00	32.30	V	--	--	--	--
NC-2455.01000	3.80	--	V	--	--	--	--
NC-2456.01000	4.00	--	V	--	--	--	--
NC-2457.01000	18.90	--	V	--	--	--	--
NC-2458.01000	101.00	--	V	--	--	--	--
NC-2458.03000	74.30	--	P	0	500	0	500
NC-2458.03001	1.10	--	V	4960	--	15371	--
NC-2458.03004	0.73	--	V	0	200	0	200
NC-2458.03008	0.04	--	V	6536	--	14783	--
NC-2458.03020	0.08	--	V	0	200	0	200
NC-2458.03030	0.00	0.01	V	0	50	1861	--
NC-2458.03040	0.01	--	V	0	50	1786	--
NC-2458.04000	5.22	--	P	0	200	0	200
NC-2459.01000	17.10	--	V	--	--	--	--
NC-2460.01000	5.30	--	V	--	--	--	--
NC-2461.01000	18.80	--	V	--	--	--	--
NC-2462.01000	28.90	--	V	--	--	--	--
NC-2462.02000	101.90	--	V	--	--	--	--
NC-2462.02001	76.35	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-2462.02004	39.30	--	V	--	--	--	--
NC-2462.04000	94.30	--	V	--	--	--	--
NC-2463.01000	103.00	--	V	--	--	--	--
NC-2464.01000	9.30	--	V	--	--	--	--
NC-2465.01000	9.80	--	V	--	--	--	--
NC-2466.01000	14.40	--	V	--	--	--	--
NC-2467.01000	34.70	--	V	--	--	--	--
NC-2468.01000	10.80	--	V	--	--	--	--
NC-2469.01000	61.20	--	V	--	--	--	--
NC-2470.03000	21.20	--	I	612921	--	846192	--
NC-2470.03001	3.60	--	P	557331	--	185949	--
NC-2470.03004	6.50	--	V	365000	--	260000	--
NC-2470.03008	11.60	--	V	124719	--	117198	--
NC-2470.03020	0.01	--	V	0	500	0	500
NC-2470.03030	0.21	--	V	0	200	0	200
NC-2470.03040	0.11	--	V	0	100	0	100
NC-2470.04000	310.00	--	V	3160765	--	5121922	--
NC-2470.11000	166.00	--	V	--	--	--	--
NC-2470.21000	288.00	--	V	--	--	--	--
NC-2470.31000	152.00	--	V	--	--	--	--
NC-2470.41000	237.00	--	V	--	--	--	--
NC-2470.51000	144.00	--	P	--	--	--	--
NC-2471.01000	264.00	--	V	--	--	--	--
NC-2472.01000	282.00	--	V	--	--	--	--
NC-2472.02000	432.00	--	I	--	--	--	--
NC-2472.02001	6.60	--	V	--	--	--	--
NC-2472.02004	3.70	--	V	--	--	--	--
NC-2472.04000	998.00	--	V	--	--	--	--
NC-2473.01000	207.00	--	V	--	--	--	--
NC-2474.01000	163.00	--	V	--	--	--	--
NC-2475.01000	27.80	--	I	--	--	--	--
NC-2476.01000	207.00	--	V	--	--	--	--
NC-2477.01000	32.60	--	V	--	--	--	--
NC-2478.01000	41.40	--	I	--	--	--	--
NC-2479.61000	40.10	--	V	--	--	--	--
NC-2480.01000	38.60	--	V	--	--	--	--
NC-2481.01000	2.19	--	P	--	--	--	--
NC-2482.01000	86.60	--	V	--	--	--	--
NC-2482.02000	87.60	--	V	--	--	--	--
NC-2482.02001	2.00	--	P	--	--	--	--
NC-2482.02004	18.00	--	V	--	--	--	--
NC-2482.04000	1.90	--	P	--	--	--	--
NC-2483.01000	32.70	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-2484.01000	10.40	--	V	--	--	--	--
NC-2485.01000	0.58	--	V	--	--	--	--
NC-2486.01000	0.05	--	I	--	--	--	--
NC-2487.01000	0.00	0.03	V	--	--	--	--
NC-24A2.01000	0.00	0.20	P	--	--	--	--
NC-24B1.01000	0.00	0.10	V	--	--	--	--
NC-2509.01000	0.40	--	P	--	--	--	--
NC-2510.01000	0.40	--	V	--	--	--	--
NC-2511.01000	1.30	--	P	--	--	--	--
NC-2512.01000	0.00	0.28	V	--	--	--	--
NC-2513.01000	0.09	--	V	--	--	--	--
NC-2514.01000	0.30	--	V	--	--	--	--
NC-2515.01000	0.00	0.30	V	--	--	--	--
NC-2516.01000	0.00	0.20	V	--	--	--	--
NC-2517.01000	1.50	--	P	--	--	--	--
NC-2518.01000	0.10	--	P	--	--	--	--
NC-2519.01000	0.00	0.10	V	--	--	--	--
NC-2520.01000	0.00	0.20	V	--	--	--	--
NC-2521.01000	14.70	--	V	--	--	--	--
NC-2522.01000	2.10	--	V	--	--	--	--
NC-2523.11000	0.20	--	P	--	--	--	--
NC-2523.21000	1.00	--	V	--	--	--	--
NC-2523.31000	0.00	0.50	V	--	--	--	--
NC-2523.41000	0.20	--	V	--	--	--	--
NC-2523.51000	1.30	--	V	--	--	--	--
NC-2524.01000	3.80	--	P	--	--	--	--
NC-2525.01000	0.90	--	P	--	--	--	--
NC-2526.01000	66.50	--	V	--	--	--	--
NC-2527.01000	106.00	--	V	--	--	--	--
NC-2527.03000	1.70	--	V	18790	--	19928	--
NC-2527.63001	307.00	--	V	1216597	--	2846529	--
NC-2527.03004	9.30	--	V	157704	--	165940	--
NC-2527.03008	0.33	--	V	59766	--	23738	--
NC-2527.03020	4.50	--	V	45586	--	59647	--
NC-2527.03030	0.73	--	V	0	50	0	50
NC-2527.03040	2.00	--	V	0	100	0	100
NC-2527.04000	1.80	--	V	68638	--	29432	--
NC-2528.01000	182.00	--	V	--	--	--	--
NC-2528.03000	0.67	--	V	8628	--	14214	--
NC-2528.03001	0.17	--	V	1766	--	1993	--
NC-2528.03004	0.22	--	V	0	500	5227	--
NC-2528.03008	0.03	--	V	0	100	1702	--
NC-2528.03020	0.00	0.01	V	0	20	0	20

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

Sample Number	TCDD (ppb) Reporting Conc.	TCDD (ppb) Reporting Limit	Status	2,4-D (ppb) Conc.	2,4-D (ppb) Detection Limit	2,4,5-T (ppb) Conc.	2,4,5-T (ppb) Detection Limit
NC-2528.03030	0.00	0.01	V	0	75	0	75
NC-2528.03040	0.00	0.01	V	0	100	0	100
NC-2528.04000	0.50	--	V	5368	--	1935	--
NC-2529.01000	6.50	--	V	--	--	--	--
NC-2530.01000	0.70	--	V	--	--	--	--
NC-2531.01000	6.50	--	V	--	--	--	--
NC-2532.01000	6.60	--	I	--	--	--	--
NC-2534.01000	0.70	--	P	--	--	--	--
NC-2535.01000	0.30	--	V	--	--	--	--
NC-2536.01000	0.20	--	V	--	--	--	--
NC-2537.01000	0.00	0.13	V	--	--	--	--
NC-2538.01000	0.80	--	V	--	--	--	--
NC-2539.01000	51.30	--	V	--	--	--	--
NC-2539.02000	410.90	--	I	--	--	--	--
NC-2539.02001	3.50	--	V	--	--	--	--
NC-2539.02004	4.40	--	V	--	--	--	--
NC-2539.04000	230.10	--	I	--	--	--	--
NC-2540.01000	11.50	--	V	--	--	--	--
NC-2541.01000	0.90	--	V	--	--	--	--
NC-2542.61000	1.50	--	V	--	--	--	--
NC-2543.01000	0.60	--	V	--	--	--	--
NC-2544.01000	18.80	--	V	--	--	--	--
NC-2544.02000	3.60	--	V	--	--	--	--
NC-2544.62001	8.70	--	V	--	--	--	--
NC-2544.02004	0.49	--	V	--	--	--	--
NC-2544.04000	2.37	--	V	--	--	--	--
NC-2545.01000	33.00	--	I	--	--	--	--
NC-2546.01000	0.99	--	I	--	--	--	--
NC-2547.01000	1.57	--	I	--	--	--	--
NC-2548.01000	14.00	--	I	--	--	--	--
NC-2549.01000	101.00	--	I	--	--	--	--
NC-2549.62000	226.50	--	I	--	--	--	--
NC-2549.02001	147.00	--	V	--	--	--	--
NC-2549.02004	8.50	--	P	--	--	--	--
NC-2549.04000	139.00	--	V	--	--	--	--
NC-2550.01000	43.10	--	I	--	--	--	--
NC-2550.02000	0.00	164.90	V	--	--	--	--
NC-2550.02001	14.40	--	I	--	--	--	--
NC-2550.02004	2.20	--	V	--	--	--	--
NC-2550.04000	284.00	--	V	--	--	--	--
NC-2551.01000	3.48	--	I	--	--	--	--
NC-2552.01000	9.00	--	I	--	--	--	--
NC-2553.02000	137.00	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-2553.02001	8.30	--	V	--	--	--	--
NC-2553.02004	18.40	--	I	--	--	--	--
NC-2553.04000	312.00	--	I	--	--	--	--
NC-2553.11000	3.30	--	V	--	--	--	--
NC-2553.21000	6.00	--	P	--	--	--	--
NC-2553.31000	4.50	--	P	--	--	--	--
NC-2553.41000	28.30	--	V	--	--	--	--
NC-2553.51000	5.50	--	V	--	--	--	--
NC-2554.01000	4.30	--	V	--	--	--	--
NC-2555.01000	1.60	--	V	--	--	--	--
NC-2556.01000	3.30	--	V	--	--	--	--
NC-2557.01000	7.20	--	V	--	--	--	--
NC-2558.01000	646.00	--	V	--	--	--	--
NC-2559.01000	7.20	--	P	--	--	--	--
NC-2560.01000	0.00	0.40	I	--	--	--	--
NC-2561.01000	13.40	--	V	--	--	--	--
NC-2561.02000	12.40	--	V	--	--	--	--
NC-2561.02001	7.80	--	V	--	--	--	--
NC-2561.02004	0.59	--	V	--	--	--	--
NC-2561.04000	0.00	4.58	V	--	--	--	--
NC-2562.01000	9.80	--	V	--	--	--	--
NC-2563.01000	6.80	--	V	--	--	--	--
NC-2564.01000	25.70	--	V	--	--	--	--
NC-2564.02000	35.50	--	V	--	--	--	--
NC-2564.02001	0.00	0.04	V	--	--	--	--
NC-2564.02004	0.13	--	V	--	--	--	--
NC-2564.04000	2.80	--	V	--	--	--	--
NC-2565.01000	20.10	--	V	--	--	--	--
NC-2566.01000	33.30	--	V	--	--	--	--
NC-2567.01000	106.00	--	V	--	--	--	--
NC-2567.03000	57.80	--	V	226753	--	96084	--
NC-2567.03001	25.80	--	V	2692861	--	3657825	--
NC-2567.03004	12.10	--	V	1953125	--	3237567	--
NC-2567.03008	0.40	--	V	140508	--	36401	--
NC-2567.03020	0.01	--	V	4255	--	4987	--
NC-2567.03030	0.00	0.01	V	0	50	0	50
NC-2567.03040	0.03	--	V	0	100	1097	--
NC-2567.04000	6.60	--	V	2235597	--	2987651	--
NC-2568.01000	49.10	--	V	--	--	--	--
NC-2569.01000	11.00	--	V	--	--	--	--
NC-2570.01000	19.00	--	V	--	--	--	--
NC-2571.01000	122.00	--	I	--	--	--	--
NC-2571.03000	593.00	--	V	131066	--	33512	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-2571.03001	122.00	--	P	712264	--	1440217	--
NC-2571.03004	77.50	--	V	1509997	--	1725714	--
NC-2571.03008	1.80	--	V	81496	--	25535	--
NC-2571.03020	2.10	--	V	60783	--	74339	--
NC-2571.03030	0.01	--	V	58169	--	76331	--
NC-2571.03040	0.04	--	V	49145	--	26382	--
NC-2571.04000	482.00	--	V	5012811	--	6630406	--
NC-2572.01000	263.00	--	I	--	--	--	--
NC-2573.01000	23.90	--	V	--	--	--	--
NC-2573.02000	15.20	--	V	--	--	--	--
NC-2573.02001	0.23	--	V	--	--	--	--
NC-2573.02004	0.23	--	V	--	--	--	--
NC-2573.04000	9.20	--	V	--	--	--	--
NC-2574.01000	11.90	--	V	--	--	--	--
NC-2575.01000	10.70	--	I	--	--	--	--
NC-2576.01000	6.20	--	V	--	--	--	--
NC-2577.01000	31.10	--	V	--	--	--	--
NC-2578.01000	147.00	--	V	--	--	--	--
NC-2579.01000	45.10	--	V	--	--	--	--
NC-2579.02000	7.60	--	V	--	--	--	--
NC-2579.02001	0.65	--	I	--	--	--	--
NC-2579.02004	0.24	--	V	--	--	--	--
NC-2579.04000	2.90	--	I	--	--	--	--
NC-2580.01000	6.70	--	V	--	--	--	--
NC-2581.01000	1.40	--	V	--	--	--	--
NC-2582.61000	8.00	--	V	--	--	--	--
NC-2583.11000	2.20	--	V	--	--	--	--
NC-2583.21000	0.50	--	V	--	--	--	--
NC-2583.31000	0.50	--	V	--	--	--	--
NC-2583.41000	18.10	--	V	--	--	--	--
NC-2583.51000	2.00	--	V	--	--	--	--
NC-2584.01000	0.10	--	V	--	--	--	--
NC-2585.01000	0.15	--	V	--	--	--	--
NC-2586.01000	0.00	0.10	V	--	--	--	--
NC-2587.01000	0.38	--	V	--	--	--	--
NC-2589.01000	0.00	0.01	V	--	--	--	--
NC-2599.01000	0.00	0.10	V	--	--	--	--
NC-25A2.01000	0.00	0.10	V	--	--	--	--
NC-25B2.01000	0.00	0.10	P	--	--	--	--
NC-25B4.01000	0.00	0.10	V	--	--	--	--
NC-25C6.01000	0.05	--	V	--	--	--	--
NC-2809.01000	0.00	0.20	V	--	--	--	--
NC-2812.01000	0.00	0.10	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONTINUED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-2820.01000	0.00	0.04	V	--	--	--	--
NC-2821.01000	0.00	0.02	I	--	--	--	--
NC-2828.01000	0.10	--	V	--	--	--	--
NC-2829.01000	0.00	0.10	V	--	--	--	--
NC-2843.01000	0.00	0.10	V	--	--	--	--
NC-2852.01000	0.00	0.10	V	--	--	--	--
NC-2856.01000	0.00	0.10	V	--	--	--	--
NC-2858.01000	0.00	0.10	V	--	--	--	--
NC-2870.01000	31.00	--	V	--	--	--	--
NC-2870.02000	5.70	--	P	--	--	--	--
NC-2870.02001	0.13	--	V	--	--	--	--
NC-2870.02004	1.20	--	P	--	--	--	--
NC-2870.04000	0.95	--	P	--	--	--	--
NC-2883.01000	0.00	0.02	V	--	--	--	--
NC-2889.01000	0.30	--	V	--	--	--	--
NC-2893.01000	0.00	0.10	V	--	--	--	--
NC-28A4.01000	0.30	--	V	--	--	--	--
NC-28A0.01000	0.00	0.04	V	--	--	--	--
NC-28B1.01000	0.30	--	V	--	--	--	--
NC-28B6.01000	0.00	0.10	V	--	--	--	--
NC-28B9.01000	0.30	--	V	--	--	--	--
NC-2928.01000	0.70	--	V	--	--	--	--
NC-7001.01000	0.00	0.10	V	--	--	--	--
NC-7002.01000	0.00	0.14	V	--	--	--	--
NC-7003.01000	0.00	0.04	V	--	--	--	--
NC-7004.01000	0.00	4.46	I	--	--	--	--
NC-7005.01000	0.00	1.30	P	--	--	--	--
NC-7006.01000	0.00	0.30	V	--	--	--	--
NC-7007.01000	0.00	0.50	V	--	--	--	--
NC-7008.01000	9.06	--	P	--	--	--	--
NC-7009.01000	0.00	5.91	I	--	--	--	--
NC-7010.01000	0.04	--	V	--	--	--	--
NC-7011.01000	0.00	0.12	V	--	--	--	--
NC-7012.01000	0.00	0.53	V	--	--	--	--
NC-7013.01000	0.50	--	V	--	--	--	--
NC-7014.01000	10.60	--	P	--	--	--	--
NC-7015.01000	0.00	0.08	V	--	--	--	--
NC-7016.01000	1.70	--	V	--	--	--	--
NC-7017.01000	107.00	--	P	--	--	--	--
NC-7018.01000	33.20	--	V	--	--	--	--
NC-7019.01000	0.90	--	V	--	--	--	--
NC-7020.01000	0.40	--	V	--	--	--	--
NC-7021.01000	2.70	--	V	--	--	--	--

TABLE C-4 NAVAL CONSTRUCTION BATTALION CENTER LISTING OF SAMPLE ANALYSES (CONCLUDED)

	TCDD (ppb)			2,4-D (ppb)		2,4,5-T (ppb)	
Sample Number	Reporting Conc.	Reporting Limit	Status	Conc.	Detection Limit	Conc.	Detection Limit
NC-7022.01000	2.67	--	V	--	--	--	--
NC-7023.01000	0.00	0.20	V	--	--	--	--
NC-7024.01000	0.10	--	V	--	--	--	--
NC-7025.01000	4.80	--	V	--	--	--	--

a. Not applicable.

C.2.2 Areas B and C

TABLE C-5

Legend for Sample Analysis Results--Areas B and C

Symbol	Explanation
-XX.XXX	Minus (-) indicates nondetect. Value (XX.XXX) specifies the DL in ppb.
XX.XXX	Numbers (XX.XXX) indicate concentration in ppb.
00.00	Indicates nondetects from the Site Characterization Study.

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BA01	0.000
BA02	0.000
BA03	0.000
BA04	0.000
BA05	0.000
BA06	0.000
BA07	0.000
BA08	0.000
BA09	0.000
BA10	0.000
BA11	2.200
BA12	0.000
BA13	0.000
BA14	0.000
BA15	0.000
BA16	0.000
BA17	0.000
BA18	0.000
BA19	0.000
BA20	0.000
BA21	0.000
BA22	0.000
BA23	0.000
BA24	17.700
BA25	0.000
BA26	0.000
BA27	0.000
BA28	0.000
BA29	0.000
BA30	0.000
BA31	0.000
BA32	0.000
BA33	0.000
BA34	0.000
BA35	0.000
BA36	0.000
BA37	0.000

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BA38	0.000
BA39	11.900
BA40	3.600
BA41	50.400
BA42	1.300
BA43	0.000
BA44	0.000
BA45	0.000
BA46	0.000
BA47	0.000
BA48	0.000
BA49	0.000
BA50	0.000
BA51	0.000
BA52	0.000
BA53	0.000
BA54	0.000
BA55	0.000
BA56	0.000
BA57	0.000
BA58	0.000
BA59	0.000
BA60	0.000
BA61	0.000
BA62	0.000
BA63	0.000
BA64	0.000
BA65	0.000
BA66	0.000
BA67	0.000
BA68	0.000
BA69	0.800
BA70	0.000
BA71	0.000
BA72	-0.430
BA73	0.000
BA74	0.000

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BA75	0.000
BA76	0.000
BA77	12.090
BA78	0.000
BA79	0.000
BA80	0.600
BA81	0.000
BA82	0.000
BA83	0.000
BA84	0.000
BA85	0.300
BA86	0.000
BA87	0.000
BA88	-0.100
BB01	0.000
BB02	114.000
BB03	0.000
BB04	1.400
BB05	0.000
BB06	0.000
BB07	0.000
BB08	0.000
BB09	0.000
BB10	0.000
BB11	0.000
BB12	0.000
BB13	0.000
BB14	0.000
BB15	0.000
BB16	0.000
BB17	0.200
BB18	0.000
BB19	0.000
BB20	0.000
BB21	0.000
BB22	0.000
BB23	0.000

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BB24	0.000
BB25	0.900
BB26	0.500
BB27	2.500
BB28	1.100
BB29	0.000
BB30	0.000
BB31	0.000
BB32	0.000
BB33	0.000
BB34	0.000
BB35	0.000
BB36	0.300
BB37	0.000
BB38	0.000
BB39	0.000
BB40	1.000
BB41	0.000
BB42	0.000
BB43	0.000
BB44	0.000
BB45	0.000
BB46	2.300
BB47	5.800
BB48	0.000
BB49	0.000
BB50	0.000
BB51	0.000
BB52	0.000
BB53	0.000
BB54	0.000
BB55	0.000
BB56	0.000
BB57	0.000
BB58	0.000
BB59	0.000
BB60	0.000

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BB61	0.000
BB62	1.100
BB63	0.000
BB64	0.000
BB65	0.000
BB66	0.000
BB67	0.000
BB68	0.000
BB69	0.000
BB70	0.000
BB71	0.000
BB72	0.000
BB73	0.000
BB74	0.000
BB75	0.000
BB76	0.000
BB77	0.000
BB78	0.000
BB79	0.000
BB80	1.500
BB81	1.100
BB82	0.000
BB83	0.000
BB84	0.000
BB85	0.000
BB86	0.000
BB87	0.000
BB88	-0.041
BC01	0.300
BC02	3.900
BC03	-0.001
BC04	5.840
BC05	8.500
BC06	0.400
BC24	0.000
BC25	0.430
BC26	1.100

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BC27	3.100
BC28	1.700
BC29	0.400
BC39	-0.001
BC40	0.500
BC41	-0.001
BC45	-0.001
BC46	2.700
BC47	13.100
BC48	-0.001
BC49	-0.400
BC60	-0.140
BC61	1.500
BC62	-0.001
BC63	-0.001
BC64	-0.300
BC79	-0.001
BC80	1.700
BC81	2.600
BC82	0.400
BD01	0.280
BD02	1.400
BD03	29.100
BD04	7.120
BD05	0.580
BD06	-0.055
BD25	0.360
BD26	0.450
BD27	2.190
BD28	2.970
BD29	-0.720
BD45	-0.025
BD46	0.280
BD47	6.730
BD48	1.130
BD49	-0.290
BD60	-0.180

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BD61	0.570
BD62	1.220
BD63	1.540
BD64	-0.280
BD79	-0.130
BD80	0.570
BD81	2.140
BD82	1.010
BD83	0.500
BE01	-0.160
BE02	-0.330
BE03	5.320
BE04	1.930
BE05	0.510
BE06	-0.350
BE26	0.130
BE27	1.110
BE28	1.900
BE29	-0.230
BE46	0.150
BE47	3.030
BE48	0.340
BE49	-0.095
BE61	0.000
BE61	-0.320
BE62	-0.230
BE63	0.200
BE64	-0.240
BE79	-0.120
BE80	-0.620
BE81	1.000
BE82	0.420
BE83	0.000
BF02	0.320
BF03	1.850
BF04	3.140
BF05	1.530

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BF06	-0.110
BF26	-0.026
BF27	0.420
BF28	0.440
BF29	-0.190
BF46	-0.134
BF47	0.750
BF48	-0.314
BF49	0.000
BF80	-0.340
BF81	1.030
BF82	0.640
BG02	0.490
BG03	1.460
BG04	4.380
BG05	0.760
BG06	-0.012
BG14	-0.340
BG21	-0.064
BG34	-0.059
BG55	-0.180
BG67	-0.200
BG80	-0.600
BG81	0.960
BG82	-1.840
BH02	0.710
BH03	1.320
BH04	5.960
BH05	0.420
BH40	-0.064
BH74	-0.110
BH80	-0.600
BH81	-0.900
BH82	-0.980
BH84	-0.100
BJ02	0.810
BJ03	-0.340

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BJ04	1.270
BJ05	0.540
BJ06	-0.070
BK02	-0.210
BK03	-0.240
BK04	1.470
BK05	-0.280
BK06	-0.630
BL10	-0.460
BL11	-0.550
BL12	-0.330
BL29	-0.650
BL30	-0.230
BL31	0.540
BL32	-0.230
BL35	0.280
BL36	2.370
BL37	1.150
BL38	-0.340
BL41	-0.260
BL42	0.840
BL43	0.710
BL66	0.370
BL67	1.630
BL68	7.730
BL69	7.170
BL70	1.030
BL71	-0.250
BM10	0.750
BM11	0.660
BM12	-0.680
BM18	-0.190
BM25	-0.032
BM29	-0.190
BM30	1.060
BM31	0.520
BM32	-0.049

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BM35	-0.180
BM36	0.690
BM37	0.720
BM41	-0.970
BM42	2.060
BM43	0.620
BM44	-0.460
BM59	-0.150
BM65	0.910
BM66	0.220
BM67	0.950
BM68	4.450
BM69	2.800
BM70	1.750
BM71	0.200
BM79	0.000
BM80	0.000
BM81	0.000
BM82	0.000
BN05	-0.045
BN09	-0.280
BN10	0.250
BN11	7.830
BN12	0.260
BN29	-0.310
BN30	0.610
BN31	1.350
BN32	-0.330
BN35	-0.840
BN36	1.630
BN37	0.410
BN41	0.460
BN42	1.720
BN43	1.250
BN44	0.410
BN49	-0.170
BN65	-0.180

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BN66	1.550
BN67	2.910
BN68	4.770
BN69	3.810
BN70	1.610
BN71	0.420
BN79	-0.590
BN80	0.470
BN81	0.300
BN82	-0.120
BP02	-0.008
BP09	-0.760
BP10	1.840
BP11	5.660
BP12	0.360
BP30	0.270
BP31	1.870
BP32	-0.130
BP33	0.055
BP35	-0.320
BP36	0.980
BP37	-0.320
BP41	-0.490
BP42	1.360
BP43	0.680
BP44	0.240
BP54	-0.530
BP55	0.840
BP56	0.260
BP65	-0.430
BP66	0.990
BP67	10.100
BP68	6.580
BP69	1.860
BP70	0.850
BP71	-0.370
BP72	-0.036

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BP73	-0.260
BP74	0.170
BP75	-0.230
BP76	0.100
BP77	-0.110
BP78	-0.071
BP79	0.360
BP80	3.380
BP81	1.050
BP82	-0.300
BR09	0.500
BR10	0.610
BR11	5.050
BR12	-0.370
BR29	-0.140
BR30	0.350
BR31	5.990
BR32	1.750
BR33	-0.012
BR35	-0.510
BR36	1.530
BR37	0.410
BR38	0.390
BR39	-0.120
BR40	-0.360
BR41	0.440
BR42	19.700
BR43	1.760
BR44	0.470
BR53	-0.110
BR54	0.620
BR55	1.200
BR56	-0.510
BR65	0.770
BR66	3.500
BR67	3.200
BR68	30.200

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BR69	1.000
BR70	0.490
BR71	0.280
BR77	0.000
BR78	-0.230
BR79	1.310
BR80	3.650
BR81	0.490
BR82	-0.370
BS08	-0.300
BS09	-0.850
BS10	1.040
BS11	7.630
BS12	0.740
BS21	0.000
BS22	0.580
BS23	0.380
BS24	0.250
BS25	0.000
BS29	-0.320
BS30	0.860
BS31	5.820
BS32	1.220
BS33	-0.030
BS34	-0.280
BS35	0.000
BS36	1.000
BS37	3.000
BS38	1.460
BS39	-0.110
BS40	-0.410
BS41	1.250
BS42	4.750
BS43	3.000
BS44	-0.150
BS52	-0.120
BS53	-0.760

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BS54	5.500
BS55	2.950
BS56	0.420
BS57	-0.140
BS64	0.390
BS65	0.600
BS66	19.400
BS67	59.200
BS68	42.600
BS69	3.060
BS70	0.240
BS77	0.000
BS78	-0.190
BS79	1.590
BS80	4.800
BS81	0.600
BS82	-0.250
BT08	-0.230
BT09	1.600
BT10	11.100
BT11	15.580
BT12	0.560
BT20	-0.052
BT21	0.670
BT22	0.810
BT23	1.320
BT24	0.850
BT25	-0.420
BT26	-0.095
BT29	0.160
BT30	1.160
BT31	9.610
BT32	5.260
BT33	-0.320
BT34	0.380
BT35	0.980
BT36	-0.001

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BT37	5.310
BT38	2.050
BT39	-0.210
BT40	-0.650
BT41	0.200
BT42	8.900
BT43	-0.001
BT44	-0.001
BT45	-0.500
BT52	-0.240
BT53	1.440
BT54	22.000
BT55	8.560
BT56	1.010
BT57	-0.270
BT64	0.710
BT65	1.810
BT66	13.600
BT67	46.900
BT68	21.900
BT69	3.250
BT70	-0.910
BT78	-0.140
BT79	0.870
BT80	6.000
BT81	2.100
BT82	-0.180
BU08	0.500
BU09	9.700
BU10	38.600
BU11	13.200
BU12	0.700
BU15	-0.001
BU16	-0.001
BU17	-0.001
BU20	0.300
BU21	1.500

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BU22	1.500
BU23	0.600
BU24	2.700
BU25	1.200
BU26	-0.001
BU27	0.400
BU28	0.800
BU29	0.300
BU30	2.700
BU31	11.900
BU32	5.600
BU33	0.900
BU34	2.000
BU35	3.400
BU36	2.400
BU37	5.500
BU38	8.700
BU39	0.200
BU40	0.400
BU41	10.400
BU42	48.300
BU43	9.800
BU44	3.100
BU45	0.000
BU52	0.000
BU53	2.200
BU54	6.700
BU55	1.100
BU56	0.310
BU57	-0.250
BU64	-0.001
BU65	2.100
BU66	39.400
BU67	94.000
BU68	14.600
BU69	-0.001
BU70	0.082

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BU78	-0.001
BU79	1.300
BU80	5.000
BU81	-0.001
BU82	-0.001
BV01	0.100
BV02	0.000
BV03	0.000
BV04	0.000
BV05	0.000
BV06	0.000
BV07	0.000
BV08	0.500
BV09	80.400
BV10	139.000
BV11	4.700
BV12	0.000
BV13	0.000
BV14	0.000
BV15	0.000
BV16	1.600
BV17	0.000
BV18	0.000
BV19	0.000
BV20	0.000
BV21	12.200
BV22	0.200
BV23	0.000
BV24	2.300
BV25	1.900
BV26	0.000
BV27	0.200
BV28	14.500
BV29	0.300
BV30	1.400
BV31	1.600
BV32	2.300

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BV33	0.000
BV34	1.000
BV35	1.500
BV36	83.700
BV37	22.600
BV38	5.900
BV39	0.000
BV40	0.600
BV41	22.900
BV42	58.400
BV43	13.000
BV44	3.500
BV45	1.000
BV46	0.000
BV47	0.000
BV48	0.000
BV49	0.000
BV50	0.000
BV51	0.000
BV52	0.000
BV53	5.100
BV54	8.300
BV55	0.000
BV56	0.000
BV57	0.000
BV58	0.000
BV59	0.000
BV60	0.000
BV61	0.000
BV62	0.000
BV63	0.000
BV64	0.000
BV65	35.200
BV66	520.000
BV67	167.000
BV68	13.800
BV69	0.000

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BV70	0.000
BV71	0.000
BV72	0.000
BV73	0.000
BV74	0.000
BV75	0.000
BV76	0.000
BV77	0.000
BV78	0.400
BV79	1.900
BV80	28.500
BV81	1.000
BV82	0.000
BV83	0.000
BV84	0.000
BV85	0.000
BV86	0.000
BV87	0.000
BV88	-0.120
BW01	0.100
BW02	0.000
BW03	0.100
BW04	0.100
BW05	0.000
BW06	0.100
BW07	0.000
BW08	0.000
BW09	218.000
BW10	344.000
BW11	21.600
BW12	3.700
BW13	0.000
BW14	0.000
BW15	0.000
BW16	0.000
BW17	0.000
BW18	0.000

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BW19	0.000
BW20	0.000
BW21	0.000
BW22	0.000
BW23	0.000
BW24	0.000
BW25	0.000
BW26	0.000
BW27	0.000
BW28	1.500
BW29	0.000
BW30	0.300
BW31	4.000
BW32	0.900
BW33	83.100
BW34	6.400
BW35	0.000
BW36	0.000
BW37	0.000
BW38	0.000
BW39	0.000
BW40	0.000
BW41	0.600
BW42	57.100
BW43	37.500
BW44	5.200
BW45	0.000
BW46	0.000
BW47	0.000
BW48	0.000
BW49	0.000
BW50	0.000
BW51	0.000
BW52	0.000
BW53	87.300
BW54	197.000
BW55	0.000

TABLE C-6

Surface Soil Sample Concentrations
NCBC - Area B

Sample Location	TCDD Concentration (ppb)
BW56	0.000
BW57	0.000
BW58	0.000
BW59	0.000
BW60	0.000
BW61	0.000
BW62	0.000
BW63	0.000
BW64	0.000
BW65	44.100
BW66	189.000
BW67	30.000
BW68	46.300
BW69	0.000
BW70	0.000
BW71	0.000
BW72	0.000
BW73	0.000
BW74	0.000
BW75	0.000
BW76	0.000
BW77	0.000
BW78	0.000
BW79	18.000
BW80	72.200
BW81	0.000
BW82	0.000
BW83	0.000
BW84	-0.150
BW85	-0.049
BW86	0.000
BW87	0.000
BW88	-0.061

TABLE C-7

Surface Soil Sample Concentrations
NCBC - Area B Ditches

Sample Location	TCDD Concentration (ppb)
DB31	-0.160
DB34	-0.055
DB35	-0.270
DB36	1.190
DB37	-0.970
DB66	0.820
DB67	2.520
DB68	9.040
DB69	8.040
DB70	2.470
DB73	0.800

TABLE C-8

Surface Soil Sample Concentrations
NCBC - Area C

Sample Location	TCDD Concentration (ppb)
CA01	0.000
CA02	0.000
CA03	0.000
CA04	0.000
CA05	1.500
CA06	1.100
CA07	0.000
CA08	0.900
CA09	1.200
CA10	0.000
CA11	0.000
CA12	0.000
CA13	0.000
CA14	0.000
CA15	0.000
CA16	0.000
CA17	0.000
CA18	0.000
CA19	0.000
CA20	0.000
CA21	0.000
CA22	0.000
CA23	0.000
CA24	0.000
CA25	0.000
CA26	0.000
CA27	0.000
CA28	0.700
CA29	0.000
CA30	1.400
CA31	2.000
CA32	1.500
CA33	0.480
CA34	-0.130
CA35	0.360
CA36	-0.059
CB01	0.000

TABLE C-8

Surface Soil Sample Concentrations
NCBC - Area C

Sample Location	TCDD Concentration (ppb)
CB02	0.000
CB03	0.000
CB04	0.000
CB05	0.000
CB06	0.000
CB07	0.000
CB08	1.700
CB09	0.000
CB10	0.000
CB11	4.400
CB12	0.000
CB13	0.000
CB14	0.000
CB15	0.000
CB16	0.000
CB17	0.000
CB18	0.000
CB19	0.000
CB20	0.000
CB21	0.000
CB22	0.000
CB23	0.000
CB24	0.000
CB25	2.700
CB26	40.800
CB27	93.100
CB28	0.700
CB29	11.200
CB30	0.700
CB31	1.400
CB32	-0.001
CB33	0.230
CB34	76.500
CB35	4.490
CB36	-0.330
CC07	0.300
CC08	1.100

TABLE C-8

Surface Soil Sample Concentrations
NCBC - Area C

Sample Location	TCDD Concentration (ppb)
CC09	0.700
CC10	0.400
CC11	2.600
CC12	3.800
CC13	-0.370
CC24	-0.001
CC25	-0.001
CC26	-0.001
CC27	1.200
CC28	0.900
CC29	-0.001
CC30	0.300
CC31	0.200
CC32	-0.001
CC33	1.060
CC34	125.000
CC35	2.490
CC36	-0.360
CD07	0.450
CD08	1.000
CD09	1.390
CD10	0.680
CD11	0.890
CD12	1.060
CD13	-0.490
CD21	-0.049
CD26	0.410
CD27	-0.001
CD28	1.450
CD29	0.610
CD32	-0.220
CD33	0.650
CD34	20.800
CD35	1.170
CD36	-0.710
CD37	-0.130
CE04	-0.058

TABLE C-8

Surface Soil Sample Concentrations
NCBC - Area C

Sample Location	TCDD Concentration (ppb)
CE07	-0.630
CE08	0.720
CE09	1.470
CE10	0.410
CE11	0.740
CE12	1.340
CE13	-0.250
CE27	-0.860
CE28	1.040
CE29	-0.630
CE33	-0.340
CE34	0.240
CE35	-0.200
CE36	1.110
CE37	-0.540
CF08	-0.640
CF09	1.410
CF10	-0.320
CF11	0.460
CF12	-0.680
CF13	-0.051
CF16	-0.110
CF27	-0.210
CF28	0.770
CF29	-0.250
CF33	0.460
CF34	0.840
CF35	-0.390
CF36	-0.130
CF37	-0.740
CG08	-0.430
CG09	0.520
CG10	-0.310
CH31	-0.072

APPENDIX D

Upper Confidence Limits for Surface Samples (Area A and Vicinity) Comprehensive Soil Characterization Study by EG&G Idaho, Inc.*

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*Crockett, A. B., A. Propp, and T. Kimes, EG&G Idaho, Inc., Idaho Falls, Idaho, January 1987. Herbicide Orange Site Characterization Study, Naval Construction Battalion Center, Final Report, April 1984-September 1986, ESL-TR-86-21, Engineering & Services Laboratory, Air Force Engineering & Services Center, Tyndall Air Force Base, Florida.

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits			
		65%	80%	90%	95%
NC-0540.01000	21.80	33.120	54.280	87.562	130.17
NC-0551.01000	7.40	11.242	18.425	29.723	44.19
NC-0555.01000	8.80	13.369	21.911	35.346	52.55
NC-0556.01000	46.80	71.101	116.527	187.977	279.45
NC-0562.01000	0.80	1.215	1.992	3.213	4.78
NC-0568.01000	0.04	0.061	0.100	0.161	0.24
NC-0572.01000	0.10	0.152	0.249	0.402	0.60
NC-0583.01000	0.01	0.015	0.025	0.040	0.06
NC-0586.01000	0.10	0.152	0.249	0.402	0.60
NC-0588.01000	0.10	0.152	0.249	0.402	0.60
NC-0590.01000	0.03	0.046	0.075	0.120	0.18
NC-0635.01000	1.90	2.887	4.731	7.632	11.35
NC-0636.01000	0.50	0.760	1.245	2.008	2.99
NC-0637.01000	0.80	1.215	1.992	3.213	4.78
NC-0638.01000	1.56	2.370	3.884	6.266	9.31
NC-0639.01000	242.00	367.658	602.554	972.017	1445.01
NC-0640.01000	4.70	7.140	11.703	18.878	28.06
NC-0641.01000	3.00	4.558	7.470	12.050	17.91
NC-0642.01000	18.00	27.346	44.818	72.299	107.48
NC-0643.01000	148.00	224.849	368.504	594.457	883.72
NC-0644.01000	18.90	28.714	47.059	75.914	112.85
NC-0645.01000	13.90	21.118	34.610	55.831	83.00
NC-0646.01000	6.90	10.483	17.180	27.715	41.20
NC-0647.01000	7.30	11.091	18.176	29.321	43.59
NC-0648.01000	26.80	40.716	66.729	107.645	160.03
NC-0649.01000	12.30	18.687	30.626	49.404	73.44
NC-0650.01000	46.50	70.645	115.780	186.772	277.66
NC-0651.01000	9.70	14.737	24.152	38.961	57.92
NC-0652.01000	6.70	10.179	16.682	26.911	40.01
NC-0653.01000	5.65	8.584	14.068	22.694	33.74
NC-0654.01000	17.10	25.979	42.577	68.684	102.11
NC-0655.01000	17.80	27.043	44.320	71.495	106.29
NC-0656.01000	90.30	137.188	224.837	362.699	539.19
NC-0657.01000	3.60	5.469	8.964	14.460	21.50
NC-0658.01000	3.20	4.862	7.968	12.853	19.11
NC-0659.01000	1.00	1.519	2.490	4.017	5.97
NC-0660.01000	1.60	2.431	3.984	6.427	9.55
NC-0661.01000	2.40	3.646	5.976	9.640	14.33
NC-0662.01000	2.40	3.646	5.976	9.640	14.33
NC-0663.01000	78.10	118.653	194.461	313.696	466.34
NC-0664.R0000	11.51	13.877	17.310	21.435	25.59
NC-0665.01000	60.00	91.155	149.394	240.996	358.27
NC-0666.01000	0.04	0.061	0.100	0.161	0.24
NC-0667.01000	0.40	0.608	0.996	1.607	2.39
NC-0668.01000	0.18	0.273	0.448	0.723	1.07

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-0669.01000	0.48	0.729	1.195	1.928	2.87
NC-0670.01000	0.02	0.030	0.050	0.080	0.12
NC-0671.01000	0.30	0.456	0.747	1.205	1.79
NC-0672.01000	0.30	0.456	0.747	1.205	1.79
NC-0674.01000	0.10	0.152	0.249	0.402	0.60
NC-0675.01000	0.02	0.030	0.050	0.080	0.12
NC-0676.01000	0.34	0.517	0.847	1.366	2.03
NC-0677.01000	0.10	0.152	0.249	0.402	0.60
NC-0678.01000	0.18	0.273	0.448	0.723	1.07
NC-0679.01000	4.20	6.381	10.458	16.870	25.08
NC-0681.01000	0.10	0.152	0.249	0.40	0.60
NC-0682.01000	17.90	27.195	44.569	71.90	106.88
NC-0683.01000	3.50	5.317	8.715	14.06	20.90
NC-0684.01000	0.60	0.912	1.494	2.41	3.58
NC-0685.01000	1.20	1.823	2.988	4.82	7.17
NC-0686.01000	11.60	17.623	28.883	46.59	69.26
NC-0687.01000	0.40	0.608	0.996	1.61	2.39
NC-0719.01001	1.01	1.534	2.515	4.06	6.03
NC-0724.01001	0.10	0.152	0.249	0.40	0.60
NC-0729.01001	0.70	1.063	1.743	2.81	4.18
NC-0732.01001	0.39	0.593	0.971	1.57	2.33
NC-0735.01000	0.60	0.912	1.494	2.41	3.58
NC-0736.01000	0.70	1.063	1.743	2.81	4.18
NC-0737.01000	0.78	1.185	1.942	3.13	4.66
NC-0738.01000	3.50	5.317	8.715	14.06	20.90
NC-0739.01000	16.80	25.523	41.830	67.48	100.31
NC-0740.01000	4.70	7.140	11.703	18.88	28.06
NC-0741.01000	1.80	2.735	4.482	7.23	10.75
NC-0742.01000	13.20	20.054	32.867	53.02	78.82
NC-0743.01000	73.80	112.121	183.754	296.43	440.67
NC-0744.R0000	10.65	12.840	16.017	19.83	23.68
NC-0745.01000	386.00	586.430	961.099	1550.41	2304.84
NC-0746.01000	98.10	149.038	244.259	394.03	585.76
NC-0747.01000	12.00	18.231	29.879	48.20	71.65
NC-0748.01000	5.21	7.915	12.972	20.93	31.11
NC-0749.01000	13.20	20.054	32.867	53.02	78.82
NC-0750.01000	20.10	30.537	50.047	80.73	120.02
NC-0751.01000	55.50	84.318	138.189	222.92	333.40
NC-0752.01000	28.00	42.539	69.717	112.46	167.19
NC-0753.01000	9.10	13.825	22.658	36.55	54.34
NC-0754.01000	13.50	20.510	33.614	54.22	80.61
NC-0755.01000	6.50	9.875	16.184	26.11	38.81
NC-0756.01000	16.70	25.371	41.581	67.08	99.72
NC-0757.01000	5.06	7.687	12.599	20.32	30.21
NC-0758.01000	4.90	7.444	12.200	19.68	29.26
NC-0759.01000	4.90	7.444	12.200	19.68	29.26

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-0760.01000	7.00	10.635	17.429	28.12	41.80
NC-0762.01000	3.40	5.165	8.466	13.66	20.30
NC-0763.61000	22.10	33.575	55.027	88.77	131.96
NC-0764.01000	8.40	12.762	20.915	33.74	50.16
NC-0765.01000	4.41	6.700	10.980	17.71	26.33
NC-0767.01000	0.10	0.152	0.249	0.40	0.60
NC-0768.01000	0.10	0.152	0.249	0.40	0.60
NC-0769.01000	1.20	1.823	2.988	4.82	7.17
NC-0770.01000	0.80	1.215	1.992	3.21	4.78
NC-0771.01000	3.60	5.469	8.964	14.46	21.50
NC-0772.01000	0.29	0.441	0.722	1.16	1.73
NC-0773.01000	61.40	93.282	152.879	246.62	366.63
NC-0774.R0000	3.14	3.786	4.722	5.85	6.98
NC-0775.01000	0.98	1.489	2.440	3.94	5.85
NC-0776.01000	0.02	0.030	0.050	0.08	0.12
NC-0777.01000	0.10	0.152	0.249	0.40	0.60
NC-0778.01000	1.03	1.565	2.565	4.14	6.15
NC-0779.01000	2.70	4.102	6.723	10.84	16.12
NC-0780.01000	4.46	6.776	11.105	17.91	26.63
NC-0781.01000	0.40	0.608	0.996	1.61	2.39
NC-0782.01000	24.20	36.766	60.255	97.202	144.50
NC-0783.01000	1.90	2.887	4.731	7.632	11.35
NC-0784.01000	0.19	0.289	0.473	0.763	1.13
NC-0785.01000	2.60	3.950	6.474	10.443	15.52
NC-0786.01000	5.30	8.052	13.196	21.288	31.65
NC-0787.01000	1.30	1.975	3.237	5.222	7.76
NC-0796.61000	0.10	0.152	0.249	0.402	0.60
NC-0822.01001	0.10	0.152	0.249	0.402	0.60
NC-0838.01000	3.40	5.165	8.466	13.656	20.30
NC-0841.01000	2.00	3.038	4.980	8.033	11.94
NC-0842.01000	10.80	16.408	26.891	43.379	64.49
NC-0843.01000	44.10	66.999	109.804	177.132	263.33
NC-0844.01000	98.50	149.646	245.255	395.635	588.15
NC-0845.01000	234.00	355.504	582.635	939.884	1397.24
NC-0846.01000	96.70	146.911	240.773	388.405	577.41
NC-0847.01000	12.30	18.687	30.626	49.404	73.44
NC-0848.01000	2.60	3.950	6.474	10.443	15.52
NC-0849.01000	2.50	3.798	6.225	10.041	14.93
NC-0851.01000	37.00	56.212	92.126	148.614	220.93
NC-0852.01000	36.40	55.301	90.632	146.204	217.35
NC-0853.61000	6.70	10.179	16.682	26.911	40.01
NC-0854.R0000	3.74	4.509	5.625	6.965	8.32
NC-0855.01000	6.50	9.875	16.184	26.108	38.81
NC-0856.01000	9.21	13.992	22.932	36.993	54.99
NC-0857.01000	15.00	22.789	37.348	60.249	89.57
NC-0858.01000	6.60	10.027	16.433	26.510	39.41

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-0859.01000	24.40	37.070	60.753	98.005	145.69
NC-0860.01000	24.60	37.374	61.251	98.808	146.89
NC-0861.01000	0.77	1.170	1.917	3.093	4.60
NC-0862.01000	2.60	3.950	6.474	10.443	15.52
NC-0863.01000	3.24	4.922	8.067	13.014	19.35
NC-0864.01000	2.50	3.798	6.225	10.041	14.93
NC-0865.01000	2.91	4.421	7.246	11.688	17.38
NC-0867.01000	1.80	2.735	4.482	7.230	10.75
NC-0868.01000	0.50	0.760	1.245	2.008	2.99
NC-0869.01000	1.00	1.519	2.490	4.017	5.97
NC-0870.01000	0.60	0.912	1.494	2.410	3.58
NC-0871.01000	0.77	1.170	1.917	3.093	4.60
NC-0872.01000	43.90	66.695	109.306	176.329	262.13
NC-0873.01000	45.30	68.822	112.792	181.952	270.49
NC-0874.01000	0.79	1.200	1.967	3.173	4.72
NC-0875.01000	0.08	0.122	0.199	0.321	0.48
NC-0876.01000	0.21	0.319	0.523	0.843	1.25
NC-0878.01000	0.16	0.243	0.398	0.643	0.96
NC-0879.01000	2.60	3.950	6.474	10.443	15.52
NC-0880.01000	1.90	2.887	4.731	7.632	11.35
NC-0881.01000	0.40	0.608	0.996	1.607	2.39
NC-0882.01000	2.80	4.254	6.972	11.246	16.72
NC-0883.01000	1.08	1.641	2.689	4.338	6.45
NC-0884.R0000	0.51	0.615	0.767	0.950	1.13
NC-0885.01000	1.90	2.887	4.731	7.632	11.35
NC-0887.01000	0.60	0.912	1.494	2.410	3.58
NC-0924.01001	0.10	0.152	0.249	0.402	0.60
NC-0928.01001	0.10	0.152	0.249	0.402	0.60
NC-0938.01000	11.50	17.471	28.634	46.191	68.67
NC-0939.01000	6.60	10.027	16.433	26.510	39.41
NC-0940.01000	4.10	6.2289	10.209	16.468	24.482
NC-0941.01000	6.20	9.4193	15.437	24.903	37.021
NC-0942.01000	19.00	28.8657	47.308	76.315	113.451
NC-0943.01000	17.00	25.8272	42.328	68.282	101.509
NC-0944.61000	41.50	63.0489	103.331	166.689	247.801
NC-0945.01000	44.40	67.4547	110.551	178.337	265.117
NC-0946.01000	35.60	54.0853	88.640	142.991	212.571
NC-0947.01000	6.90	10.4828	17.180	27.715	41.201
NC-0948.01000	5.50	8.3559	13.694	22.091	32.841
NC-0949.01000	2.20	3.3423	5.478	8.837	13.136
NC-0950.01000	17.60	26.7388	43.822	70.692	105.091
NC-0951.01000	35.70	54.2372	88.889	143.393	213.168
NC-0952.01000	12.50	18.9906	31.124	50.207	74.639
NC-0956.01000	5.00	7.5962	12.449	20.083	29.855
NC-0964.R0000	3.35	4.0390	5.038	6.239	7.449
NC-0965.01000	6.00	9.1155	14.939	24.100	35.827

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-0967.01000	5.00	7.5962	12.449	20.083	29.855
NC-0968.01000	0.40	0.6077	0.996	1.607	2.388
NC-0969.01000	0.12	0.1823	0.299	0.482	0.717
NC-0970.01000	0.87	1.3217	2.166	3.494	5.195
NC-0971.01000	0.70	1.0635	1.743	2.812	4.180
NC-0973.01000	3.30	5.0135	8.217	13.255	19.705
NC-0974.01000	0.60	0.9115	1.494	2.410	3.583
NC-0975.01000	0.11	0.1671	0.274	0.442	0.657
NC-0976.01000	0.50	0.7596	1.245	2.008	2.986
NC-0977.01000	0.20	0.3038	0.498	0.803	1.194
NC-0978.01000	0.20	0.3038	0.498	0.803	1.194
NC-0979.01000	2.20	3.3423	5.478	8.837	13.136
NC-0980.01000	1.10	1.6712	2.739	4.418	6.568
NC-0981.01000	0.20	0.3038	0.498	0.803	1.194
NC-0982.01000	0.50	0.7596	1.245	2.008	2.986
NC-0983.01000	0.50	0.7596	1.245	2.008	2.986
NC-0984.61000	0.40	0.6077	0.996	1.607	2.388
NC-0985.01000	1.50	2.2789	3.735	6.025	8.957
NC-0986.01000	1.60	2.4308	3.984	6.427	9.554
NC-0987.01000	0.20	0.3038	0.498	0.803	1.194
NC-0992.R0000	0.05	0.0603	0.075	0.093	0.111
NC-0999.01000	0.10	0.1519	0.249	0.402	0.597
NC-09A3.01000	0.10	0.1519	0.249	0.402	0.597
NC-1023.01001	0.10	0.1519	0.249	0.402	0.597
NC-1025.01001	0.10	0.1519	0.249	0.402	0.597
NC-1028.01001	4.00	6.0770	9.960	16.066	23.884
NC-1031.01001	0.10	0.1519	0.249	0.402	0.597
NC-1035.01000	0.80	1.2154	1.992	3.213	4.777
NC-1037.01000	4.60	6.9885	11.454	18.476	27.467
NC-1040.01000	9.20	13.9771	22.907	36.953	54.934
NC-1041.01000	2.80	4.2539	6.972	11.246	16.719
NC-1042.01000	1.70	2.5827	4.233	6.828	10.151
NC-1043.01000	1.90	2.8866	4.731	7.632	11.345
NC-1044.R0000	8.86	10.6822	13.325	16.500	19.701
NC-1045.01000	34.60	52.5660	86.150	138.974	206.600
NC-1046.01000	24.10	36.6139	60.006	96.800	143.904
NC-1047.01000	2.50	3.7981	6.225	10.041	14.928
NC-1048.01000	1.90	2.8866	4.731	7.632	11.345
NC-1049.01000	2.30	3.4943	5.727	9.238	13.734
NC-1050.01000	8.20	12.4578	20.417	32.936	48.963
NC-1051.01000	10.80	16.4079	26.8909	43.379	64.488
NC-1052.01000	4.70	7.1405	11.7025	18.878	28.064
NC-1053.01000	2.10	3.1904	5.2288	8.435	12.539
NC-1054.01000	0.41	0.6229	1.0209	1.647	2.448
NC-1055.01000	1.50	2.2789	3.7348	6.025	8.957
NC-1056.01000	3.50	5.3174	8.7146	14.058	20.899

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-1057.01000	10.00	15.1925	24.8989	40.166	59.711
NC-1058.01000	14.60	22.1810	36.3525	58.642	87.178
NC-1059.01000	25.10	38.1332	62.4963	100.817	149.875
NC-1060.01000	8.70	13.2175	21.6621	34.944	51.949
NC-1061.01000	0.23	0.3494	0.5727	0.924	1.373
NC-1062.01000	2.00	3.0385	4.9798	8.033	11.942
NC-1063.01000	7.00	10.6347	17.4293	28.116	41.798
NC-1064.01000	0.80	1.2154	1.9919	3.213	4.777
NC-1067.01000	0.17	0.2583	0.4233	0.683	1.015
NC-1068.01000	0.09	0.1367	0.2241	0.361	0.537
NC-1069.01000	0.16	0.2431	0.3984	0.643	0.955
NC-1070.01000	0.50	0.7596	1.2449	2.008	2.986
NC-1071.01000	0.80	1.2154	1.9919	3.213	4.777
NC-1072.01000	0.80	1.2154	1.9919	3.213	4.777
NC-1073.61000	0.27	0.4102	0.6723	1.084	1.612
NC-1074.R0000	0.04	0.0482	0.0602	0.074	0.089
NC-1075.01000	0.10	0.1519	0.2490	0.402	0.597
NC-1076.01000	0.10	0.1519	0.2490	0.402	0.597
NC-1077.01000	0.10	0.1519	0.2490	0.402	0.597
NC-1078.01000	0.40	0.6077	0.9960	1.607	2.388
NC-1079.01000	1.50	2.2789	3.7348	6.025	8.957
NC-1080.01000	0.40	0.6077	0.9960	1.607	2.388
NC-1081.01000	0.40	0.6077	0.9960	1.607	2.388
NC-1082.01000	0.40	0.6077	0.9960	1.607	2.388
NC-1083.01000	0.63	0.9571	1.5686	2.530	3.762
NC-1084.R0000	0.45	0.5426	0.6768	0.838	1.001
NC-1085.01000	1.70	2.5827	4.2328	6.828	10.151
NC-1086.01000	1.80	2.7346	4.4818	7.230	10.748
NC-1087.01000	0.10	0.1519	0.2490	0.402	0.597
NC-1123.01001	0.10	0.1519	0.2490	0.402	0.597
NC-1131.01001	0.29	0.4406	0.7221	1.165	1.732
NC-1135.01000	1.90	2.8866	4.7308	7.632	11.345
NC-1136.01000	4.40	6.6847	10.9555	17.673	26.273
NC-1137.01000	5.00	7.5962	12.4495	20.083	29.855
NC-1140.01000	28.10	42.6909	69.9660	112.866	167.788
NC-1141.01000	4.60	6.9885	11.4535	18.476	27.467
NC-1142.01000	1.14	1.7319	2.8385	4.579	6.807
NC-1143.01000	0.85	1.2914	2.1164	3.414	5.075
NC-1144.01000	10.50	15.9521	26.1439	42.174	62.697
NC-1145.01000	14.20	21.5733	35.3565	57.036	84.790
NC-1146.01000	6.10	9.2674	15.1884	24.501	36.424
NC-1148.01000	0.30	0.4558	0.7470	1.205	1.791
NC-1149.01000	12.90	19.5983	32.1196	51.814	77.027
NC-1150.01000	20.40	30.9927	50.7938	81.939	121.810
NC-1151.01000	7.10	10.7867	17.6782	28.518	42.395
NC-1152.01000	3.40	5.1654	8.4656	13.656	20.302

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-1153.01000	4.60	6.9885	11.4535	18.476	27.467
NC-1154.01000	1.40	2.1269	3.4859	5.623	8.360
NC-1155.01000	3.90	5.9251	9.7106	15.665	23.287
NC-1156.01000	24.80	37.6774	61.7494	99.612	148.083
NC-1157.01000	27.00	41.020	67.227	108.448	161.220
NC-1158.01000	104.00	158.002	258.949	417.726	620.994
NC-1159.01000	11.50	17.471	28.634	46.191	68.668
NC-1160.01000	1.80	2.735	4.482	7.230	10.748
NC-1161.01000	0.30	0.456	0.747	1.205	1.791
NC-1162.01000	2.30	3.494	5.727	9.238	13.734
NC-1163.61000	35.00	53.174	87.146	140.581	208.988
NC-1164.R0000	0.62	0.748	0.932	1.155	1.379
NC-1167.01000	0.20	0.304	0.498	0.803	1.194
NC-1168.01000	0.07	0.106	0.174	0.281	0.418
NC-1169.01000	0.10	0.152	0.249	0.402	0.597
NC-1170.01000	0.30	0.456	0.747	1.205	1.791
NC-1171.01000	0.52	0.790	1.295	2.089	3.105
NC-1172.01000	0.09	0.137	0.224	0.361	0.537
NC-1173.01000	0.08	0.122	0.199	0.321	0.478
NC-1174.01000	0.07	0.106	0.174	0.281	0.418
NC-1175.01000	0.09	0.137	0.224	0.361	0.537
NC-1176.01000	0.06	0.091	0.149	0.241	0.358
NC-1177.01000	0.34	0.517	0.847	1.366	2.030
NC-1178.01000	0.30	0.456	0.747	1.205	1.791
NC-1179.01000	0.95	1.443	2.365	3.816	5.673
NC-1180.01000	0.27	0.410	0.672	1.084	1.612
NC-1181.01000	0.03	0.046	0.075	0.120	0.179
NC-1182.01000	1.20	1.823	2.988	4.820	7.165
NC-1183.01000	1.78	2.704	4.432	7.150	10.629
NC-1185.01000	1.55	2.355	3.859	6.226	9.255
NC-1186.01000	0.40	0.608	0.996	1.607	2.388
NC-1187.01000	0.10	0.152	0.249	0.402	0.597
NC-1229.01000	0.20	0.304	0.498	0.803	1.194
NC-1231.01001	0.10	0.152	0.249	0.402	0.597
NC-1235.01000	0.36	0.547	0.896	1.446	2.150
NC-1236.01000	1.20	1.823	2.988	4.820	7.165
NC-1237.01000	4.70	7.140	11.703	18.878	28.064
NC-1238.01000	8.80	13.369	21.911	35.346	52.546
NC-1239.01000	11.60	17.623	28.883	46.593	69.265
NC-1240.01000	13.70	20.814	34.112	55.027	81.804
NC-1241.01000	5.10	7.748	12.698	20.485	30.453
NC-1242.01000	1.80	2.735	4.482	7.230	10.748
NC-1243.01000	4.00	6.077	9.960	16.066	23.884
NC-1244.R0000	16.02	19.315	24.092	29.834	35.622
NC-1245.01000	15.60	23.700	38.842	62.659	93.149
NC-1247.01000	3.30	5.014	8.217	13.255	19.705

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-1248.01000	0.70	1.063	1.743	2.812	4.180
NC-1249.01000	1.20	1.823	2.988	4.820	7.165
NC-1250.01000	8.80	13.369	21.911	35.346	52.546
NC-1251.01000	11.20	17.016	27.887	44.986	66.876
NC-1252.01000	3.40	5.165	8.466	13.656	20.302
NC-1253.01000	2.40	3.646	5.976	9.640	14.331
NC-1254.61000	0.90	1.367	2.241	3.615	5.374
NC-1255.01000	0.10	0.152	0.249	0.402	0.597
NC-1256.01000	36.80	55.908	91.628	147.811	219.736
NC-1257.01000	17.90	27.195	44.569	71.897	106.883
NC-1258.01000	30.80	46.793	76.689	123.711	183.910
NC-1259.01000	9.80	14.889	24.401	39.363	58.517
NC-1260.01000	26.90	40.868	66.978	108.047	160.623
NC-1264.01000	1.50	2.279	3.735	6.025	8.957
NC-1265.01000	0.34	0.517	0.847	1.366	2.030
NC-1267.01000	0.10	0.152	0.249	0.402	0.597
NC-1268.01000	0.05	0.076	0.124	0.201	0.299
NC-1269.01000	0.10	0.152	0.249	0.402	0.597
NC-1270.01000	0.53	0.805	1.320	2.129	3.165
NC-1271.01000	0.80	1.215	1.992	3.213	4.777
NC-1272.01000	0.39	0.593	0.971	1.566	2.329
NC-1273.01000	0.20	0.304	0.498	0.803	1.194
NC-1274.R0000	0.07	0.084	0.105	0.130	0.156
NC-1275.01000	0.07	0.106	0.174	0.281	0.418
NC-1276.01000	0.10	0.152	0.249	0.402	0.597
NC-1277.01000	0.32	0.486	0.797	1.285	1.911
NC-1278.01000	0.50	0.760	1.245	2.008	2.986
NC-1279.01000	1.10	1.671	2.739	4.418	6.568
NC-1280.01000	0.07	0.106	0.174	0.281	0.418
NC-1281.01000	0.07	0.106	0.174	0.281	0.418
NC-1282.01000	0.09	0.137	0.224	0.361	0.537
NC-1283.01000	0.90	1.367	2.241	3.615	5.374
NC-1284.01000	0.50	0.760	1.245	2.008	2.986
NC-1285.01000	0.26	0.395	0.647	1.044	1.552
NC-1286.01000	0.10	0.152	0.249	0.402	0.597
NC-1287.01000	0.01	0.015	0.025	0.040	0.060
NC-1292.01000	0.10	0.152	0.249	0.402	0.597
NC-1295.01000	0.10	0.152	0.249	0.402	0.597
NC-1312.01000	0.10	0.152	0.249	0.402	0.597
NC-1317.01000	0.10	0.152	0.249	0.402	0.597
NC-1319.01000	0.10	0.152	0.249	0.402	0.597
NC-1326.01000	0.06	0.091	0.149	0.241	0.358
NC-1335.01000	0.40	0.608	0.996	1.607	2.388
NC-1336.01000	5.30	8.052	13.196	21.288	31.647
NC-1338.01000	27.60	41.931	68.721	110.858	164.802
NC-1339.01000	3.10	4.710	7.719	12.451	18.510

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-1340.01000	17.90	27.195	44.569	71.897	106.883
NC-1341.01000	2.00	3.038	4.980	8.033	11.942
NC-1342.01000	1.40	2.127	3.486	5.623	8.360
NC-1343.01000	5.80	8.812	14.441	23.296	34.632
NC-1345.01000	0.04	0.061	0.100	0.161	0.239
NC-1346.01000	13.70	20.814	34.112	55.027	81.804
NC-1347.01000	116.00	176.233	288.828	465.926	692.648
NC-1349.01000	0.19	0.289	0.473	0.763	1.135
NC-1350.01000	24.20	36.766	60.255	97.202	144.501
NC-1351.01000	37.40	56.820	93.122	150.221	223.319
NC-1352.01000	2.60	3.950	6.474	10.443	15.525
NC-1353.01000	2.40	3.646	5.976	9.640	14.331
NC-1354.R0000	1.47	1.772	2.211	2.738	3.269
NC-1355.01000	0.06	0.091	0.149	0.241	0.358
NC-1356.01000	0.40	0.608	0.996	1.607	2.388
NC-1357.01000	145.00	220.291	361.035	582.407	865.809
NC-1358.01000	5.80	8.812	14.441	23.296	34.632
NC-1359.01000	2.40	3.646	5.976	9.640	14.331
NC-1360.01000	11.10	16.864	27.638	44.584	66.279
NC-1361.01000	0.40	0.608	0.996	1.607	2.388
NC-1364.01000	2.70	4.102	6.723	10.845	16.122
NC-1365.01000	0.70	1.063	1.743	2.812	4.180
NC-1367.01000	0.11	0.167	0.274	0.442	0.657
NC-1368.01000	0.10	0.152	0.249	0.402	0.597
NC-1369.01000	0.07	0.106	0.174	0.281	0.418
NC-1370.01000	0.40	0.608	0.996	1.607	2.388
NC-1371.01000	0.50	0.760	1.245	2.008	2.986
NC-1372.01000	0.50	0.760	1.245	2.008	2.986
NC-1373.01000	0.90	1.367	2.241	3.615	5.374
NC-1374.01000	0.23	0.349	0.573	0.924	1.373
NC-1375.01000	0.03	0.046	0.075	0.120	0.179
NC-1376.01000	0.08	0.122	0.199	0.321	0.478
NC-1377.01000	0.20	0.304	0.498	0.803	1.194
NC-1378.01000	0.23	0.349	0.573	0.924	1.373
NC-1379.01000	0.55	0.836	1.369	2.209	3.284
NC-1380.01000	0.30	0.456	0.747	1.205	1.791
NC-1381.01000	0.02	0.030	0.050	0.080	0.119
NC-1382.01000	0.10	0.152	0.249	0.402	0.597
NC-1383.01000	0.92	1.398	2.291	3.695	5.493
NC-1384.R0000	0.69	0.832	1.038	1.285	1.534
NC-1385.61000	0.59	0.896	1.469	2.370	3.523
NC-1386.01000	0.11	0.167	0.274	0.442	0.657
NC-1387.01000	0.10	0.152	0.249	0.402	0.597
NC-1390.01000	0.10	0.152	0.249	0.402	0.597
NC-1397.01000	0.10	0.152	0.249	0.402	0.597
NC-13A4.01000	0.50	0.760	1.245	2.008	2.986

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits			
		65%	80%	90%	95%
NC-13A6.61000	0.10	0.152	0.249	0.402	0.22
NC-1426.R0000	0.09	0.11	0.14	0.22	0.200
NC-1427.01000	0.10	0.152	0.249	0.402	0.597
NC-1431.01000	0.10	0.152	0.249	0.402	0.597
NC-1435.01000	0.36	0.547	0.896	1.446	2.150
NC-1436.01000	1.50	2.279	3.735	6.025	8.957
NC-1437.01000	3.45	5.241	8.590	13.857	20.600
NC-1438.01000	6.70	10.179	16.682	26.911	40.006
NC-1439.01000	7.10	10.787	17.678	28.518	42.395
NC-1440.01000	2.40	3.646	5.976	9.640	14.331
NC-1441.01000	1.10	1.671	2.739	4.418	6.568
NC-1442.01000	0.50	0.760	1.245	2.008	2.986
NC-1443.01000	1.39	2.112	3.461	5.583	8.300
NC-1444.01000	6.23	9.465	15.512	25.023	37.200
NC-1445.01000	112.00	170.156	278.868	449.859	668.763
NC-1446.01000	18.00	27.346	44.818	72.299	107.480
NC-1447.01000	1.90	2.887	4.731	7.632	11.345
NC-1448.01000	0.68	1.033	1.693	2.731	4.060
NC-1449.01000	0.30	0.456	0.747	1.205	1.791
NC-1450.01000	149.00	226.368	370.994	598.473	889.694
NC-1451.01000	19.80	30.081	49.300	79.529	118.228
NC-1452.01000	2.50	3.798	6.225	10.041	14.928
NC-1453.01000	1.70	2.583	4.233	6.828	10.151
NC-1454.01000	1.10	1.671	2.739	4.418	6.568
NC-1455.01000	0.50	0.760	1.245	2.008	2.986
NC-1456.01000	0.21	0.319	0.523	0.843	1.254
NC-1457.01000	2.60	3.950	6.474	10.443	15.525
NC-1458.01000	13.40	20.358	33.365	53.822	80.013
NC-1459.01000	5.28	8.022	13.147	21.208	31.527
NC-1460.01000	0.49	0.744	1.220	1.968	2.926
NC-1461.01000	1.30	1.975	3.237	5.222	7.762
NC-1462.01000	0.14	0.213	0.349	0.562	0.836
NC-1463.01000	0.20	0.304	0.498	0.803	1.194
NC-1464.R0000	0.63	0.760	0.947	1.173	1.401
NC-1467.01000	0.15	0.22789	0.37348	0.6025	0.8957
NC-1468.01000	0.10	0.15192	0.24899	0.4017	0.5971
NC-1469.01000	0.19	0.28866	0.47308	0.7632	1.1345
NC-1471.01000	0.90	1.36732	2.24090	3.6149	5.3740
NC-1472.01000	3.20	4.86160	7.96766	12.8531	19.1075
NC-1473.01000	0.17	0.25827	0.42328	0.6828	1.0151
NC-1474.61000	0.05	0.07596	0.12449	0.2008	0.2986
NC-1475.01000	0.10	0.15192	0.24899	0.4017	0.5971
NC-1476.01000	0.28	0.42539	0.69717	1.1246	1.6719
NC-1477.01000	0.20	0.30385	0.49798	0.8033	1.1942
NC-1478.01000	0.40	0.60770	0.99596	1.6066	2.3884
NC-1479.01000	0.60	0.91155	1.49394	2.4100	3.5827

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-1480.01000	0.10	0.15192	0.24899	0.4017	0.5971
NC-1481.01000	0.08	0.12154	0.19919	0.3213	0.4777
NC-1482.01000	0.12	0.18231	0.29879	0.4820	0.7165
NC-1484.01000	0.60	0.91155	1.49394	2.4100	3.5827
NC-1485.01000	0.56	0.85078	1.39434	2.2493	3.3438
NC-1486.01000	0.20	0.30385	0.49798	0.8033	1.1942
NC-1487.01000	0.10	0.15192	0.24899	0.4017	0.5971
NC-14B4.01000	0.10	0.15192	0.24899	0.4017	0.5971
NC-1525.01000	0.21	0.31904	0.52288	0.8435	1.2539
NC-1528.01000	0.14	0.21269	0.34859	0.5623	0.8360
NC-1535.01000	0.10	0.15192	0.24899	0.4017	0.5971
NC-1542.01000	1.10	1.67117	2.73888	4.4183	6.5682
NC-1548.01000	3.80	5.77315	9.46160	15.2631	22.6902
NC-1555.01000	0.10	0.15192	0.24899	0.4017	0.5971
NC-1561.01000	0.40	0.60770	0.99596	1.6066	2.3884
NC-1562.01000	0.10	0.15192	0.24899	0.4017	0.5971
NC-1568.01000	0.11	0.16712	0.27389	0.4418	0.6568
NC-1574.R0000	0.12	0.14468	0.18047	0.2235	0.2668
NC-1575.01000	0.06	0.09115	0.14939	0.2410	0.3583
NC-1582.01000	0.06	0.09115	0.14939	0.2410	0.3583
NC-1583.01000	0.15	0.22789	0.37348	0.6025	0.8957
NC-1584.01000	1.70	2.58272	4.23282	6.8282	10.1509
NC-1585.01000	0.40	0.60770	0.99596	1.6066	2.3884
NC-1586.01000	0.10	0.15192	0.24899	0.4017	0.5971
NC-1587.01000	0.10	0.15192	0.24899	0.4017	0.5971
NC-15A0.01000	0.10	0.15192	0.24899	0.4017	0.5971
NC-15B0.01000	0.10	0.15192	0.24899	0.4017	0.5971
NC-1612.01000	0.31	0.47097	0.77187	1.2451	1.8510
NC-1613.01000	0.08	0.12154	0.19919	0.3213	0.4777
NC-1614.01000	0.09	0.13673	0.22409	0.3615	0.5374
NC-1615.01000	0.10	0.15192	0.24899	0.4017	0.5971
NC-1616.01000	0.60	0.91155	1.49394	2.4100	3.5827
NC-1617.01000	0.10	0.15192	0.24899	0.4017	0.5971
NC-1618.01000	0.05	0.07596	0.12449	0.2008	0.2986
NC-1619.01000	1.60	2.43080	3.98383	6.4266	9.5538
NC-1620.01000	2.00	3.03850	4.97979	8.0332	11.9422
NC-1621.01000	0.40	0.60770	0.99596	1.6066	2.3884
NC-1622.01000	0.10	0.15192	0.24899	0.4017	0.5971
NC-1623.01000	0.10	0.15192	0.24899	0.4017	0.5971
NC-1624.01000	0.80	1.21540	1.99192	3.2133	4.7769
NC-1625.01000	0.17	0.25827	0.42328	0.6828	1.0151
NC-1626.01000	1.00	1.51925	2.48989	4.0166	5.9711
NC-1627.R0000	0.48	0.57872	0.72187	0.8939	1.0673
NC-1628.01000	0.20	0.30385	0.49798	0.8033	1.1942
NC-1629.01000	0.01	0.015	0.025	0.040	0.060
NC-1630.01000	0.09	0.137	0.224	0.361	0.537

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-1631.01000	1.14	1.732	2.838	4.579	6.807
NC-1632.01000	0.70	1.063	1.743	2.812	4.180
NC-1635.01000	0.13	0.198	0.324	0.522	0.776
NC-1636.01000	0.20	0.304	0.498	0.803	1.194
NC-1642.01000	0.70	1.063	1.743	2.812	4.180
NC-1648.01000	0.10	0.152	0.249	0.402	0.597
NC-1655.01000	0.10	0.152	0.249	0.402	0.597
NC-1661.01000	0.10	0.152	0.249	0.402	0.597
NC-1662.01000	0.20	0.304	0.498	0.803	1.194
NC-1668.01000	0.10	0.152	0.249	0.402	0.597
NC-1674.01000	0.18	0.273	0.448	0.723	1.075
NC-1675.01000	0.01	0.015	0.025	0.040	0.060
NC-1681.01000	0.10	0.152	0.249	0.402	0.597
NC-1682.01000	0.19	0.289	0.473	0.763	1.135
NC-1683.01000	1.30	1.975	3.237	5.222	7.762
NC-1684.01000	0.90	1.367	2.241	3.615	5.374
NC-1685.01000	0.18	0.273	0.448	0.723	1.075
NC-1686.01000	0.05	0.076	0.124	0.201	0.299
NC-1687.01000	0.03	0.046	0.075	0.120	0.179
NC-1691.01000	0.03	0.046	0.075	0.120	0.179
NC-16A3.01000	0.10	0.152	0.249	0.402	0.597
NC-1711.01000	0.02	0.030	0.050	0.080	0.119
NC-1712.R0000	0.24	0.289	0.361	0.447	0.534
NC-1713.01000	0.05	0.076	0.124	0.201	0.299
NC-1714.01000	0.09	0.137	0.224	0.361	0.537
NC-1715.01000	0.10	0.152	0.249	0.402	0.597
NC-1716.01000	0.10	0.152	0.249	0.402	0.597
NC-1717.01000	0.03	0.046	0.075	0.120	0.179
NC-1718.61000	0.24	0.365	0.598	0.964	1.433
NC-1719.01000	0.90	1.367	2.241	3.615	5.374
NC-1720.01000	0.90	1.367	2.241	3.615	5.374
NC-1721.01000	0.30	0.456	0.747	1.205	1.791
NC-1722.01000	0.10	0.152	0.249	0.402	0.597
NC-1723.01000	0.14	0.213	0.349	0.562	0.836
NC-1724.01000	0.36	0.547	0.896	1.446	2.150
NC-1725.01000	0.80	1.215	1.992	3.213	4.777
NC-1726.01000	4.75	7.216	11.827	19.079	28.363
NC-1727.01000	2.05	3.114	5.104	8.234	12.241
NC-1728.01000	0.18	0.273	0.448	0.723	1.075
NC-1729.01000	0.11	0.167	0.274	0.442	0.657
NC-1730.01000	0.20	0.304	0.498	0.803	1.194
NC-1731.01000	1.40	2.127	3.486	5.623	8.360
NC-1732.01000	1.58	2.400	3.934	6.346	9.434
NC-1734.01000	0.60	0.912	1.494	2.410	3.583
NC-1735.01000	0.20	0.304	0.498	0.803	1.194
NC-1736.01000	0.11	0.167	0.274	0.442	0.657

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	aSample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-1737.01000	33.40	50.743	83.162	134.154	199.435
NC-1737.01000	88.70	134.757	220.854	356.272	529.637
NC-1739.01000	55.10	83.711	137.193	221.315	329.008
NC-1740.R1000	2.14	2.580	3.218	3.985	4.759
NC-1741.01000	0.80	1.215	1.992	3.213	4.777
NC-1742.01000	0.09	0.137	0.224	0.361	0.537
NC-1743.01000	0.45	0.684	1.120	1.807	2.687
NC-1744.01000	2.40	3.646	5.976	9.640	14.331
NC-1745.01000	6.20	9.4193	14.4373	24.9029	37.0208
NC-1746.01000	4.30	6.5328	10.7065	17.2714	25.6757
NC-1747.01000	3.40	5.1654	8.4656	13.6564	20.3017
NC-1748.01000	0.04	0.0608	0.0996	0.1607	0.2388
NC-1749.01000	10.20	15.4963	25.3969	40.9693	60.9052
NC-1750.01000	1.50	2.2789	3.7348	6.0249	8.9566
NC-1751.01000	3.38	5.1351	8.4158	13.5761	20.1823
NC-1752.01000	2.50	3.7981	6.2247	10.0415	14.9277
NC-1753.01000	1.80	2.7346	4.4818	7.2299	10.7480
NC-1754.01000	8.30	12.6098	20.6661	33.3378	49.5601
NC-1755.01000	0.27	0.4102	0.6723	1.0845	1.6122
NC-1756.01000	1.60	2.4308	3.9838	6.4266	9.5538
NC-1757.01000	5.90	8.9636	14.6904	23.6979	35.2295
NC-1758.61000	5.90	8.9636	14.6904	23.6979	35.2295
NC-1759.01000	8.10	12.3059	20.1681	32.5345	48.3659
NC-1760.01000	3.40	5.1654	8.4656	13.6564	20.3017
NC-1761.01000	0.50	0.7596	1.2449	2.0083	2.9855
NC-1762.01000	0.10	0.1519	0.2490	0.4017	0.5971
NC-1763.01000	0.80	1.2154	1.9919	3.2133	4.7769
NC-1764.01000	0.70	1.0635	1.7429	2.8116	2.1798
NC-1765.01000	2.01	3.0537	5.0047	8.0734	12.0019
NC-1766.01000	0.44	0.6685	1.0956	1.7673	2.6273
NC-1767.01000	0.07	0.1063	0.1743	0.2812	0.4180
NC-1768.01000	0.07	0.1063	0.1743	0.2812	0.4180
NC-1769.01000	0.04	0.0608	0.0996	0.1607	0.2388
NC-1770.R0000	0.21	0.2532	0.3158	0.3911	0.4670
NC-1771.01000	1.10	1.6712	2.7389	4.4183	6.5682
NC-1772.01000	1.40	2.1269	3.4859	5.6232	8.3595
NC-1773.01000	0.83	1.2610	2.0666	3.3338	4.9560
NC-1774.01000	0.16	0.2431	0.3984	0.6427	0.9554
NC-1775.01000	0.10	0.1519	0.2490	0.4017	0.5971
NC-1776.01000	0.20	0.3038	0.4980	0.8033	1.1942
NC-1777.01000	0.60	0.9115	1.4939	2.4100	3.5827
NC-1778.01000	1.10	1.6712	2.7389	4.4183	6.5682
NC-1779-01000	1.15	1.7471	2.8634	4.6191	6.8668
NC-1780.01000	0.06	0.0912	0.1494	0.2410	0.3583
NC-1781.01000	0.03	0.0456	0.0747	0.1205	0.1791
NC-1782.01000	0.20	0.3038	0.4980	0.8033	1.1942

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits			
		65%	80%	90%	95%
NC-1783.01000	0.69	1.0483	1.7180	2.7715	4.1201
NC-1784.01000	0.41	0.6229	1.0209	1.6468	2.4482
NC-1785.01000	2.40	3.6462	5.9757	9.6398	14.3306
NC-1786.01000	0.01	0.0152	0.0249	0.0402	0.0597
NC-1787.01000	0.10	0.1519	0.2490	0.4017	0.5971
NC-17A7.01000	0.10	0.1519	0.2490	0.4017	0.5971
NC-1811.01000	0.06	0.0912	0.1494	0.2410	0.3583
NC-1812.01000	0.10	0.1519	0.2490	0.4017	0.4971
NC-1813.01000	0.26	0.3950	0.6474	1.0443	1.5525
NC-1814.01000	0.40	0.6077	0.9960	1.6066	2.3884
NC-1815.01000	0.10	0.1519	0.2490	0.4017	0.5971
NC-1816.01000	2.30	3.4943	5.7268	9.2382	13.7335
NC-1817.01000	0.24	0.3646	0.5976	0.9640	1.4331
NC-1818.01000	0.60	0.9115	1.4939	2.4100	3.5827
NC-1819.01000	0.96	1.4585	2.3903	3.8559	5.7323
NC-1820.01000	1.20	1.8231	2.9879	4.8199	7.1653
NC-1821.01000	0.47	0.7140	1.1703	1.8878	2.8064
NC-1822.01000	0.05	0.0760	0.1245	0.201	0.299
NC-1823.01000	0.15	0.18	0.24	0.37	0.334
NC-1825.01000	1.20	1.8231	2.9879	4.820	7.165
NC-1826.01000	11.80	17.9271	29.3807	47.396	70.459
NC-1827.61000	0.03	0.0456	0.0747	0.120	0.179
NC-1828.01000	0.30	0.4558	0.7470	1.205	1.791
NC-1829.01000	0.10	0.1519	0.2490	0.402	0.597
NC-1830.01000	0.80	1.2154	1.9919	3.213	4.777
NC-1831.01000	10.40	15.8002	25.8949	41.773	62.099
NC-1832.01000	2.52	3.8285	6.2745	10.122	15.047
NC-1834.01000	0.20	0.3038	0.4980	0.803	1.194
NC-1835.01000	0.23	0.3494	0.5727	0.924	1.373
NC-1836.01000	0.15	0.2279	0.3735	0.602	0.896
NC-1837.01000	9.60	14.5848	23.9030	38.559	57.323
NC-1838.01000	10.10	15.3444	25.1479	40.568	60.308
NC-1839.01000	21.70	32.9677	54.0307	87.160	129.573
NC-1840.01000	0.60	0.9115	1.4939	2.410	3.583
NC-1841.01000	0.35	0.5317	0.8715	1.406	2.090
NC-1842.01000	0.13	0.1975	0.3237	0.522	0.776
NC-1843.01000	4.04	6.1378	10.0592	16.227	24.123
NC-1844.01000	13.20	20.0541	32.8666	53.019	78.819
NC-1845.01000	1.69	2.5675	4.2079	6.788	10.091
NC-1846.01000	2.30	3.4943	5.7268	9.238	13.734
NC-1847.01000	4.00	6.0770	9.9596	16.066	23.884
NC-1848.01000	0.46	0.6989	1.1454	1.848	2.747
NC-1849-01000	2.20	3.3423	5.4778	8.837	13.136
NC-1850.01000	25.30	38.4370	62.9943	101.620	151.069
NC-1851.01000	3.10	4.7097	7.7187	12.451	18.510
NC-1852.01000	38.60	58.6430	96.1099	155.041	230.484

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits			
		65%	80%	90%	95%
NC-1853.R1000	0.88	1.0610	1.3234	1.639	1.957
NC-1854.01000	13.30	20.2060	33.1156	53.421	79.416
NC-1855.01000	0.10	0.1419	0.2490	0.402	0.597
NC-1856.01000	0.50	0.7596	1.2449	2.008	2.986
NC-1857.01000	0.80	1.2154	1.9919	3.213	4.777
NC-1858.01000	5.10	7.7482	12.6985	20.485	30.453
NC-1859.01000	11.50	17.4714	28.6338	46.191	68.668
NC-1860.01000	1.70	2.5827	4.2328	6.828	10.151
NC-1861.61000	0.20	0.3038	0.4980	0.803	1.194
NC-1862.01000	0.14	0.2127	0.3486	0.562	0.836
NC-1863.01000	0.20	0.3038	0.4980	0.803	1.194
NC-1864.01000	2.36	0.5469	0.8964	1.446	2.150
NC-1865.01000	0.50	0.7596	1.2449	2.008	2.986
NC-1866.01000	0.43	0.6533	1.0707	1.727	2.568
NC-1869.01000	0.18	0.2735	0.4482	0.723	1.075
NC-1870.01000	0.11	0.1671	0.2739	0.442	0.657
NC-1871.01000	0.30	0.4558	0.7470	1.205	1.791
NC-1872.01000	0.60	0.9115	1.4939	2.410	3.583
NC-1873.01000	1.90	2.8866	4.7308	7.632	11.345
NC-1874.01000	0.10	0.1519	0.2490	0.402	0.597
NC-1875.01000	0.10	0.1519	0.2490	0.402	0.597
NC-1876.01000	0.62	0.9419	1.5437	2.490	3.702
NC-1877.01000	2.30	3.4943	5.7268	9.238	13.734
NC-1878.01000	2.00	3.0385	4.9798	8.033	11.942
NC-1880.01000	0.10	0.1519	0.2490	0.402	0.597
NC-1881.01000	0.10	0.1519	0.2490	0.402	0.597
NC-1882.01000	0.30	0.4558	0.7470	1.205	1.791
NC-1883.01000	0.62	0.478	0.932	1.155	1.379
NC-1884.01000	1.40	2.127	3.486	5.623	8.360
NC-1885.01000	0.50	0.760	1.245	2.008	2.986
NC-1886.01000	0.07	0.106	0.174	0.281	0.418
NC-1887.01000	0.10	0.152	0.249	0.402	0.597
NC-1896.01000	0.10	0.152	0.249	0.402	0.597
NC-18A1.01000	0.10	0.152	0.249	0.402	0.597
NC-1910.01000	0.10	0.152	0.249	0.402	0.597
NC-1911.01000	0.02	0.030	0.050	0.080	0.119
NC-1912.01000	0.13	0.198	0.324	0.522	0.776
NC-1913.01000	0.30	0.456	0.747	1.205	1.791
NC-1914.01000	1.99	3.023	4.955	7.993	11.882
NC-1915.01000	0.07	0.1063	0.174	0.281	0.418
NC-1917.01000	0.33	0.501	0.822	1.325	1.970
NC-1918.01000	0.70	1.063	1.743	2.812	4.180
NC-1919-01000	2.40	3.646	5.976	0.640	14.331
NC-1920.01000	7.00	10.635	17.429	28.116	41.798
NC-1921.01000	0.80	1.215	1.992	3.213	4.777
NC-1922.01000	0.10	0.152	0.249	0.402	0.597

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-1923.01000	0.10	0.152	0.249	0.402	0.597
NC-1924.61000	0.40	0.608	0.996	1.607	2.388
NC-1925.01000	4.00	6.077	9.960	16.066	23.884
NC-1926.01000	22.60	34.335	56.272	90.775	134.947
NC-1927.01000	1.40	2.127	3.486	5.623	8.360
NC-1928.01000	9.40	14.281	23.405	37.756	56.128
NC-1929.01000	0.30	0.456	0.747	1.205	1.791
NC-1930.01000	1.80	2.735	4.482	7.230	10.748
NC-1931.61000	13.00	19.750	32.369	52.216	77.624
NC-1932.01000	1.99	3.023	4.955	7.993	11.882
NC-1934.01000	0.30	0.456	0.747	1.205	1.791
NC-1936.R0000	0.26	0.32	0.41	0.64	0.578
NC-1937.01000	0.40	0.608	0.996	1.607	2.388
NC-1938.01000	0.90	1.367	2.241	3.615	5.374
NC-1939.01000	0.40	0.608	0.996	1.607	2.388
NC-1940.01000	0.30	0.456	0.747	1.205	1.791
NC-1941.01000	6.50	9.875	16.184	26.108	38.812
NC-1942.01000	0.20	0.304	0.498	0.803	1.194
NC-1943.01000	74.90	113.792	186.493	300.843	447.235
NC-1944.01000	14.80	22.485	36.850	59.446	88.372
NC-1945.01000	4.70	7.140	11.703	18.878	28.064
NC-1946.01000	1.90	2.887	4.731	7.632	11.345
NC-1947.01000	64.70	98.295	161.096	259.874	386.330
NC-1948.01000	0.90	1.367	2.241	3.615	5.374
NC-1949.01000	1.30	1.975	3.237	5.222	7.762
NC-1950.01000	1.40	2.127	3.486	5.623	8.360
NC-1951.01000	1.20	1.823	2.988	4.820	7.165
NC-1952.01000	1.80	2.735	4.482	7.230	10.748
NC-1953.01000	0.70	1.063	1.743	2.812	4.180
NC-1954.01000	0.70	1.063	1.743	2.812	4.180
NC-1955.01000	3.00	4.558	7.470	12.050	17.913
NC-1956.01000	0.10	0.152	0.249	0.402	0.597
NC-1957.01000	1.20	1.823	2.988	4.820	7.165
NC-1958.01000	7.13	10.832	17.753	28.638	42.574
NC-1959.01000	35.50	53.933	88.391	142.589	211.974
NC-1960.01000	6.30	9.571	15.686	25.305	37.618
NC-1961.01000	0.60	0.912	1.494	2.410	3.583
NC-1962.01000	0.50	0.7596	1.2449	2.0083	2.9855
NC-1963.01000	0.50	0.7596	1.2449	2.0083	2.9855
NC-1964.61000	0.37	0.5621	0.9213	1.4861	2.2093
NC-1965.01000	0.60	0.9115	1.4939	2.4100	3.5827
NC-1966.R0000	0.34	0.4099	0.5113	0.6332	0.7560
NC-1967.01000	0.10	0.1519	0.2490	0.4017	0.4971
NC-1968.01000	0.02	0.0304	0.0498	0.0803	0.1194
NC-1969.01000	0.10	0.1519	0.2490	0.4017	0.5971
NC-1970.01000	0.04	0.0608	0.0996	0.1607	0.2388

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits			
		65%	80%	90%	95%
NC-1971.01000	1.00	1.5192	2.4899	4.0166	5.9711
NC-1972.01000	1.70	2.5827	4.2328	6.8282	10.1509
NC-1973.01000	0.31	0.4710	0.7719	1.2451	1.8510
NC-1974.01000	0.10	0.1519	0.2490	0.4017	0.5971
NC-1975.01000	0.13	0.1975	0.3237	0.5222	0.7762
NC-1976.01000	0.50	0.7596	1.2449	2.0083	2.9855
NC-1978.01000	4.40	6.6847	10.9555	17.6730	26.2728
NC-1979.01000	0.50	0.7596	1.2449	2.0083	2.9855
NC-1980.01000	0.10	0.1519	0.2490	0.4017	0.5971
NC-1981.01000	0.15	0.2279	0.3735	0.6025	0.8957
NC-1982.01000	0.05	0.0760	0.1245	0.2008	0.2986
NC-1983.01000	0.31	0.4710	0.7719	1.2451	1.8510
NC-1984.01000	0.80	1.2154	1.9919	3.2133	4.7769
NC-1985.01000	1.10	1.6712	2.7389	4.4183	6.5682
NC-1986.01000	0.09	0.1367	0.2241	0.3615	0.5374
NC-1987.01000	0.10	0.1519	0.2490	0.4017	0.5971
NC-19A6.01000	0.10	0.1519	0.2490	0.4017	0.5971
NC-19B5.01000	0.10	0.1519	0.2490	0.4017	0.5971
NC-2010.01000	0.17	0.2583	0.4233	0.6828	1.0151
NC-2011.01000	0.35	0.5317	0.8715	1.4058	2.0899
NC-2012.01000	0.02	0.0304	0.0498	0.0803	0.1194
NC-2013.01000	1.00	1.5192	2.4899	4.0166	5.9711
NC-2014.01000	3.30	5.0135	8.2167	13.2548	19.7046
NC-2015.01000	1.09	1.6560	2.7140	4.3781	6.5085
NC-2016.01000	0.30	0.4558	0.7470	1.2050	1.7913
NC-2017.01000	0.80	1.2154	1.9919	3.2133	4.7769
NC-2018.01000	0.60	0.9115	1.4939	2.4100	3.5827
NC-2019.R0000	2.50	3.0142	3.7597	4.6557	5.5590
NC-2020.01000	7.40	11.2424	18.4252	29.7228	44.1861
NC-2021.01000	1.46	2.2181	3.6352	5.8642	8.7178
NC-2022.01000	0.14	0.2127	0.3486	0.5623	0.8360
NC-2023.01000	0.15	0.2279	0.3735	0.6025	0.8957
NC-2024.01000	1.20	1.8231	2.9879	4.8199	7.1653
NC-2025.01000	6.00	9.1155	14.9394	24.0996	35.8266
NC-2027.61000	16.40	24.9157	40.8343	65.8722	97.9260
NC-2026.01000	14.80	22.4849	36.8504	59.4457	88.3723
NC-2028.01000	1.50	2.2789	3.7348	6.0249	8.9566
NC-2029.01000	0.53	0.8052	1.3196	2.1288	3.1647
NC-2030.01000	1.30	1.9750	3.2369	5.2216	7.7624
NC-2031.01000	12.70	19.2945	31.6217	51.0108	75.8330
NC-2032.01000	4.40	6.6847	10.9555	17.6730	26.2728
NC-2034.01000	0.60	0.9115	1.4939	2.4100	3.5827
NC-2035.01000	0.20	0.3038	0.4980	0.8033	1.1942
NC-2036.01000	0.26	0.3950	0.6474	1.0443	1.5525
NC-2037.01000	0.41	0.6229	1.0209	1.6468	2.4482
NC-2038.01000	0.80	1.2154	1.9919	3.2133	4.7769

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits			
		65%	80%	90%	95%
NC-2039.01000	0.68	1.0331	1.6931	2.7313	4.0603
NC-2040.01000	0.27	0.410	0.672	1.084	1.612
NC-2041.01000	0.40	0.608	0.996	1.607	2.388
NC-2042.01000	0.08	0.122	0.199	0.321	0.478
NC-2043.01000	1.90	2.887	4.731	7.632	11.345
NC-2044.01000	147.00	223.330	366.014	590.440	877.752
NC-2045.01000	1.10	1.671	2.739	4.418	6.568
NC-2046.01000	0.80	1.215	1.992	3.213	4.777
NC-2047.01000	1.12	1.702	2.789	4.499	6.688
NC-2048.01000	0.30	0.456	0.747	1.205	1.791
NC-2049.R0000	0.28	0.338	0.421	0.521	0.623
NC-2050.01000	0.65	0.988	1.618	2.611	3.881
NC-2051.01000	0.71	1.079	1.768	2.852	4.239
NC-2054.01000	0.20	0.304	0.498	0.803	1.194
NC-2055.01000	0.01	0.015	0.025	0.040	0.060
NC-2056.01000	0.30	0.456	0.747	1.205	1.791
NC-2057.01000	0.63	0.957	1.569	2.530	3.762
NC-2058.01000	1.95	2.963	4.855	7.832	11.644
NC-2059.01000	2.10	3.190	5.229	8.435	12.539
NC-2060.01000	1.00	1.519	2.490	4.017	5.971
NC-2061.01000	0.02	0.030	0.050	0.080	0.119
NC-2062.01000	0.12	0.182	0.299	0.482	0.717
NC-2063.01000	0.45	0.684	1.120	1.807	2.687
NC-2064.01000	1.57	2.385	3.909	6.306	9.375
NC-2065.01000	1.07	1.626	2.664	4.298	6.389
NC-2067.61000	0.15	0.228	0.373	0.602	0.896
NC-2068.01000	0.42	0.638	1.046	1.687	2.508
NC-2069.01000	0.60	0.912	1.494	2.410	3.583
NC-2070.01000	0.16	0.243	0.398	0.643	0.955
NC-2071.01000	0.86	1.307	2.141	3.454	5.135
NC-2072.01000	5.10	7.748	12.698	20.485	30.453
NC-2073.01000	0.27	0.410	0.672	1.084	1.612
NC-2074.01000	0.10	0.152	0.249	0.402	0.597
NC-2075.01000	0.01	0.015	0.025	0.040	0.060
NC-2076.01000	0.13	0.198	0.324	0.522	0.776
NC-2077.01000	2.51	3.813	6.250	10.082	14.987
NC-2078.01000	4.30	6.533	10.707	17.271	25.676
NC-2079.R0000	0.34	0.42	0.54	0.83	0.756
NC-2080.01000	0.10	0.152	0.249	0.402	0.597
NC-2081.01000	0.26	0.395	0.647	1.044	1.552
NC-2082.01000	0.09	0.137	0.224	0.361	0.537
NC-2083.01000	0.96	1.458	2.390	3.856	5.732
NC-2084.01000	2.18	3.312	5.428	8.756	13.017
NC-2085.01000	0.87	1.322	2.166	3.494	5.195
NC-2086.01000	0.16	0.243	0.398	0.643	0.955
NC-2087.01000	0.04	0.061	0.100	0.161	0.239

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-2096.01000	0.10	0.152	0.249	0.402	0.597
NC-2098.01000	0.10	0.152	0.249	0.402	0.597
NC-20A7.61000	0.10	0.152	0.249	0.402	0.597
NC-2110.01000	0.10	0.152	0.249	0.402	0.597
NC-2111.01000	0.10	0.152	0.249	0.402	0.597
NC-2112.01000	0.20	0.304	0.498	0.803	1.194
NC-2113.01000	0.90	1.367	2.241	3.615	5.374
NC-2114.01000	4.30	6.533	10.707	17.271	25.676
NC-2115.01000	7.60	11.546	18.923	30.526	45.380
NC-2116.01000	0.40	0.608	0.996	1.607	2.388
NC-2117.01000	1.60	2.431	3.984	6.427	9.554
NC-2118.01000	5.00	7.5962	12.4495	20.083	29.855
NC-2119.01000	5.40	8.2039	13.4454	21.690	32.244
NC-2120.01000	4.40	6.6847	10.9555	17.673	26.273
NC-2121.01000	2.80	4.2539	6.9717	11.246	16.719
NC-2122.01000	0.40	0.6077	0.9960	1.607	2.388
NC-2123.01000	0.44	0.6685	1.0956	1.767	2.627
NC-2124.01000	2.00	3.0385	4.9798	8.033	11.942
NC-2125.01000	4.60	6.9885	11.4535	18.476	27.467
NC-2126.01000	10.50	15.9521	26.1439	42.174	62.697
NC-2127.01000	5.60	8.5078	13.9434	22.493	33.438
NC-2128.01000	1.70	2.5827	4.2328	6.828	10.151
NC-2129.01000	0.90	1.3673	2.2409	3.615	5.374
NC-2130.61000	31.90	48.4641	79.4276	128.130	190.478
NC-2131.R0000	18.60	22.93	29.35	45.5	41.359
NC-2132.01000	2.90	4.4058	7.2207	11.648	17.316
NC-2134.01000	0.40	0.6077	0.9960	1.607	2.388
NC-2135.01000	0.20	0.3038	0.4980	0.803	1.194
NC-2136.01000	0.22	0.3342	0.5478	0.884	1.314
NC-2137.01000	0.60	0.9115	1.4939	2.410	3.583
NC-2138.01000	0.56	0.8508	1.3943	2.249	3.344
NC-2139.01000	1.00	1.5192	2.4899	4.017	5.971
NC-2140.01000	0.80	1.2154	1.9919	3.213	4.777
NC-2141.01000	0.40	0.6077	0.9960	1.607	2.388
NC-2142.01000	0.20	0.3038	0.4980	0.803	1.194
NC-2143.01000	0.30	0.4558	0.7470	1.205	1.791
NC-2144.01000	0.86	1.3066	2.1413	3.454	5.135
NC-2145.01000	0.90	1.3673	2.2409	3.615	5.374
NC-2146.01000	0.70	1.0635	1.7429	2.812	4.180
NC-2147.01000	1.30	1.9750	3.2369	5.222	7.762
NC-2148.01000	0.97	1.4737	2.4152	3.896	5.792
NC-2149.01000	0.13	0.1975	0.3237	0.522	0.776
NC-2150.01000	0.05	0.0760	0.1245	0.201	0.299
NC-2151.01000	1.10	1.6712	2.7389	4.418	6.568
NC-2152.01000	0.80	1.2154	1.9919	3.213	4.777
NC-2153.01000	0.26	0.3950	0.6474	1.044	1.5552

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-2154.01000	0.05	0.0760	0.1245	0.201	0.299
NC-2155.01000	0.10	0.1519	0.2490	0.402	0.597
NC-2156.01000	0.10	0.1519	0.2490	0.402	0.597
NC-2158.01000	4.13	6.2745	10.2833	16.589	24.661
NC-2159.01000	1.08	1.6408	2.6891	4.338	6.449
NC-2160.01000	0.50	0.7596	1.2449	2.008	2.986
NC-2161.01000	0.08	0.1215	0.1992	0.321	0.478
NC-2162.R0000	0.10	0.12	0.16	0.24	0.222
NC-2163.01000	1.00	1.5192	2.4899	4.017	5.971
NC-2164.01000	1.80	2.7346	4.4818	7.230	10.748
NC-2165.01000	5.90	8.9636	14.6904	23.698	35.229
NC-2166.01000	1.70	2.5827	4.2328	6.828	10.151
NC-2167.01000	0.37	0.5621	0.9213	1.486	2.209
NC-2168.01000	0.20	0.3038	0.4980	0.803	1.194
NC-2169.01000	0.19	0.2887	0.4731	0.763	1.135
NC-2170.61000	0.47	0.7140	1.1703	1.888	2.806
NC-2171.01000	2.00	3.0385	4.9798	8.033	11.942
NC-2172.01000	10.00	15.1925	24.8989	40.166	59.711
NC-2173.01000	1.60	2.4308	3.9838	6.427	9.554
NC-2174.01000	0.10	0.1519	0.2490	0.402	0.597
NC-2175.01000	0.67	1.0179	1.6682	2.691	4.001
NC-2176.01000	0.13	0.1975	0.324	0.522	0.776
NC-2177.01000	9.95	15.1165	24.774	39.965	59.412
NC-2178.01000	3.50	5.3174	8.715	14.058	20.899
NC-2180.01000	0.15	0.2279	0.373	0.602	0.896
NC-2181.01000	0.48	0.7292	1.195	1.928	2.866
NC-2182.01000	0.90	1.3673	2.241	3.615	5.374
NC-2184.01000	4.68	7.1101	11.653	18.798	27.945
NC-2185.01000	4.02	6.1074	10.009	16.147	24.004
NC-2186.01000	1.41	2.1421	3.511	5.663	8.419
NC-2187.01000	3.20	4.8616	7.968	12.853	19.108
NC-2211.01000	2.60	3.9500	6.474	10.443	15.525
NC-2212-01000	34.60	52.5660	86.150	138.974	206.600
NC-2213.01000	1.75	2.6587	4.357	7.029	10.449
NC-2214.01000	7.20	10.9386	17.927	28.920	42.992
NC-2215.R0000	80.05	96.5139	120.387	149.077	177.999
NC-2216.01000	0.40	0.6077	0.996	1.607	2.388
NC-2217.01000	7.30	11.0905	18.176	29.321	43.589
NC-2218.01000	13.50	20.5099	33.614	54.224	80.610
NC-2219.01000	6.10	9.2674	15.188	24.501	36.424
NC-2220.01000	2.10	3.1904	5.229	8.435	12.539
NC-2221.01000	4.80	7.2924	11.951	19.280	28.661
NC-2222.01000	2.50	3.7981	6.225	10.041	14.928
NC-2223.01000	1.00	1.5192	2.490	4.017	5.971
NC-2224.01000	3.90	5.9251	9.711	15.665	23.287
NC-2225.01000	2.60	3.9500	6.474	10.443	15.525

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-2226.01000	10.20	15.4963	25.397	40.969	60.905
NC-2227.01000	37.20	56.5161	92.624	149.418	222.125
NC-2228.01000	3.50	5.3174	8.715	14.058	20.899
NC-2229.01000	0.80	1.2154	1.992	3.213	4.777
NC-2230.01000	63.00	95.7127	156.863	253.046	376.179
NC-2231.01000	14.30	21.7253	35.605	57.437	85.387
NC-2232.01000	6.90	10.4828	17.180	27.715	41.201
NC-2234.01000	0.70	1.0635	1.743	2.812	4.180
NC-2235.01000	0.26	0.3950	0.647	1.044	1.552
NC-2236.01000	0.20	0.3038	0.498	0.803	1.194
NC-2237.01000	0.40	0.6077	0.996	1.607	2.388
NC-2238.01000	0.50	0.7596	1.245	2.008	2.986
NC-2239.01000	1.10	1.6712	2.739	4.418	6.568
NC-2240.01000	2.10	3.1904	5.229	8.435	12.539
NC-2241.01000	0.80	1.2154	1.992	3.213	4.777
NC-2242.01000	0.21	0.3190	0.523	0.843	1.254
NC-2243.01000	0.70	1.0635	1.743	2.812	4.180
NC-2244.01000	1.90	2.8866	4.731	7.632	11.345
NC-2245.R0000	1.36	1.6397	2.045	2.533	3.024
NC-2246.01000	3.10	4.7097	7.719	12.451	18.510
NC-2247.01000	1.60	2.4308	3.984	6.427	9.554
NC-2248.01000	1.10	1.6712	2.739	4.418	6.568
NC-2249.01000	1.40	2.1269	3.486	5.623	8.360
NC-2250.01000	2.00	3.0385	4.980	8.033	11.942
NC-2251.01000	3.06	4.6489	7.619	12.291	18.272
NC-2252.01000	5.20	7.9001	12.947	20.886	31.050
NC-2253.01000	5.50	8.3559	13.694	22.091	32.841
NC-2254.01000	3.30	5.0135	8.217	13.255	19.705
NC-2255.01000	0.18	0.2735	0.448	0.723	1.075
NC-2256.01000	3.80	5.7731	9.462	15.263	22.690
NC-2257.01000	11.30	17.1675	28.136	45.388	67.473
NC-2258.01000	29.10	44.2102	72.456	116.883	173.759
NC-2259.01000	9.30	14.1290	23.156	37.354	55.531
NC-2260.01000	4.00	6.0770	9.960	16.066	23.884
NC-2261.01000	1.90	2.8866	4.731	7.632	11.345
NC-2262.01000	0.95	1.4433	2.365	3.816	5.673
NC-2263.01000	4.70	7.1405	11.703	18.878	28.064
NC-2264.01000	13.30	20.2060	33.116	53.421	79.416
NC-2265.01000	19.80	30.0811	49.300	79.529	118.228
NC-2266.01000	5.70	8.6597	14.192	22.895	34.035
NC-2267.01000	14.70	22.3330	36.601	59.044	87.775
NC-2268.01000	1.20	1.8231	2.988	4.820	7.165
NC-2269.01000	2.80	4.2539	6.972	11.246	16.719
NC-2270.01000	1.70	2.5827	4.233	6.828	10.151
NC-2270.01000	9.90	15.0406	24.650	39.764	59.114
NC-2271.01000	27.50	41.7794	68.472	110.456	164.205

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-2272.01000	25.30	38.4370	62.994	101.620	151.069
NC-2274.01000	7.68	11.6678	19.122	30.847	45.858
NC-2275.R0000	2.11	2.5440	3.173	3.929	4.692
NC-2276.01000	4.90	7.4443	12.200	19.681	29.258
NC-2277.01000	9.40	14.2809	23.405	37.756	56.128
NC-2279.01000	5.00	7.5962	12.449	20.083	29.855
NC-2280.01000	0.70	1.0635	1.743	2.812	4.180
NC-2281.01000	0.20	0.3038	0.498	0.803	1.194
NC-2282.01000	7.10	10.7867	17.678	28.518	42.395
NC-2284.01000	4.58	6.9582	11.404	18.396	27.348
NC-2285.01000	2.10	3.1904	5.229	8.435	12.539
NC-2286.01000	0.10	0.1519	0.249	0.402	0.597
NC-2287.01000	0.21	0.3190	0.523	0.843	1.254
NC-2293.01000	0.10	0.1519	0.249	0.402	0.597
NC-22B5.R0000	0.15	0.1809	0.226	0.279	0.334
NC-22B9.01000	0.10	0.1519	0.249	0.402	0.597
NC-2309.01000	0.06	0.0912	0.149	0.241	0.358
NC-2310.01000	0.10	0.1519	0.249	0.402	0.597
NC-2310.01000	0.10	0.1519	0.249	0.402	0.597
NC-2311.01000	0.20	0.3038	0.498	0.803	1.194
NC-2312.01000	0.30	0.4558	0.747	1.205	1.791
NC-2313.01000	0.75	1.1394	1.867	3.012	4.478
NC-2315.01000	0.70	1.0635	1.743	2.812	4.180
NC-2318.01000	4.90	7.4443	12.200	19.681	29.258
NC-2319.01000	0.40	0.6077	0.996	1.607	2.388
NC-2320.01000	1.60	2.4308	3.984	6.427	9.554
NC-2321.01000	38.00	57.7315	94.616	152.631	226.902
NC-2323.01000	1.30	1.9750	3.237	5.222	7.762
NC-2324.01000	7.63	11.5919	18.998	30.647	45.559
NC-2325.01000	13.90	21.1176	34.610	55.831	82.998
NC-2326.01000	15.10	22.9407	37.597	60.651	90.164
NC-2327.01000	59.30	90.0915	147.651	238.184	354.086
NC-2328.R0000	55.00	66.3118	82.714	102.426	122.298
NC-2329.01000	3.90	5.9251	9.711	15.665	23.287
NC-2330.01000	37.30	56.6680	92.873	149.819	222.722
NC-2331.01000	31.20	47.4006	77.685	125.318	186.298
NC-2332.01000	4.70	7.1405	11.703	18.878	28.064
NC-2334.01000	0.40	0.6077	0.996	1.607	2.388
NC-2335.01000	0.30	0.4558	0.747	1.205	1.791
NC-2336.61000	0.60	0.912	1.494	2.410	3.58
NC-2337.01000	0.52	0.790	1.295	2.089	3.10
NC-2338.01000	0.70	1.063	1.743	2.812	4.18
NC-2339.01000	1.30	1.975	3.237	5.222	7.76
NC-2340.01000	0.90	1.367	2.241	3.615	5.37
NC-2341.01000	0.70	1.063	1.743	2.812	4.18
NC-2342.01000	0.42	0.638	1.046	1.687	2.51

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-2343.01000	1.50	2.279	3.735	6.025	8.96
NC-2344.01000	3.30	5.014	8.217	13.255	19.70
NC-2345.01000	9.90	15.041	24.650	39.764	59.11
NC-2346.01000	1.79	2.719	4.457	7.190	10.69
NC-2347.01000	3.60	5.469	8.964	14.460	21.50
NC-2348.01000	1.91	2.902	4.756	7.672	11.40
NC-2349.01000	3.37	5.120	8.391	13.536	20.12
NC-2350.01000	2.24	3.403	5.577	8.997	13.38
NC-2351.01000	3.88	5.895	9.661	15.584	23.17
NC-2352.01000	3.50	5.317	8.715	14.058	20.90
NC-2353.01000	2.34	3.555	5.826	9.399	13.97
NC-2354.01000	7.14	10.847	17.778	28.679	42.63
NC-2355.01000	5.42	8.234	13.495	21.770	32.36
NC-2356.01000	10.80	16.408	26.891	43.379	64.49
NC-2357.01000	8.21	12.473	20.442	32.976	49.02
NC-2358.R0000	34.37	41.439	51.689	64.007	76.43
NC-2359.01000	8.20	12.458	20.417	32.936	48.96
NC-2360.01000	6.05	9.191	15.064	24.300	36.13
NC-2361.01000	7.31	11.106	18.201	29.361	43.65
NC-2362.01000	4.80	7.292	11.951	19.280	28.66
NC-2363.01000	6.50	9.875	16.184	26.108	38.81
NC-2364.01000	13.40	20.358	33.365	53.822	80.01
NC-2365.01000	17.30	26.283	43.075	69.487	103.30
NC-2366.01000	9.10	13.825	22.658	36.551	54.34
NC-2367.01000	9.40	14.281	23.405	37.756	56.13
NC-2368.01000	8.00	12.154	19.919	32.133	47.77
NC-2369.01000	100.00	151.925	248.989	401.660	597.11
NC-2370.01000	36.70	55.756	91.379	147.409	219.14
NC-2371.01000	57.80	87.813	143.916	232.159	345.13
NC-2372.01000	94.60	143.721	235.544	379.970	564.87
NC-2373.01000	58.10	88.268	144.663	233.364	346.92
NC-2374.01000	47.60	72.316	118.519	191.190	284.22
NC-2376.61000	179.00	271.946	445.691	718.971	1068.83
NC-2377.01000	72.60	110.298	180.766	291.605	433.50
NC-2378.01000	31.40	47.704	78.183	126.121	187.49
NC-2379.01000	14.80	22.485	36.850	59.446	88.37
NC-2381.01000	25.70	39.045	63.990	103.227	153.46
NC-2382.01000	2.90	4.406	7.221	11.648	17.32
NC-2383.01000	25.20	38.285	62.745	101.218	150.47
NC-2384.01000	135.00	205.099	336.136	542.241	806.10
NC-2385.01000	7.10	10.787	17.678	28.518	42.39
NC-2386.01000	0.10	0.152	0.249	0.402	0.60
NC-2387.01000	0.10	0.152	0.249	0.402	0.60
NC-2390.01000	0.10	0.152	0.249	0.402	0.60
NC-2409.01000	0.30	0.456	0.747	1.205	1.79
NC-2410.R0000	0.22	0.265	0.331	0.410	0.49

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-2411.01000	2.60	3.950	6.474	10.443	15.52
NC-2412.01000	1.11	1.686	2.764	4.458	6.63
NC-2413.01000	0.40	0.608	0.996	1.607	2.39
NC-2414.01000	0.40	0.608	0.996	1.61	2.39
NC-2415.01000	1.40	2.127	3.486	5.62	8.36
NC-2416.01000	0.90	1.367	2.241	3.61	5.37
NC-2417.01000	1.30	1.975	3.237	5.22	7.76
NC-2418.01000	0.78	1.185	1.942	3.13	4.66
NC-2419.01000	0.50	0.760	1.245	2.01	2.99
NC-2420.01000	28.20	42.843	70.215	113.27	168.39
NC-2421.01000	19.90	30.233	49.549	79.93	118.82
NC-2422.01000	3.10	4.710	7.719	12.45	18.51
NC-2423.01000	5.20	7.900	12.947	20.89	31.05
NC-2424.01000	26.50	40.260	65.982	106.44	158.23
NC-2425.01000	54.20	82.343	134.952	217.70	323.63
NC-2426.01000	66.60	101.182	165.827	267.51	397.68
NC-2427.01000	52.10	79.153	129.723	209.26	311.09
NC-2428.01000	164.00	249.157	408.343	658.72	979.26
NC-2429.01000	56.80	86.293	141.426	228.14	339.16
NC-2430.01000	2.30	3.494	5.727	9.24	13.73
NC-2431.01000	35.40	53.781	88.142	142.19	211.38
NC-2432.01000	2.10	3.190	5.229	8.43	12.54
NC-2434.01000	0.50	0.760	1.245	2.01	2.99
NC-2435.01000	0.20	0.304	0.498	0.80	1.19
NC-2436.01000	0.20	0.304	0.498	0.80	1.19
NC-2437.01000	0.26	0.395	0.647	1.04	1.55
NC-2438.01000	0.70	1.063	1.743	2.81	4.18
NC-2439.61000	3.90	5.925	9.711	15.66	23.29
NC-2440.R0000	3.58	4.316	5.384	6.67	7.96
NC-2442.01000	1.50	2.279	3.735	6.02	8.96
NC-2443.01000	1.20	1.823	2.988	4.82	7.17
NC-2444.01000	13.40	20.358	33.365	53.82	80.01
NC-2445.01000	7.40	11.242	18.425	29.72	44.19
NC-2446.01000	2.90	4.406	7.221	11.65	17.32
NC-2447.01000	3.40	5.165	8.466	13.66	20.30
NC-2448.01000	3.50	5.317	8.715	14.06	20.90
NC-2449.01000	2.70	4.102	6.723	10.84	16.12
NC-2454.01000	32.30	49.072	80.424	129.74	192.87
NC-2455.01000	3.80	5.773	9.462	15.26	22.69
NC-2456.01000	4.00	6.077	9.960	16.07	23.88
NC-2457.01000	18.90	28.714	47.059	75.91	112.85
NC-2458.01000	101.00	153.444	251.479	405.68	603.08
NC-2459.01000	17.10	25.979	42.577	68.68	102.11
NC-2460.01000	5.30	8.052	13.196	21.29	31.65
NC-2461.01000	18.80	28.562	46.810	75.51	112.26
NC-2462.01000	28.90	43.906	71.958	116.08	172.56

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-2463.01000	103.00	156.483	256.459	413.71	615.02
NC-2464.01000	9.30	14.129	23.156	37.35	55.53
NC-2465.01000	9.80	14.889	24.401	39.36	58.52
NC-2466.01000	14.40	21.877	35.854	57.84	85.98
NC-2467.01000	34.70	52.718	86.399	139.38	207.20
NC-2468.01000	10.80	16.408	26.891	43.38	64.49
NC-2469.01000	61.20	92.978	152.382	245.82	365.43
NC-2470.R0000	190.06	229.150	285.831	353.95	422.62
NC-2471.01000	264.00	401.082	657.332	1060.38	1576.37
NC-2472.01000	282.00	428.428	702.150	1132.68	1683.85
NC-2473.01000	207.00	314.485	515.408	831.44	1236.02
NC-2474.01000	163.00	247.638	405.853	654.71	973.29
NC-2476.01000	207.00	314.485	515.408	831.44	1236.02
NC-2477.01000	32.60	49.528	81.17	130.94	194.66
NC-2479.61000	40.10	60.922	99.84	161.07	239.44
NC-2480.01000	38.60	58.643	96.11	155.04	230.48
NC-2481.01000	2.19	3.327	5.45	8.80	13.08
NC-2482.01000	86.60	131.567	215.62	347.84	517.10
NC-2483.01000	32.70	49.679	81.42	131.34	195.25
NC-2484.01000	10.40	15.800	25.89	41.77	62.10
NC-2485.01000	0.58	0.881	1.44	2.33	3.46
NC-2487.01000	0.03	0.046	0.07	0.12	0.18
NC-24A2.01000	0.20	0.304	0.50	0.80	1.19
NC-24B1.01000	0.10	0.152	0.25	0.40	0.60
NC-2509.01000	0.40	0.608	1.00	1.61	2.39
NC-2510.01000	0.40	0.608	1.00	1.61	2.39
NC-2511.01000	1.30	1.975	3.24	5.22	7.76
NC-2512.01000	0.28	0.425	0.70	1.12	1.67
NC-2513.01000	0.09	0.137	0.22	0.36	0.54
NC-2514.01000	0.30	0.456	0.75	1.20	1.79
NC-2515.01000	0.30	0.456	0.75	1.20	1.79
NC-2516.01000	0.20	0.304	0.50	0.80	1.19
NC-2517.01000	1.50	2.279	3.73	6.02	8.96
NC-2518.01000	0.10	0.152	0.25	0.40	0.60
NC-2519.01000	0.10	0.152	0.25	0.40	0.60
NC-2520.01000	0.20	0.304	0.50	0.80	1.19
NC-2521.01000	14.70	22.333	36.60	59.04	87.78
NC-2522.01000	2.10	3.190	5.23	8.43	12.54
NC-2523.R0000	0.48	0.579	0.72	0.89	1.07
NC-2524.01000	3.80	5.773	9.46	15.26	22.69
NC-2525.01000	0.90	1.367	2.24	3.61	5.37
NC-2526.01000	66.50	101.030	165.58	267.10	397.08
NC-2527.01000	106.00	161.040	263.93	425.76	632.94
NC-2528.01000	182.00	276.503	453.16	731.02	1086.74
NC-2529.01000	6.50	9.875	16.18	26.11	38.81
NC-2530.01000	0.70	1.063	1.74	2.81	4.18

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONTINUED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-2531.01000	6.50	9.875	16.18	26.11	38.81
NC-2534.01000	0.70	1.063	1.74	2.81	4.18
NC-2535.01000	0.30	0.456	0.75	1.20	1.79
NC-2536.01000	0.20	0.304	0.50	0.80	1.19
NC-2537.01000	0.13	0.198	0.32	0.52	0.78
NC-2538.01000	0.80	1.215	1.99	3.21	4.78
NC-2539.01000	51.30	77.938	127.73	206.05	306.32
NC-2540.01000	11.50	17.471	28.63	46.19	68.67
NC-2541.01000	0.90	1.367	2.24	3.61	5.37
NC-2542.61000	1.50	2.279	3.73	6.02	8.96
NC-2543.01000	0.60	0.912	1.49	2.41	3.58
NC-2544.01000	18.80	28.562	46.81	75.51	112.26
NC-2553.R0000	6.74	8.126	10.14	12.55	14.99
NC-2554.01000	4.30	6.533	10.71	17.27	25.68
NC-2555.01000	1.60	2.431	3.98	6.43	9.55
NC-2556.01000	3.30	5.014	8.22	13.25	19.70
NC-2557.01000	7.20	10.939	17.93	28.92	42.99
NC-2558.01000	646.00	981.435	1608.47	2594.72	3857.33
NC-2559.01000	7.20	10.939	17.93	28.92	42.99
NC-2561.01000	13.40	20.358	33.36	53.82	80.01
NC-2562.01000	9.80	14.889	24.40	39.36	58.52
NC-2563.01000	6.80	10.331	16.93	27.31	40.60
NC-2564.01000	25.70	39.045	63.99	103.23	153.46
NC-2565.01000	20.10	30.537	50.047	80.734	120.019
NC-2566.01000	33.30	50.591	82.913	133.753	198.838
NC-2567.01000	106.00	161.040	263.929	425.760	632.937
NC-2568.01000	49.10	74.595	122.254	197.215	293.181
NC-2569.01000	11.00	16.712	27.389	44.183	65.682
NC-2570.01000	19.00	28.866	47.308	76.315	113.451
NC-2573.01000	23.90	36.310	59.508	95.997	142.709
NC-2574.01000	11.90	18.079	29.630	47.798	71.056
NC-2576.01000	6.20	9.419	15.437	24.903	37.021
NC-2577.01000	31.10	47.249	77.436	124.916	185.701
NC-2578.01000	147.00	223.330	366.014	590.440	877.752
NC-2579.01000	45.10	68.518	112.294	181.149	269.297
NC-2580.01000	6.70	10.179	16.682	26.911	40.006
NC-2581.01000	1.40	2.127	3.486	5.623	8.360
NC-2582.61000	8.00	12.154	19.919	32.133	47.769
NC-2583.R0000	1.82	2.194	2.737	3.389	4.047
NC-2584.01000	0.10	0.152	0.249	0.402	0.597
NC-2585.01000	0.15	0.228	0.373	0.602	0.896
NC-2586.01000	0.10	0.152	0.249	0.402	0.597
NC-2587.01000	0.38	0.577	0.946	1.526	2.269
NC-2589.01000	0.01	0.015	0.025	0.040	0.060
NC-2599.01000	0.10	0.152	0.249	0.402	0.597
NC-25A2.01000	0.10	0.152	0.249	0.402	0.597

TABLE D-1 UPPER CONFIDENCE LIMITS FOR SURFACE SAMPLES (CONCLUDED)

Sample Number	[a]Sample TCDD Result (ppb)	Upper Confidence Limits 65%	80%	90%	95%
NC-25B2.01000	0.10	0.152	0.249	0.402	0.597
NC-25B4.01000	0.10	0.152	0.249	0.402	0.597
NC-25C6.01000	0.05	0.076	0.124	0.201	0.299
NC-2809.01000	0.20	0.304	0.498	0.803	1.194
NC-2812.01000	0.10	0.152	0.249	0.402	0.597
NC-2820.01000	0.04	0.061	0.100	0.161	0.239
NC-2828.01000	0.10	0.152	0.249	0.402	0.597
NC-2829.01000	0.10	0.152	0.249	0.402	0.597
NC-2843.01000	0.10	0.152	0.249	0.402	0.597
NC-2852.01000	0.10	0.152	0.249	0.402	0.597
NC-2856.01000	0.10	0.152	0.249	0.402	0.597
NC-2858.01000	0.10	0.152	0.249	0.402	0.597
NC-2870.01000	31.00	47.097	77.187	124.515	185.104
NC-2883.01000	0.02	0.030	0.050	0.080	0.119
NC-2889.01000	0.30	0.456	0.747	1.205	1.791
NC-2893.01000	0.10	0.152	0.249	0.402	0.597
NC-28A4.01000	0.30	0.456	0.747	1.205	1.791
NC-28A0.01000	0.04	0.061	0.100	0.161	0.239
NC-28B1.01000	0.30	0.456	0.747	1.205	1.791
NC-28B6.01000	0.10	0.152	0.249	0.402	0.597
NC-28B9.01000	0.30	0.456	0.747	1.205	1.791
NC-2928.01000	0.70	1.063	1.743	2.812	4.180

a. NC-____.R0000 indicates that plot is a replicated plot, and sample result is the geometric mean of the composite samples.