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VOL VI

FULL-SCALE INCINERATION SYSTEM DEMONSTRATION AT THE NAVAL BATTALION CONSTRUCTION CENTER, GULFPORT, MISSISSIPPI - VOL VI: SOIL EXCAVATION

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This technical report is divided into eight volumes. This portion of the report comprises Volume VI, Soil Excavation. This volume describes the methods in 1987 and 1988 to excavate 15,000 yd^2 of soil contaminated with dioxins and other hazardous constituents of Herbicide Orange at the center. The document presents the technologies and processes used, including ambient air monitoring and sampling procedures, and outlines the planning and implementation, field operations and field data, costs and data analysis, evaluation and discussion, and conclusions and recommendations. The overall goal of the project was to determine the reliability and cost effectiveness of a 100 ton/day rotary kiln incinerator. The demonstration project consisted of three phases: (1) demonstration of the effectiveness of the incinerator to process the soil, (2) demonstration of the ability of the incinerator to meet Resource Conservation and Recovery Act requirements (Destruction and Removal Efficiency of 99.9999%), and (3) determination of the cost and reliability of using the incinerator on a long-term basis.

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EXECUTIVE SUMMARY

The Naval Construction Battalion Center (NCBC) Demonstration Project was conducted as part of the research, test, and evaluation phase of the U.S. Air Force Installation Restoration Program, and was sponsored by the Air Force Engineering and Services Center (AFESC). The overall goal of the project was to determine the cost and effectiveness of a 100 tons/day rotary kiln incinerator in processing soil contaminated with dioxins and other hazardous constituents of Herbicide Orange.

The demonstration program consisted of three phases. The first phase, the verification test burn, demonstrated the effectiveness of the 100 tons/day incinerator to destroy soil contaminated with constituents of Herbicide Orange, in particular 2,3,7,8-tetrachlorinated dibenzo dioxin (2,3,7,8-TCDD).

The second phase demonstrated the ability of the incinerator to meet the requirements of the Resource Conservation and Recovery Act (RCRA), which specifies that the incinerator must meet or exceed a Destruction and Removal Efficiency of 99.9999%.

The third phase determined the cost and reliability of using the incinerator on a long-term basis.

Five verification test burns were conducted and evaluated for a range of operating conditions. One hundred tons of contaminated soil were processed under a Research, Development, and Demonstration permit issued by the U.S. Environmental Protection Agency, Region IV, in accordance with RCRA, as amended. Soil feed rates ranged between 2.8 and 6.3 tons per hour. Average kiln temperatures for the five test burns varied between 1,355 and 1,645°F. The Secondary Combustion Chamber average temperatures for the five test burns varied between 2,097 and 2,174°F. All test burns achieved the AFESC goal that the treated soil polychlorodibenzo-p dioxin/polychlorodibenzofuran (PCDD/PCDF) congener sum (tetra, penta, hexa) be less than 1.0 part per billion (ppb).

In May 1987, a RCRA trial burn was performed to demonstrate the ability of the incinerator to meet the Destruction and Removal Efficiency requirement of 99.9999% as specified in 40 CFR 214.

Hexachloroethane and 1,2,4-trichlorobenzene were used as the two surrogate Principal Organic Hazardous Constituents (POHCs). Clean builders sand was used as a surrogate soil matrix in lieu of native soil.

Three tests were completed at a nominal feed rate of 5.3 tons per hour. The surrogate POHC concentration in the sand was nominally 2,500 parts per million (ppm). Destruction and Removal Efficiencies of 99.999977, 99.999979, and 99.99997% were demonstrated.

During the third phase of the NCBC Demonstration Project, 1,006 20 by 20-foot plots were excavated from a depth of 3 inches up to as much as 51 inches.

The total soil excavated from these plots was approximately 15,000 yd^3. The equipment used in the soil excavation task were a bulldozer, front-end loader, dump truck, asphalt mill (planer), and track hoe. Air monitoring was performed at all times during excavation to minimize the possibility of movement of contaminated dust offsite. Immediately after the excavation of a plot, a bottom-of-hole sample was taken from the plot and shipped to an analytical laboratory for 2,3,7,8-TCDD analysis. If the analytical results showed the 2,3,7,8-TCDD concentration to be less than 1.0 ppb, the plot was considered to be clean. If the results showed the concentration to be 1.0 ppb or greater, the plot was re-excavated.

As the soil was excavated, it was placed in one of three soil storage tents located near the incinerator. A material handler, using a front-end loader, transferred the soil from the storage tents to the weigh hopper/shredder unit where it was weighed, shredded into small pieces, and dropped onto a covered feed conveyor. The covered conveyor belt carried the soil to the feed hopper where the auger fed the soil into the rotary kiln incinerator. The soil in the rotary kiln was subjected to a minimum temperature of 1,450°F for 20 to 40 minutes to volatilize the organics. At the outlet of the kiln, the burned solids (ash) fell into a water quench tank, while the gases and submicron particulate flowed upward through the cyclones and crossover duct to the Secondary Combustion Chamber. The treated soil (ash) was removed from the quench tank and stored in roll-off boxes awaiting laboratory analysis. Upon receipt of satisfactory analytical results, the treated soil was removed from the roll-off boxes and placed back in the field. None of the treated soil required reprocessing.

Maintenance information pertaining to the incineration system was collected daily from the operator's logbook, scheduled and unscheduled maintenance forms, and the Data Acquisition System Interlock Summary Sheet. The maintenance and cost data were entered into a computer data base and were used to calculate the availability and cost effectiveness of the incineration system.

The results of the NCBC Demonstration Project prove that a mobile waste incineration system is effective in treating contaminated soil.

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PREFACE

This report was prepared by EG&G Idaho, Inc., P. O. Box 1625, Idaho Falls, ID 83415, under Job Order Number (JON) 2103 9027, for the Air Force Engineering and Services Center, Engineering and Services Laboratory, Tyndall Air Force Base, Florida 32403-6001.

This report summarizes work done between September 1989 and February 1989 Major Terry Stoddart and Major Michael L. Shelley were the AFESC/RDVS Project Officers.

This report has been reviewed by the Fublic Affairs Office (PA) and is releasable to the general public, including foreign nationals.

This report has been reviewed and is approved for publication.

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AAMD	Ambient Air Monitoring Data Sheet
AAMP	Ambient Air Monitoring Plan
AFESC	Air Force Engineering and Services Center
BFI	Browning Ferris Industries
BOH	bottom of hole
DOD	Department of Defense
DRE	Destruction and Removal Efficiency
EPA	Environmental Protection Agency
GC/MS	gas chromatography/mass spectrometry
Hi-Vol	high volumne
HO	Herbicide Orange
HRMS	high resolution mass spectrometry
INEL	Idaho National Engineering Laboratory
LRMS	low resolution mass spectrometry
MS	mass spectrometry
NCBC	Naval Construction Battalion Center
POHC	Principal Organic Hazardous Constituent
POTW	Publicly Owned Treatment Works
ppb	parts per billion
ppm	parts per million
PUF	polyurethane foam
QA	Quality Assurance
RCRA	Resource Conservation and Recovery Act
RD&D	Research, Development, and Demonstration
TCDD	tetrachlorodibenzodioxin
TCDF	tetrachlorodibenzofuran
USAF	U.S. Air Force

SECTION I

INTRODUCTION

A. OBJECTIVE

The purpose of the Naval Construction Battalion Center (NCBC) Demonstration Project was to demonstrate the reliability and cost effectiveness of a mobile rotary kiln incinerator in the soil treatment and site restoration of a Herbicide Orange (HO) contaminated site. The mobile waste incineration system, Model MWP-2000, manufactured and operated by Environmental Services Company (now known as ENSCO) of Little Rock, Arkansas, was selected for this Air Force full-scale demonstration. The former HO storage site at NCBC in Gulfport, Mississippi, was the selected location for the demonstration.

The specific goal of this technology demonstration was to reduce the total isomers of tetra-, penta-, and hexa-chlorodibenzo-p-dioxin and respective isomers of polychlorodibenzofuran to less than 1 part per billion (ppb). The overall soil treatment goal was to reduce the contaminants to meet criteria approved by the Environmental Protection Agency (EPA), which would facilitate the delisting of soil under the auspices of the Resource Conservation and Recovery Act (RCRA) of 1976, as amended by the Hazardous and Solid Waste Amendments of 1984.

The effectiveness of the demonstration was monitored in terms of cost, availability, maintainability, schedule, and the ability to satisfy the current regulations in terms of total site remediation.

B. BACKGROUND

HO is composed primarily of two compounds, 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), and various esters of these two compounds. HO was sprayed as a defoliant in Vietnam during the 1960s, and NCBC served as an interim storage site (6 to 18 months) for drums destined for Southeast Asia until 1970.

In April 1970, the Secretaries of Agriculture; Health, Education, and Welfare; and 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 tetrachlorodibenzodioxin (TCDD). Subsequently, the Department of Defense (DOD) suspended the use of HO, which contained 2,4,5-T. At the time of suspension, the U.S. Air Force (USAF) had an inventory of 1.37 million gallons of HO in South Vietnam and 0.85 million gallons at NCBC. In September 1971, the 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. The 1.37 million gallons were moved to Johnston Island in the Central Pacific in April 1972. The average concentration of dioxin in the HO was about 2 parts per million (ppm), with the total amount of TCDD in the entire HO stock estimated at 44.1 pounds.

Various disposal techniques for HO were investigated from 1971 to 1974. Of those techniques investigated, only high-temperature incineration was sufficiently developed to warrant further investigation. Therefore, during the summer of 1977, the USAF disposed of 2.22 million gallons of HO by high-temperature incineration at sea. This operation, Project PACER HO, was accomplished under very stringent EPA ocean dumping permit requirements.

During storage and handling at the storage sites, some of the HO was spilled onto the surrounding soil. The soil was therefore contaminated with dioxin as well as the 2,4-D and 2,4,5-T components. Prior to this project, the dioxin contamination on the site ranged from nondetectable to over 640 ppb; the average concentration was estimated at 20 ppb.

The USAF plan for disposal of the bulk quantities of HO and the EPA permits for the disposal of the herbicide committed the USAF to a follow-up storage site reclamation and environmental monitoring program.

The major objectives of that required program were to:

- Determine the magnitude of herbicide, TCDD, and tetrachlorodibenzofuran (TCDF) contamination in and around the former HO storage and test sites.

- Determine the rate of natural degradation for the phenoxy herbicides (2,4-D and 2,4,5-T), their phenolic degradation products, and TCDD and TCDF in soils of the storage and test sites.

- Monitor for potential movement of residues from the storage and test sites into adjacent water, sediments, and biological organisms.

- Recommend managerial techniques for minimizing any impact of the herbicides and dioxin residues on the ecology and human populations near the storage and test sites.

Immediately following the at-sea incineration in 1977, the USAF Occupational and Environmental Health Laboratory, which is responsible for routine environmental monitoring, initiated site monitoring studies of chemical residues in soil, silt, water, and biological organisms associated with the former HO storage sites at NCBC and Johnston Island.

To accomplish the goals of returning the former HO storage site to full and beneficial use, the USAF used the technical capabilities of the Department of Energy's Idaho National Engineering Laboratory (INEL) and, in particular, EG&G Idaho, Inc., a Department of Energy contractor.

In 1985, the USAF and EG&G Idaho coordinated a site characterization study (Reference 1). The USAF and EG&G Idaho continued the remediation investigation by coordinating two small-scale projects to demonstrate the feasibility of two different technologies for the removal of dioxin from HO-contaminated soil. Although those demonstrations were successful, the technologies were not sufficiently developed to use for full-scale site remediation. When the small-scale projects were completed, the USAF still had little data to predict the cost and feasibility of remediating large quantities of contaminated soil. The USAF, in coordination with EG&G Idaho, conducted a full-scale demonstration project in which cost and reliability data would be collected during site remediation.

Rotary kiln incineration was chosen as the technology most likely to be cost effective and reliable. Bids were solicited from a variety of incinerator contractors. Bid evaluation resulted in choosing ENSCO as the incinerator contractor. While ENSCO provided the equipment and operational personnel for the incinerator and soil excavation, EG&G Idaho provided the expertise in overall project management, EPA permitting, and regulatory compliance. Versar, Inc., provided sampling assistance. IT Analytical Services, Twin Cities Testing, and U.S. Testing provided analytical support.

The full-scale research, development, and demonstration (RD&D) project began in September 1986, when the incinerator was assembled onsite. A verification test burn conducted in December 1986 successfully demonstrated that the incinerator produced no hazardous effluents. In May 1987, a RCRA trial burn successfully demonstrated that the incinerator could achieve the required 99.9999 ("six 9s") percent Destruction and Removal Efficiency (DRE). Operational testing and site remediation began when EPA Region IV issued the final RD&D permit on 23 November 1987. Testing and remediation continued until 19 November 1988 when the last contaminated soil was processed. The incinerator was decontaminated, disassembled, and removed from the site in February 1989.

The former HO storage site is located at the northern end of NCBC. In the 1940s, the site was designated as a heavy equipment storage area. To accommodate that function, the soil was tilled and mixed with portland cement. The natural precipitation and subsequent drying left a 6- to 10-inch hardpan layer of cement-stabilized soil.

The boundaries of the former HO storage site were determined through an extensive investigation, using aerial photographs, personal interviews, and shipping documents. Based upon those data, an extensive sampling and analysis program was developed.

Figure 1 shows the former HO storage area, which was divided into three major sections separated by railroad tracks. Each area was subdivided into 20- by 20-foot plots and sampled for 2,3,7,8-TCDD.

Area A was used for long-term storage of HO from 1970 to 1977. Areas B and C were used in the 1960s for short-term storage of HO awaiting shipment to Southeast Asia. The average length of time that a drum of HO remained at NCBC was approximately 9 months. Contamination of Areas B and C resulted from spillage during handling of the stored HO drums. Because the drums remained in those areas for only a relatively short time, the spread of contamination was less significant than in Area A. The contaminant migration followed a pattern of decreasing concentration toward the drainage ditches, which lie at the center of the areas. This is because the drums were stored on the rows near Holtman and Greenwood Avenues in Area B and near Holtman Avenue in Area C. The natural gradient of the site is from those rows toward the drainage ditches.

The total area actually used for HO storage was approximately 16 acres. Because of the storage pattern, however, all of areas A, B, and C were left unusable; those areas comprise approximately 31 acres.

Because of the cement-stabilized soil, the spilled HO tended to remain close to the surface and did not penetrate deeply into the underlying soil. Additionally, the principal hazard, 2,3,7,8-TCDD, has a very low solubility in water and a very high affinity to soil particles; hence, it did not migrate to deep subsurface layers of soil.

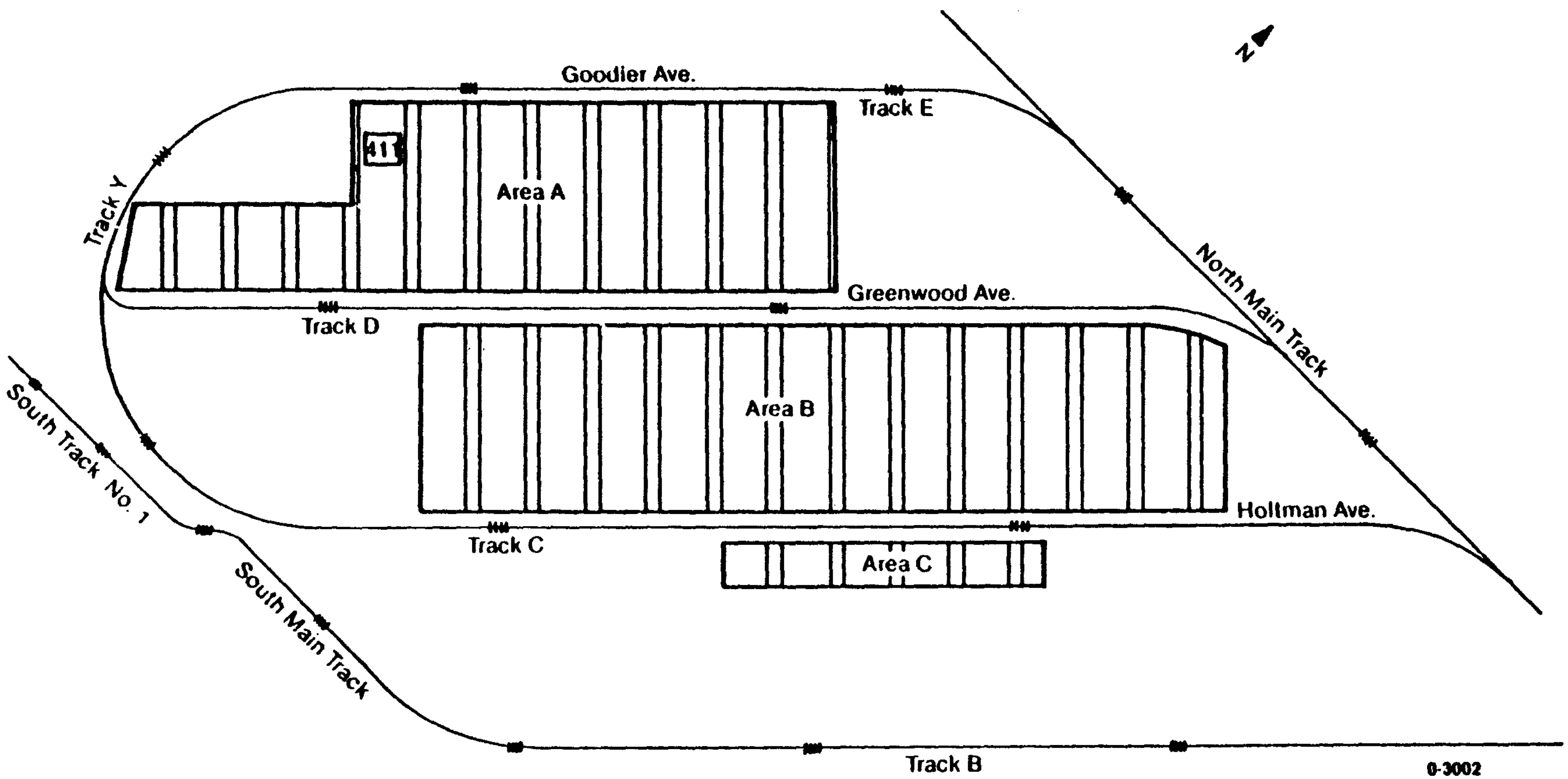

Figure 1. Former Herbicide Orange Storage Site.

In the late 1970s, the USAF Occupational and Environmental Health Laboratory conducted studies that determined that dioxin was migrating slowly offsite via the drainage ditches. Based upon those studies, the USAF had sediment filters installed in the drainage ditches to reduce the contaminant migration.

Site characterization of Area A was conducted in two separate campaigns in 1977-1978 and in 1980-1982. Over 1700 samples and 200 Quality Assurance (QA) samples were collected to characterize the 16-acre site. These sampling programs consisted of both surface and subsurface sampling. Surface soil samples were obtained at depths up to 5 feet. The sampling program for Areas B and C conducted in 1986-1987 consisted of 920 surface samples with an additional 87 samples collected for QA purposes.

C. SCOPE/APPROACH

This report summarizes the various phases of soil excavation activities for the NCBC Demonstration Project. These phases include the technologies used in excavating and storing of HO-contaminated soil. Also discussed are the costs associated with these activities. Recommendations are made for conducting a site remediation project in the future.

SECTION II
TECHNOLOGIES AND PROCESSES

A. EXCAVATION AND STORAGE OF SOIL

Several excavation methods were used in the HO-contaminated soil excavation and soil storage operations at NCBC. The primary method was to use a small asphalt planer owned by the USAF to remove the top 3 to 6 inches of cement-stabilized soil. The planer is shown in Figures 2 and 3. A bulldozer and a front-end loader were used to scoop up the fine milled soil produced by the asphalt planer. The front-end loader deposited the soil in a covered dump truck for transportation to the soil storage area. The excavated soil was placed in domed tents to provide some drying, to protect the soil from precipitation, and to reduce the potential for fugitive dust emissions. A soil storage tent is shown in Figure 4.

The asphalt planer was only used in areas where large numbers of adjacent plots needed to be excavated. In areas where the soil contamination was relatively high, deeper excavation was required. Also, many plots were situated such that the asphalt planer could not maneuver. Therefore, on those plots, a track hoe was used for excavation. The track hoe excavated the soil and placed it directly in a dump truck, which was covered during transport. The truck moved the excavated soil to the soil storage area to await processing. After the cement-stabilized soil layer was removed from a plot, deeper excavation of that plot was done with a small bulldozer and front-end loader, or the track hoe, which are shown in Figure 5.

Because of high heat stress during the day, excavation was scheduled for night operations to minimize worker stress. When temperatures were cooler, the excavation was scheduled for daytime operations.

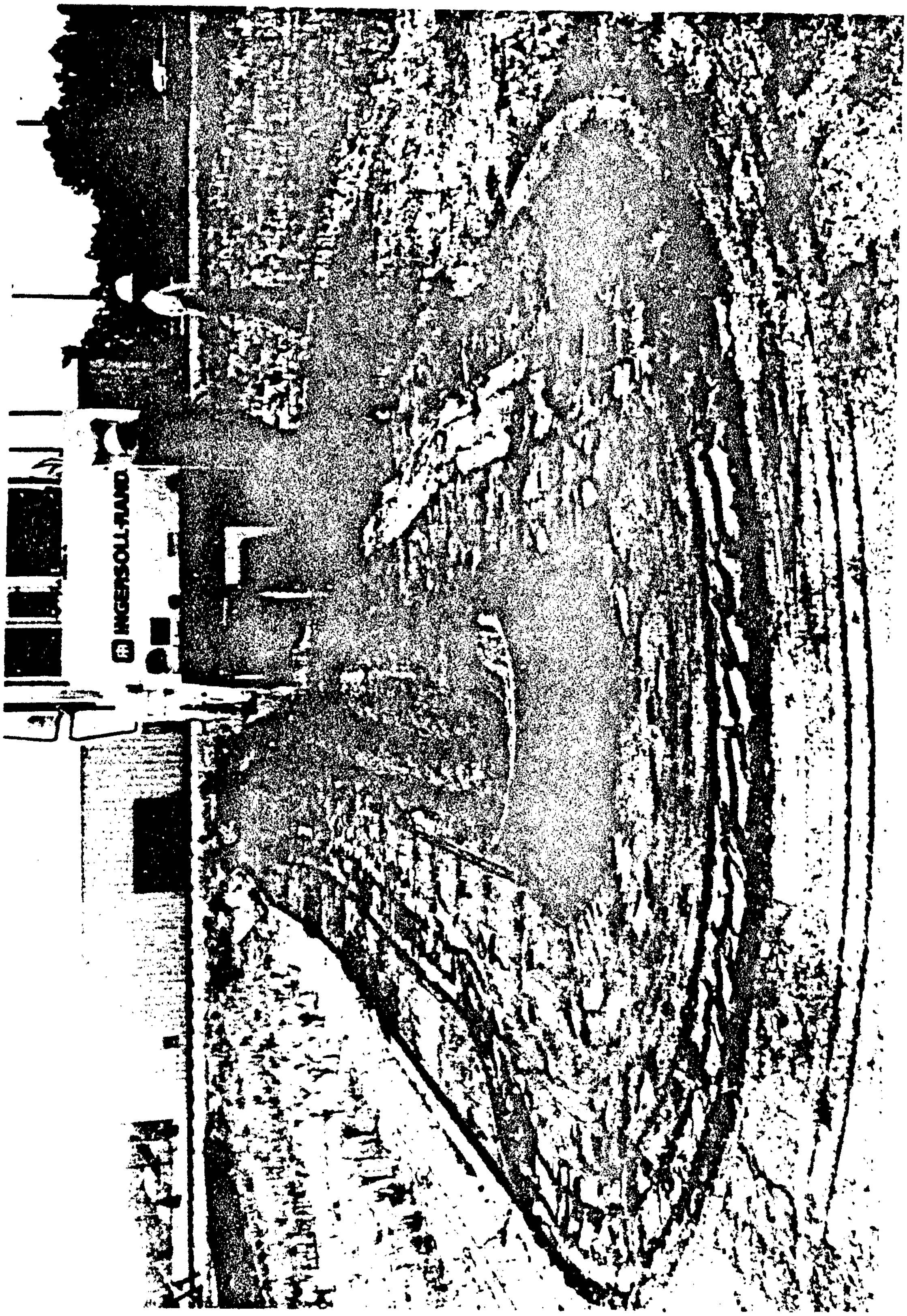

Figure 2. Asphalt Planer.

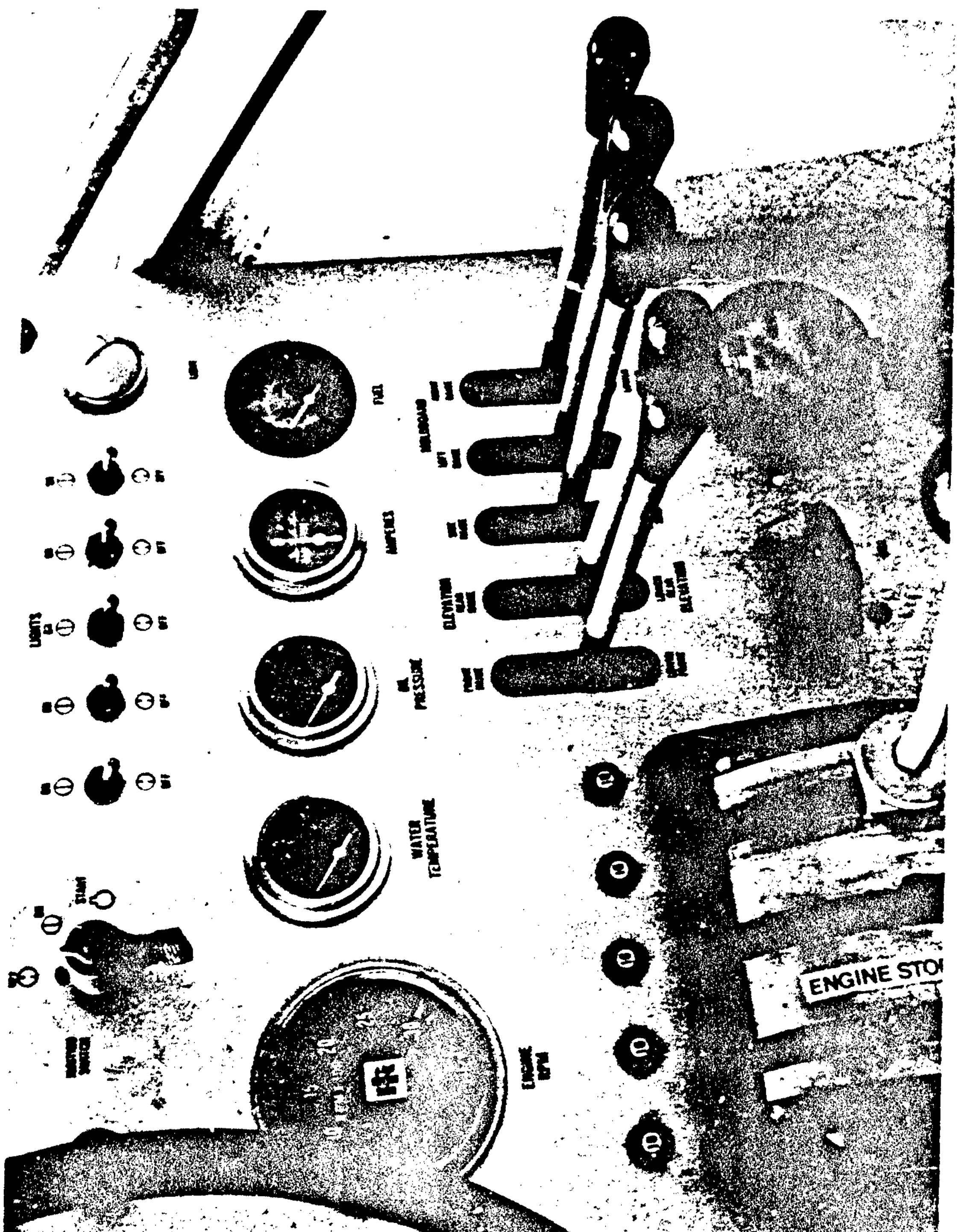

Figure 3. Asphalt Planer Control Panel.

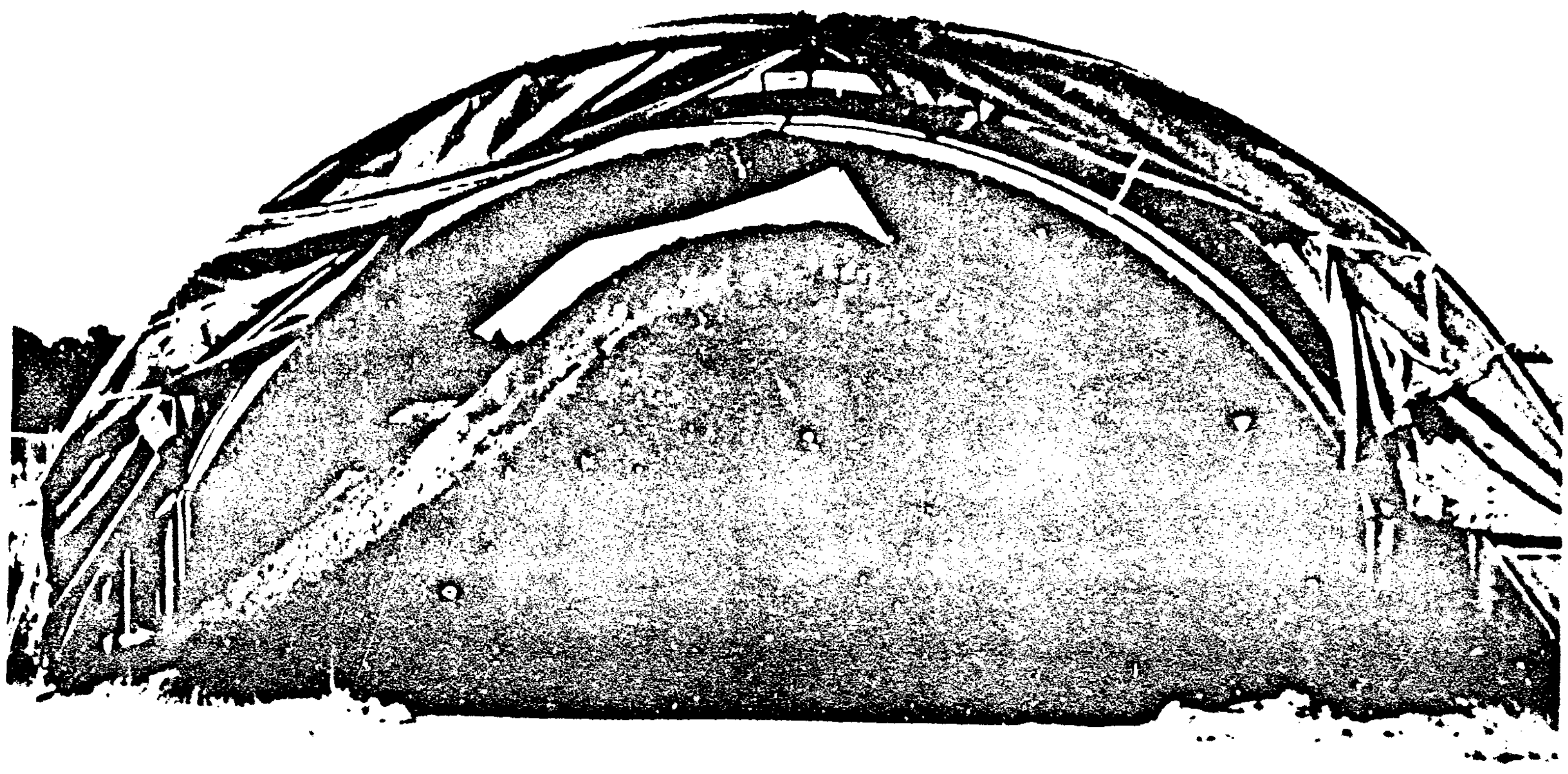

Figure 4. Soil Storage Tent.

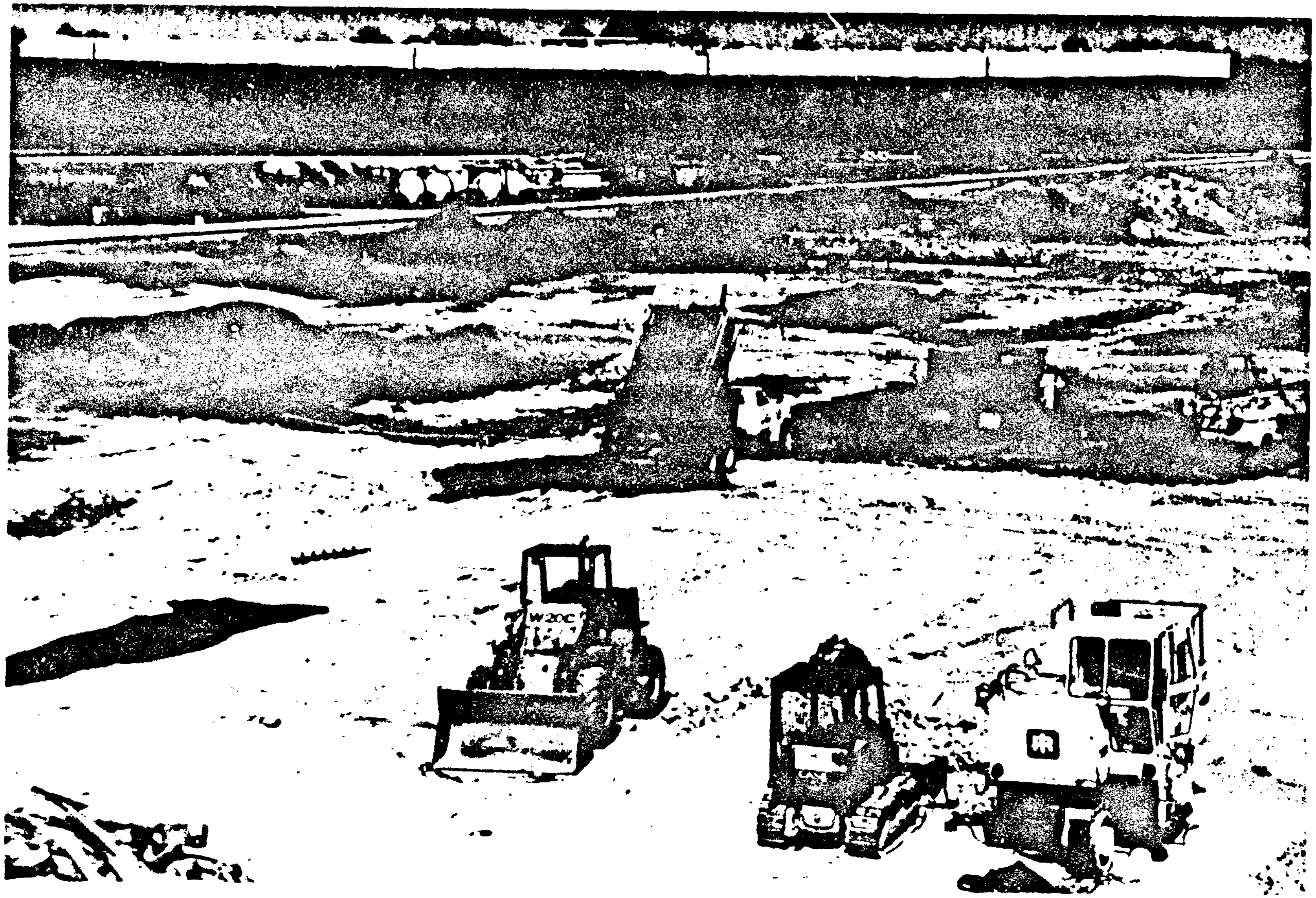

Figure 5. Planer, Bulldozer, and Front-End Loader.

B. AMBIENT AIR MONITORING

Ambient air sampling during all activities associated with routine operations was performed per the Ambient Air Monitoring Plan (AAMP) (Reference 2), using model PS-1 polyurethane foam (PUF) samplers. The PS-1 ambient air sampler is capable of detecting both fugitive particulate matter and organic vapors.

The samplers are equipped with a dual chamber sampling module. The upper chamber supports the airborne particulate filter media in a 4-inch circular filter holder. The lower chamber encapsulates a glass cartridge that contains PUF for vapor entrapment. The foam collects organic vapors from the ambient air in addition to organic vapors that may be stripped off of particulate matter that is collected on the filter.

In addition to the PUF monitors, two high volume (Hi-Vol) air samplers were used to determine total suspended particulate concentration.

1. Polyurethane Foam (PUF) Analysis

The PUF cartridges from the air samplers were analyzed for 2,3,7,8-TCDD using high-resolution gas chromatography (GC)/low-resolution mass spectrometry (MS) techniques. This methodology is specified in the AAMP (Reference 2). Although Appendix B of the AAMP specifies a detection limit of 1.63 ng TCDD/sample, EG&G Idaho's contract with Envirodyne specified a detection limit of 1.0 ng/sample. By assuming a PUF sampler flow rate of 9.8 ft^3/min for 24 sampling hours, a detection limit of 2.5 pg/m^3 of sampled air is achievable as described in Equation 1:

$$\frac{1.0\ ng}{PUF} \cdot \frac{1\ PUF}{1440\ minute} \cdot \frac{1\ minute}{9.8\ ft^3} \cdot \frac{35.31\ ft^3}{m^3} \cdot \frac{1000\ pg}{ng} = 2.5\ pg/m^3 \quad (1)$$

The laboratory initially analyzed only the sample immediately downwind of the excavation. The other samples were archived. If this downwind sample showed a positive detection above the 3 pg/m^3 limit, it analyzed the remaining samples from the same batch. Data for those samples were reported approximately 48 hours later.

2. Mini-Ram

The Mini-Ram is an optical particle counter and is a direct reading instrument. Therefore, the dust concentration measured by it is available immediately. Because of the Mini-Ram capabilities, operations personnel used the Mini-Ram as the first line of defense against excessive dust releases. The Mini-Ram data were used to immediately determine if dust control methods were required during excavation work.

C. SAMPLING PROCEDURES

1. Soil Sampling Procedures

Sampling of surface grids involved a single sample from each grid and an analysis for 2,3,7,8-TCDD. All the soil samples were taken using the sampling techniques and procedures described in the Operational Sampling Plan for the NCBC Demonstration Project (see Appendix A).

If the surface sample showed 1.0 ppb or greater 2,3,7,8-TCDD, the grid was excavated and the bottom of the hole (BOH) was sampled. The sample from the BOH was split in the field, and one sample was sent for analysis of 2,3,7,8-TCDD. The other sample (i.e., the sister sample) was archived at NCBC for possible later use.

Analytical results showing less than 1.0 ppb for 2,3,7,8-TCDD on a BOH sample caused the archived sample of the same plot to be composited with others, or analyzed alone, for total tetrachlorodibenzo dioxins (total TCDD) and total tetrachlorodibenzo furans (total TCDF).

The following guidelines applied:

- If the 2,3,7,8-TCDD analysis showed the concentration of the BOH to be greater than or equal to 0.70 ppb, but less than 1.0 ppb, then the archived sister sample was sent as an individual sample and analyzed for total TCDD, total TCDF, and 2,3,7,8-TCDD. (The measurement of 2,3,7,8-TCDD helped to gauge interlaboratory variability of analysis.)

- If the total TCDD, total TCDF, and the 2,3,7,8-TCDD analysis showed the concentrations of each to be less than 1.0 ppb, that plot was declared clean.

- If the 2,3,7,8-TCDD analysis on a single plot showed the concentration to be less than 0.7 ppb, then a composite was made that consisted of equal portions of up to 10 other plot samples that were in archived storage at NCBC. The plots all came from the same geographical area on the site. For example, samples from plot AY-80 were not combined with a sample from plot AA-40.

- A sister sample (i.e., a sample split) of the composite was archived onsite.

If the analysis of the composite sample was 1.0 ppb or greater, a decision on further excavation, or individual plot analysis, for total dioxins and total furans was made.

If a BOH sample analyzed for 2,3,7,8-TCDD was 1.0 ppb or greater, the archived sample from that plot was discarded (i.e., placed in the contaminated trash for incineration).

2. Training

ENSCO was responsible for the complete training of all the personnel involved in sampling. The training records of all employees trained for this project were also maintained by ENSCO.

As sampling techniques were refined, ENSCO ensured that all procedures were immediately updated and that all appropriate employees were kept abreast of these changes.

3. Sampling Frequency

On excavation days, sampling of the BOH for all the excavated plots was done and the samples (air and soil) were sent by Federal Express to the laboratories.

4. Sampling Documentation

The sampling documentation maintained by EG&G Idaho encompassed the full spectrum of data generated from the soil sampling activities. Additionally, a backup data base file was kept at the EG&G Idaho offices at the INEL.

5. Chain-of-Custody Forms

Chain-of-custody forms were generated by ENSCO personnel during their sampling process. The two top copies were sent with the samples to the laboratory and the third copy was retained by EG&G Idaho and filed.

6. Federal Express Forms

Before soil samples were sent to the laboratory for analysis, ENSCO generated a Federal Express shipping form. These forms, in addition to the previously mentioned chain-of-custody forms and any other pertinent records or information needed for the shipping of samples, were maintained by ENSCO and audited by EG&G Idaho.

7. Soil Sampling Data Sheets

While in the field obtaining soil samples, ENSCO completed the Soil Sampling Data Sheet, which contained vital information such as the sample number. At the end of each workday, ENSCO gave EG&G Idaho a copy of each data sheet completed that day. This form is presented in the Operational Sampling Plan (see Appendix A).

8. Quality Assurance

To ensure that all procedures were being followed and standards maintained at both the actual sampling site and within the laboratory, EG&G Idaho established QA programs for all necessary areas, monitored the results, and contacted the appropriate personnel when problems arose. Based upon EPA recommendations, a 10% Quality Control soil sampling program was implemented.

9. Splits and Field Blanks

The laboratory QA program consisted of submitting approximately 10% of all soil samples for QA verification. Seventy-five percent of the QA samples were sample splits; 25% were field blanks.

10. Equipment Blanks

Initially, the equipment (spoons, drill bits, screens, etc.) used in sampling were cleaned before taking the next sample. After cleaning, a hexane rinse sample from the equipment was taken from every tenth item cleaned. This practice was changed later in the project because it was not cost effective. Discarding the equipment used in sampling proved to be more economical.

11. Field Procedures

Random visits were made to the sampling area by EG&G Idaho personnel to ensure that all procedures were being followed in obtaining the soil samples. All discrepancies noted were brought to the attention of the ENSCO Site Superintendent. EG&G Idaho noted all discrepancies in the project records.

12. Sample Packaging and Shipping

Procedures for packaging and shipping soil samples are addressed in the Operational Sampling Plan (see Appendix A).

13. Sample Data Base

All pertinent sample data were kept by EG&G Idaho in a computer data base. This information included the date the sample was taken, grid location, sample number, date the analysis information was received from the laboratory, and date the analysis results were validated.

14. Laboratory Results Input

The sample test results were reported on the chain-of-custody forms and transmitted via telefax to the EG&G Idaho NCBC field office. The laboratory transmitted the sample test results to the field office as soon as they were available.

15. Data Base Backup

The computer used to compile the sample data had a hard drive for storage. Once a week all the current data were copied onto a floppy disk and sent to EG&G Idaho's project office at the INEL.

16. Sample Analysis Validation

The laboratory analysis data package for each sample was reviewed by the EG&G Idaho Chemical Sciences Group for completeness and compliance with the required procedures. All laboratory equipment calibrations were reviewed for procedure compliance and validity for the date of sample analysis. Any missing sample data were requested from the performing laboratory to complete the analysis package prior to validation of the results. The validated results were entered in the computer data base.

SECTION III
PLANNING AND IMPLEMENTATION

A. EPA PERMIT CRITERIA

The EPA permit for excavation and incineration of the NCBC soil can be found in Reference 3.

- Soil samples were obtained as specified in the Operational Sampling Plan (see Appendix A).

- The permittees followed the AAMP (Reference 2).

- The permittees immediately stopped excavation if PUF Sampler C exceeded the 2,3,7,8-TCDD action level of 3 pg/m^3 as described in Reference 3. If the action level was exceeded, the permittees would not resume excavation until approval was received from the EPA Regional Administrator. This occurred only two times.

The permittees continued ambient air monitoring with the PUF samplers until the EPA Regional Administrator approved the summary report and revised sampling plan (Reference 2).

B. SOIL EXCAVATION CRITERIA

If the surface sample analysis results showed a 2,3,7,8-TCDD concentration of less than 1.0 ppb, the plot (20- by 20-foot) was considered clean and was not excavated.

If the surface sample showed 1.0 ppb or greater 2,3,7,8-TCDD, the plot was excavated and the BOH was sampled. The sample from the BOH was split in the field, and one sample was sent for analysis of 2,3,7,8-TCDD. The other sample (i.e., the sister sample) was archived at NCBC for possible later use. If the BOH sample showed 1.0 ppb or greater 2,3,7,8-TCDD, the plot was excavated again until the 2,3,7,8-TCDD concentration was less than 1.0 ppb.

If analytical results showed less than 1.0 ppb for 2,3,7,8-TCDD on a BOH sample, the archived sample of the same plot was composited with others, or analyzed alone for total TCDD and total TCDF. If the total TCDD, total TCDF, and the 2,3,7,8-TCDD analysis showed the concentrations of each to be less than 1.0 ppb, that plot was declared clean and was not excavated any deeper.

If the total TCDD or total TCDF analysis was 1.0 ppb or greater, further excavation of the plot was undertaken until the BOH analysis was less than 1.0 ppb for 2,3,7,8-TCDD, total TCDD, and total TCDF.

C. AMBIENT AIR MONITORING PLAN

The AAMP for the NCBC Demonstration Project (Reference 2) was followed during all excavations of contaminated soil. Ambient air background and intensive monitoring data collected during the first 30 days of site excavation were evaluated to determine:

- Adequacy of sampling frequency
- Appropriateness of QA sampling
- Whether sampling frequency could be effectively reduced based on data quality and the ability to establish quantitative relationships between optical particulate measurements, PUF samplers, and Hi-Vol samplers, and any observed dioxin releases from the excavation site.

Following the 30-day intensive sampling program, the air monitoring data were analyzed at the INEL.

The proposed methodology described in Reference 2 uses methylene chloride instead of benzene for the Soxhelet extraction. This alternate extraction technique was approved by EPA Region VIII. The data to substantiate the alternate technique were transmitted to EPA Region IV on 17 September 1987. The alternate extraction technique was verbally approved by EPA Region IV.

1. High-Volume (Hi-Vol) Analysis

The filters from the Hi-Vol air samplers were desiccated for 24 hours and weighed on an analytical balance to determine the total particulate weight. The volume of air sampled was determined from the volumetric flow rate and the duration of sampling. During the first few months of incinerator operation, the filters were desiccated and weighed by a local laboratory. After procurement of an analytical balance and desiccator, the filters were weighed and desiccated by the onsite Versar personnel.

2. PUF Analysis

Envirodyne Engineers, Inc., was the analytical laboratory contracted to perform the TCDD analyses. The turnaround time to obtain data results from the laboratory was 5 days from the date of receipt of the samples. Federal Express was used for shipment of samples to the laboratory. Normally, samples were received in the laboratory the day after collection. Therefore, this effectively made the turnaround time 6 days from completion of a sample.

For example, a sample that was collected on Monday morning would be sent on Monday and received in the laboratory by noon on Tuesday. Data results would be telefaxed to NCBC the following Sunday (i.e., approximately 6 days after collection of the sample). Written results were returned within 14 days to the INEL for data validation and interpretation.

3. TCDD or Excessive Dust Releases

Because of analytical laboratory turnaround time on data results, there was no possible method of determining the real-time potential release of dioxin to the atmosphere. As a result, a technique was developed to avert releases.

At the beginning of each excavation shift, a brief field evaluation was conducted to determine the suitability of current meteorological conditions. If the wind speed was stirring up substantial quantities of dust, dust suppression was employed by spraying water over the area to be excavated. Mini-Ram readings (real time) were taken before and after the dust suppression was employed to provide relative dust suppression data.

Once excavation began, the ENSCO health and safety officer, or his designated alternate, took hourly dust readings at Sample Stations A and C by using the Mini-Ram optical dust counter. If the observed dust concentration at Station C exceeded three times the normal background concentration, the water suppression was employed to reduce the dust concentration. Another Mini-Ram reading was taken to determine the success or failure of the dust suppression. If the suppression was successful, then excavation commenced, followed by hourly Mini-Ram readings. If the dust suppression was unsuccessful, additional dust suppression was employed. If four attempts spaced approximately 20 minutes apart failed to suppress the dust, excavation activities were halted until more favorable weather conditions prevailed or until alternative excavation techniques were developed.

4. PUF and Hi-Vol Sampler Location

The samplers were located at four different points relative to the excavation site. The locations are listed in Table 1.

TABLE 1. AIR SAMPLER LOCATIONS.

Location	Description
A	One PUF and one Hi-Vol, located 100 meters upwind of excavation
B	One PUF, located 30 meters downwind of excavation
C	Two PUF (one designated as Quality Assurance PUF) and one Hi-Vol, located at a position nearest the downwind site boundary of the HO storage area.
D	One PUF, located 150 meters downwind of the HO site boundary or the NCBC base boundary, whichever was closer.

Initially, only PUF Sampler C was analyzed for 2,3,7,8-TCDD. If dioxin was detected at a concentration greater than 3 pg/m^3, the other four samplers were analyzed to determine the source of the contamination and the extent of migration to offsite areas. If Sampler C indicated a positive TCDD concentration above 3 pg/m^3, the EPA was notified immediately and soil excavation ceased, pending evaluation of the problem.

The data obtained from the Hi-Vol air samplers were used much the same way as the Mini-Ram data. If the Hi-Vol data indicated dust concentrations more than three times the background concentration at Station C, excavation was halted until additional dust suppression was conducted or until alternate excavation techniques were developed.

During calm periods (i.e., wind speeds less than 2 mph) the sampler was located according to the previous predominant wind direction. Following a calm period, the new predominant wind duration was established for at least 60 minutes before any sampler was relocated.

Sampler A, the background sampler, did not require relocation with respect to changes in wind direction as long as it was upwind of the excavation site.

During storms, the wind direction deviated radically from the normal wind direction. To accommodate stormy conditions, the ambient air monitors were located according to the prevailing wind direction during the storm. If the wind direction changed from the stormy condition by more than 30 degrees for more than 1 hour, the samplers were relocated with respect to the existing predominant wind vector.

The meteorological data obtained from Kessler Air Force Base indicated that the wind normally comes from north-northeast during late September through October. These data were used as a starting point for sampler location. Actual sampler location was based upon existing wind direction at the beginning of the sampling period.

Variations in wind direction, however, sometimes caused the sampling equipment to fall outside of an acceptable range downwind. Therefore, it was technically desirable to move the sampling stations to the new downwind location. This need, however, had to be tempered with the logistical problems of moving seven sampling stations and five power generators.

In an effort to maximize the probability that Sample Station B would sample a fugitive plume, that sampler was kept within 15 degrees of the downwind vector. If the wind direction changed more than 15 degrees for more than 60 minutes, the sampler was relocated. Because of the nearness to the excavation site, this requirement usually did not require large lateral sampler movements.

Samplers C and D, however, were farther away from the excavation site. It was logistically difficult to maintain the 15 degrees downwind boundary. Therefore, the criterion for moving those samplers was

30 degrees. If the wind varied more than 30 degrees for more than 60 minutes, the sampler was relocated to the new predominant downwind direction. If there was no new predominant downwind direction (i.e., highly variable winds), the samplers were aligned with the average downwind vector observed for the previous 2 hours.

The worker recording the hourly Mini-Ram data also recorded observations of dust dispersion with respect to sampler location.

When movement of the monitors was required, Versar personnel would notify the ENSCO excavation crew if it was necessary to interrupt excavation. To minimize the impact on excavation, Versar moved the monitors at Location C first, since that sampler was the compliance sampler and suspended excavation, if any, could resume quickly. Once movement was completed, excavation continued.

D. SOIL EXCAVATION AND ASH MOVEMENT EXCAVATION PLAN

1. Excavation Plan

The contaminated soil in Area A was the first priority for excavation because it contained the most soil volume and because it was near the incinerator and soil storage tents. The excavation of Area A did not require the excavation equipment to be moved over uncontaminated areas or roads. The excavation of Row A in Area A was planned as the first excavation and backfill to provide a clean road around the perimeter of the area for ash movement.

Excavation of Area B was planned as the second priority because its volume of soil was estimated greater than Area C, but less than Area A. Both Area B and Area C excavations required hauling the soil on uncontaminated roads.

After the perimeter road around Area A was established, the plots farthest away from the incinerator were excavated first. By excavating the plots farthest away from the incinerator, the excavation equipment could be kept on contaminated plots and the contaminated haul roads could be used. As the excavation of Area A progressed, the haul roads shortened as the plot excavations moved closer to the soil storage tents.

2. Ash Movement

The ash roll-off boxes to be emptied and the plots to be excavated were specified by the EG&G Idaho site representative on the "plan of the day" forms that were given to the excavation crew supervisor, the ENSCO site superintendent, and ENSCO site health and safety officer.

The ash from the specified roll-off boxes was trucked over uncontaminated roads and plots to Area A where it was off-loaded. The excavation logbook was used to record the roll-off box number emptied and the plot number where the ash was off-loaded.

E. SOIL SAMPLING PLAN

All soil sampling was done by ENSCO employees according to the Operational Sampling Plan (see Appendix A).

F. SO'L EXCAVATION DATA

The soil excavation and BOH sample results were displayed on a status map. The map is shown in Figure 6. This figure shows the map after all the project excavation was completed; thus, the map is all one color (green).

The status map was updated daily as to the status of laboratory results, excavation depth, and plots excavated. The data clerk updated the map and entered the information into data bases. This revised data base information was transmitted via computer modem to the INEL. As a minimum, the data base maintained for the excavated plots contained the information shown in Table 2.

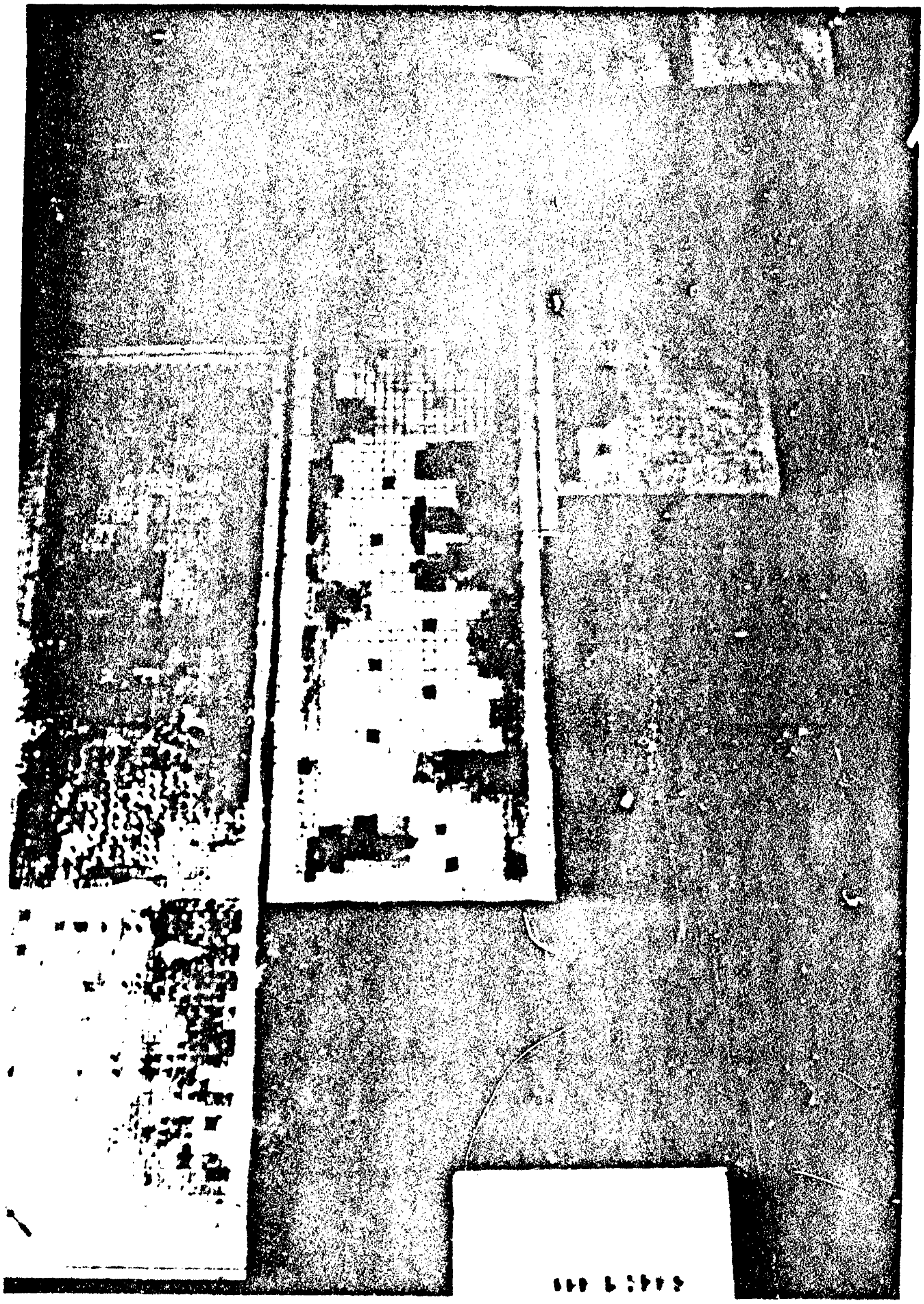

Figure 6. Soil Excavation Status Map.

TABLE 2. STATUS MAP INFORMATION.

	Description
Location	Designates the plot on the NCBC site, using an X and Y axis system
Surface T2378	Original plot surface concentration of 2,3,7,8-TCDD
BOH T2378	BOH 2,3,7,8-TCDD concentration
Number	Sample number (unique).
Composite CPTCDD	Level of concentration of total TCDD when this plot was included as an aliquot in a composite sample.
Composite CPTCDF	Level of concentration of total TCDF when this plot was included as an aliquot in a composite sample.
Single TCDD	Level of concentration of total TCDD when this plot was sent in singly.
Single TCDF	Level of concentration of total TCDF when this plot was sent in singly.
Depth	The depth in inches that the plot was excavated.

The data base was maintained at the NCBC site and was transmitted weekly to the INEL where it was verified.

G. HEALTH AND SAFETY PLAN

The excavation and backfilling operations at the NCBC HO-contaminated site were performed under the guidance of the ENSCO health and safety officer and to the requirements of the ENSCO Health and Safety Plan. The procedures and records of the health and safety officer were audited periodically by the EG&G Idaho health and safety officer. The EG&G Idaho site representatives reviewed and observed the health and safety procedures daily.

All personnel working in excavation and backfilling were required to be trained in the use of protective equipment, respirators, emergency equipment, first aid equipment, and fire protection equipment. The personnel involved with excavation and backfilling were also required to attend weekly health and safety meetings.

H. QUALITY PLAN

Decontamination of excavation and backfilling equipment was performed according to the Quality Assurance Plan (see Appendix B). To ensure and document compliance with the EPA permit closure requirements, an independent consultant (Versar) was selected to write and administer the Quality Assurance Plan. During the decontamination of equipment and dismantling of the incinerator, a representative of Versar was frequently onsite to observe and instruct the personnel doing the decontamination and wipe sampling. The Versar representative documented the work performed by taking pictures and maintaining a wipe sample file.

I. DECONTAMINATION AND DEMOBILIZATION

This section describes the closure procedures that were followed when the soil processing activities at NCBC were completed and before the MWP-2000 was removed from the site. The excavation and backfilling equipment leaving the site was cleaned to acceptable levels.

Equipment used in excavating or moving contaminated soil was decontaminated before it left that area to enter a clean area. Equipment used to transfer incinerator ash was not decontaminated before making each ash delivery from the kiln to the roll-off boxes.

Contaminated equipment was decontaminated by being thoroughly washed with clean, hot high-pressure water. Material removed from the equipment by cleaning and the washwater was burned in the MWP-2000. If the equipment was to be returned to noncontaminated service, representative surface wipe samples were taken and analyzed to determine the adequacy of decontamination before the equipment was allowed to go offsite. Each wipe sample was taken following procedures in the Operational Sampling Plan. Decontamination was considered adequate and the equipment "clean" when the laboratory analysis for each wipe sample was 40 ng or less of 2,3,7,8 TCDD/m^2.

At the end of the project, empty roll-off boxes that had been used for holding ash generated by the incinerator were cleaned with high-pressure water and the washwater was incinerated in the MWP-2000. The MWP-2000 was then operated for 48 hours to ensure the destruction of possible contaminants. Following this operation, treated soil, solids, water in the several sumps and tanks of the system, and effluents in staging units were removed from the system, sampled, and analyzed. The sumps and tanks of the system and the effluent staging tanks were flushed with high-pressure water, and this water was sampled and analyzed. The MWP-2000 was then disassembled for removal from the site.

Wastes generated by decontamination activities were incinerated whenever possible. Treated soil and solids were sampled and analyzed before placement in a verified clean spot on the HO site. Liquid wastes (decontamination washwaters, scrubber water, etc.) were incinerated whenever possible. Otherwise, the liquids were filtered through activated carbon, held in a tank for sampling and analysis, and then discharged to the Publicly Owned Treatment Works (POTW).

SECTION IV
FIELD OPERATIONS AND FIELD DATA

A. EXCAVATION AND STORAGE OF SOIL

1. Equipment

Depending on the plots being excavated/re-excavated, the equipment listed in Table 3 below was used.

TABLE 3. EXCAVATION EQUIPMENT

Model	Item
450C	Case bulldozer
880D	Case track hoe (excavator)
W20C	Case front-end loader
MW5517	Ingersall-Rand planer
	Dump truck
	Water truck

All of the equipment, except the planer and water truck, were rented from local equipment rental companies. The planer was loaned to the project by Tyndall Air Force Base, Florida. The water truck (translift truck with tank) is owned by ENSCO.

2. Bottom of Hole (BOH) Samples

After each excavation or re-excavation of a plot, a soil sample was taken from the new surface elevation of the plot, using the same sampling procedures that were used to take the ground level surface samples. The samples were given unique numbers and recorded on chain-of-custody forms. The laboratories telefaxed the chain-of-custody forms back to the site with the analysis results. The results of all BOH samples were entered on the computer data base at the site and on the data base at the INEL.

3. Area A--Excavation

Initial excavation of the 20- by 20-foot plots that had been cement-stabilized consisted of first scraping the top layer (approximately 2 inches) of soil and vegetation off the top of the cement-stabilized layer of soil with the bulldozer and pushing it into the front-end loader. The front-end loader would then load the soil into the dump truck. The planer was then used to cut through the cement-stabilized soil layer. The width of the planer cutting drum is approximately 5 feet; thus, it required several planer passes to completely cover a 20- by 20-foot plot. The bulldozer was again used to push the soil into the bucket of the front-end loader for loading into the dump truck. The soil was then hauled to the soil storage tent area and off-loaded. To protect the soil from wind erosion and rain, the soil was moved into the soil storage tents, using a front-end loader.

Initial excavation of unstabilized gravel roadway plots was accomplished using the bulldozer, front-end loader, and dump truck. Re-excavation of unstabilized plots and plots with the stabilized layer of soil removed was also done with the bulldozer, front-end loader, and dump truck.

The ditch plots were excavated with the track hoe (excavator). Many of the ditch plots had a deep layer of gravel lying on top of the stabilized soil; this was removed using the bulldozer, front-end loader, and dump truck.

Deep excavation (over 18 inches below ground level) was necessary on some plots. This excavation was accomplished with the track hoe and dump truck.

4. Area B--Excavation

The soil in Area B was the same type as that in Area A and was excavated and/or re-excavated using the same equipment and same techniques. The exception to this was that the dump truck had to travel clean (noncontaminated) roads to reach the soil storage area. This was accomplished by decontaminating the truck tires and using a clean ramp for the truck to back onto to reach the contaminated storage area. As a further precaution against the spread of contaminated soil, the loaded dump truck was covered with a tarp while traveling to the soil storage area.

5. Area C--Excavation

The soil in Area C was not cement-stabilized and was therefore much easier to excavate than Areas A and B. For this reason, only the track hoe and dump truck were used in this area. Several plots did contain a thin layer of a tar/gravel mixture, but this was easily penetrated using the bucket of the track hoe. Travel to the soil storage area was also over noncontaminated roads; subsequently, the same procedure was used as for Area B.

6. Weather Conditions

From the start of soil excavation in November 1987 until 18 May 1988, all excavation work was performed during daylight hours. From 18 May 1988 until the end of the project the soil excavation was performed at night because of the high heat index [82°F, as measured by the Wet Bulb Globe Test (WBGT)]. Two portable light towers were rented from a local equipment rental company to illuminate excavation. These units were moved to ensure proper lighting for the operation of the excavation equipment.

Initial excavation of plots could be performed during light rain. However, as the intensity of rain increased, the ditches on the site could not hold or transport the water downstream fast enough to prohibit the water from pooling on the plots. The excavated areas would hold the rain water for days to weeks depending on the depth of the excavation and the evaporation rate (relative humidity, temperature, etc.). During storms with lightning it was unsafe to operate the heavy equipment needed for excavation.

The water in excavated areas was normally allowed to stand and evaporate naturally before re-excavation, but occasionally it was necessary to expedite the re-excavation of some plots. Re-excavation of water-filled plots was accelerated by pumping the water from the plots to be re-excavated into the contaminated ditches in Area A. These ditches had been equipped with additional redundant filter berms to ensure that contaminated particles that might be transported with the water would be contained in the ditches. Water pumped from the Area B and C plots was trucked in roll-off boxes and held until a laboratory analysis of the water indicated it was uncontaminated.

7. Number of Plots Excavated and Soil Volume Excavated

The total number of 20- by 20-foot plots excavated in the three designated areas including drainage ditches was 1,006. Fifty-two of the plots excavated had surface concentrations less than 1.0 ppb. These plots were excavated for the convenience of the excavation crew. The 52 plots were located in areas that were very difficult to work around without spreading contaminated soil on the plots.

Numerous plots in the three areas had to be excavated more than once before a clean BCH soil sample analysis was received. Table 4 is a breakdown of these re-excavations by area.

TABLE 4. NUMBER OF PLOTS VERSUS NUMBER OF EXCAVATIONS.

	Number of Times Excavated							
Area	1	2	3	4	5	6	8	Total
A	497	178	47	23	8	2	2	757
B	184	21	6	4	1	0	0	216
C	18	9	2	2	1	1	0	33
Total	699	208	55	29	10	3	2	1006

The percent of plots re-excavated in each area was not consistent. The variables effecting re-excavation were soil type, length of HO storage time, and number of times barrels were handled.

8. Concrete Slabs

Four concrete slabs are located on Areas A and C of the site. All exposed surfaces of the slabs were cleaned with high-pressure water and sampled by drilling with a masonry bit 1-inch deep. The slab surface was sectioned into approximately 20- by 20-foot areas and five points on each section were drilled to obtain the necessary 8-ounce sample for the laboratory analysis. The samples were analyzed for the same contaminants as the BOH soil samples.

The concrete floor of Building 411 was divided into four plots. These four plots were sampled by drilling into the concrete approximately 1 inch in several places and collecting the dust for 2,3,7,8-TCDD analysis. One area (plot) of the building showed a 2,3,7,8-TCDD concentration higher than 1.0 ppb. The following describes the various methods used to clean and/or remove a portion of the concrete slab in order to reclassify the building as clean.

a. The first approach was to clean the area using a high-pressure/detergent wash system. This method was used twice, and sampling was performed after each attempt. However, both cleanings failed to appreciably reduce the level of 2,3,7,8-TCDD.

b. The second approach was to use a small 10-inch hand-operated planer to remove a 1-inch layer of the concrete slab. The planer was able to cut the thin concrete/sand layer on top, but was unable to penetrate the concrete/rock portion. Three sets of carbon steel cutter blades were worn out in working on only one-half of the area. A set of hardened steel teeth for the planer could not be located, so the planer was decontaminated and returned to the rental company.

c. The third method was to use an air-driven scabbler, which can be best described as a large meat tenderizer with five heads. While the scabbler worked much better than the planer, it was tediously slow and the first set of heads were worn out after working approximately one-fifth of the slab. It was estimated that it would take 1 month to complete the work on the slab using the scabbler.

d. The final method was to use a jackhammer to remove the top 1 or 2 inches of the slab. This method was suggested early in the decontamination effort, but was discounted in favor of using a method to maintain a fairly smooth surface. It took 8 hours to complete the removal of the contaminated concrete. The concrete rubble was mixed with contaminated soil and processed in the incinerator. The slab was reanalyzed and found to be clean.

The other three concrete slabs were also sampled. The laboratory analysis found 2,3,7,8-TCDD concentrations less than 1.0 ppb. A portion of the decontamination slab in Area A was placed on top of contaminated plots. An area approximately 2 by 30 feet in size was jackhammered from one edge of the slab to allow excavation of the soil underneath. The concrete rubble was mixed with the contaminated soil and processed in the incinerator.

9. Rock Crusher

The rock crusher was a used jaw-type crusher purchased by ENSCO. The crusher was set up in Area A on contaminated plots between the incinerator and Building 411. The rock crusher was first used on 21 April 1988, and was occasionally used thereafter to crush rocks and soil cement chunks. The rock crusher was not used after 29 August 1988 when the old shredder was replaced with a larger shredder that would break up the rocks.

The operation required the front-end loader to feed the rocks to and remove the crushed rocks from the rock crusher. One laborer had to be on the crusher with a sledgehammer to break up any large pieces of soil cement that would not feed into the jaws of the crusher. This was not an efficient machine for crushing the large rocks.

The power line to the rock crusher was run underground across several contaminated plots. When these plots were excavated, the power lines were cut, resulting in a power outage for the incinerator. Loss of power to the incinerator caused the rotary kiln feed, burners, drive, etc., to be shut down until the power was restored.

10. Fire Water Pipeline Rupture

During excavation of Area B contaminated plots, the planer ruptured the fire water pipeline that was buried underground. The 3-inch cast iron pipe was installed during World War II by German prisoners of war. The cast iron pipe should have been 1 foot underground but was only 2 to 3 inches underground in this area. The line was ruptured in three separate places during the excavation and backfill of Area B.

Repair of the fire water pipeline consisted of cutting out a section of the pipe and installing a new piece of cast iron pipe with flanged couplings at each end. The couplings used rubber ferrule gaskets to seal the joints. Repair of the pipe was done with the line isolated from the system water pressure by valves. Even with the pipe section isolated, the water flowed out of both ends of the pipe after the ruptured section of pipe had been removed. This water flow purged any metal or soil particles that might have entered the pipe during removal of the ruptured section. The flowing water was caused by the residual water in the line and leakage past the isolation valves.

11. Additional Area B and C Surface Samples

The barrels of HO were stored in Areas B and C next to the railroad tracks; thus, the initial surface samples taken in these areas were from plots identified from photographs showing the barrels stacked in Areas B and C. The two rows of plots next to Tracks C and D were sampled first. When surface concentrations of 2,3,7,8-TCDD greater than 1.0 ppb were found, additional sampling of plots adjacent to the contaminated plots was done to determine the size of the area and the magnitude of the spill concentration.

Some of the excavation areas extended to the ditch that traverses the length of Area B. The ditch bottom was also sampled in these cases to determine if the spill had migrated either upstream or downstream. In all cases, the sampling continued until the spill was ringed with plots whose surface samples were less than 1.0 ppb.

12. Soil Excavation Tests

Before the start of normal soil excavation and incinerator operation, EPA authorized some excavation testing on the NCBC cement-stabilized soil. The tests were conducted in the same manner and using the same procedures as the actual permit excavation and sampling.

The tests consisted of planer excavation tests and one track hoe excavation test. Air monitoring was performed during the excavation tests. Air-monitoring samplers (PUF and Hi-Vol) were run for a minimum of 24 hours before the filters were sent to the laboratory for analysis.

a. Planer Tests

From 1 October 1987 through 3 October 1987, excavation and sampling of eight plots was undertaken to determine if the excavation and sampling techniques needed to be modified. The bulldozer was used to push the overburden off the test plots. Once the soft overburden (2 to 6 inches deep) was removed from the cement-stabilized soil, the planer made a 2-inch-deep cut in the cement-stabilized soil. The soil was scooped up by a front-end loader after each cut and transferred to the soil storage area by a dump truck.

The top surface of the overburden was sampled before its removal. The cement-stabilized soil was sampled twice after removing the overburden and twice after the 2-inch planer cut. The methods used to sample the cement-stabilized soil were:

(1) The area of each plot to be sampled was swept to remove excess soil and then drilled with a clean masonry bit to get a five-point sample on each plot. Drill depth was nominally 1-inch deep.

(2) The area of each plot to be sampled was vacuumed and then drilled with a clean masonry bit to get a five-point sample on each plot. The drill depth was nominally 1-inch deep.

From 3 October 1987 through 5 October 1987, 10 plots (AY-61 through AY-70) were excavated using the planer. These plots did not have any overburden on top of the cement-stabilized soil layer. The planer made two 2-inch-deep cuts on these 10 plots. After the first 2-inch cut, the loose soil was scooped up by the front-end loader and the thin layer of loose soil on top of the excavated area was sampled. After each 2-inch cut with the planer, the plots were first swept, then drill sampled with a masonry drill bit. The plots were then vacuumed and another drill sample was taken.

From 5 October 1987 through 6 October 1987, 10 plots (AW-61 through AW-70) were excavated using the planer. These plots had no overburden and were excavated in the same manner as the previous 10 plots. The sampling of plots was the same as the previous 10-plot test.

b. Track Hoe Test

From 6 October 1987 through 7 October 1987, five plots (AY-50 through AY-54) were excavated using the track hoe. There was no overburden on these plots and the first cut with the track hoe removed the entire layer of cement-stabilized soil. The second cut removed 6 inches of the sandy soil below the stabilized layer. The bottom of the excavated plots was sampled after each cut with the track hoe.

B. BACKFILL AND RECONTOURING

All the ash from the incinerator was placed on Excavation Area A. The ash was dumped on both excavated and unexcavated plots. The excavated plots in Areas A, B, and C were not backfilled unless they were adjacent to the roadways parallel to the railroad tracks. Clean fill dirt was used for this backfilling. Backfilling and recontouring of the excavation areas will be done after the ash is delisted and the site is closed.

1. Equipment

The equipment used to move the ash from the roll-off boxes to a dumping location in Area A included a model 880D Case track hoe (excavator) and two dump trucks.

2. Ash Movement

The track hoe was used to dig the ash out of the roll-off boxes and load the dump trucks. The use of the track hoe to empty the roll-off boxes was necessary because a roll-off box filled with wet ash could not be picked up by the Browning Ferris Industries (BFI) translift truck.

The track hoe was rented with two buckets. One bucket had teeth (for contaminated soil excavation) and one grade bucket had no teeth (for uncontaminated ash removal). The contaminated bucket was removed from the track hoe after soil excavation and left in the contaminated area. Use of the track hoe to dig out the roll-off boxes permitted the incinerator workers to completely fill the roll-off boxes, thus, requiring fewer roll-off boxes for ash storage than would have been required if the BFI translift truck was used to dump the ash.

3. Backfilling

Backfill of Row A plots in Area A was done with ash to provide a roadway parallel to the railroad Track E (Figure 1). The deep excavations adjacent to roadways in Areas A, B, and C were backfilled with sandy clay fill dirt trucked in from offsite. These excavations were backfilled to minimize the safety hazard of a vehicle running off the roadway. The volume of fill dirt trucked in was approximately 2,000 yd^3.

C. DECONTAMINATION AND DEMOBILIZATION

1. Excavation Equipment

The excavation equipment shown in Figure 7 was cleaned with high-pressure hot water on the decontamination pad. The decontamination pad was constructed of carbon steel sheet with a sump to collect the water and a fabric tent top to contain any overspray.

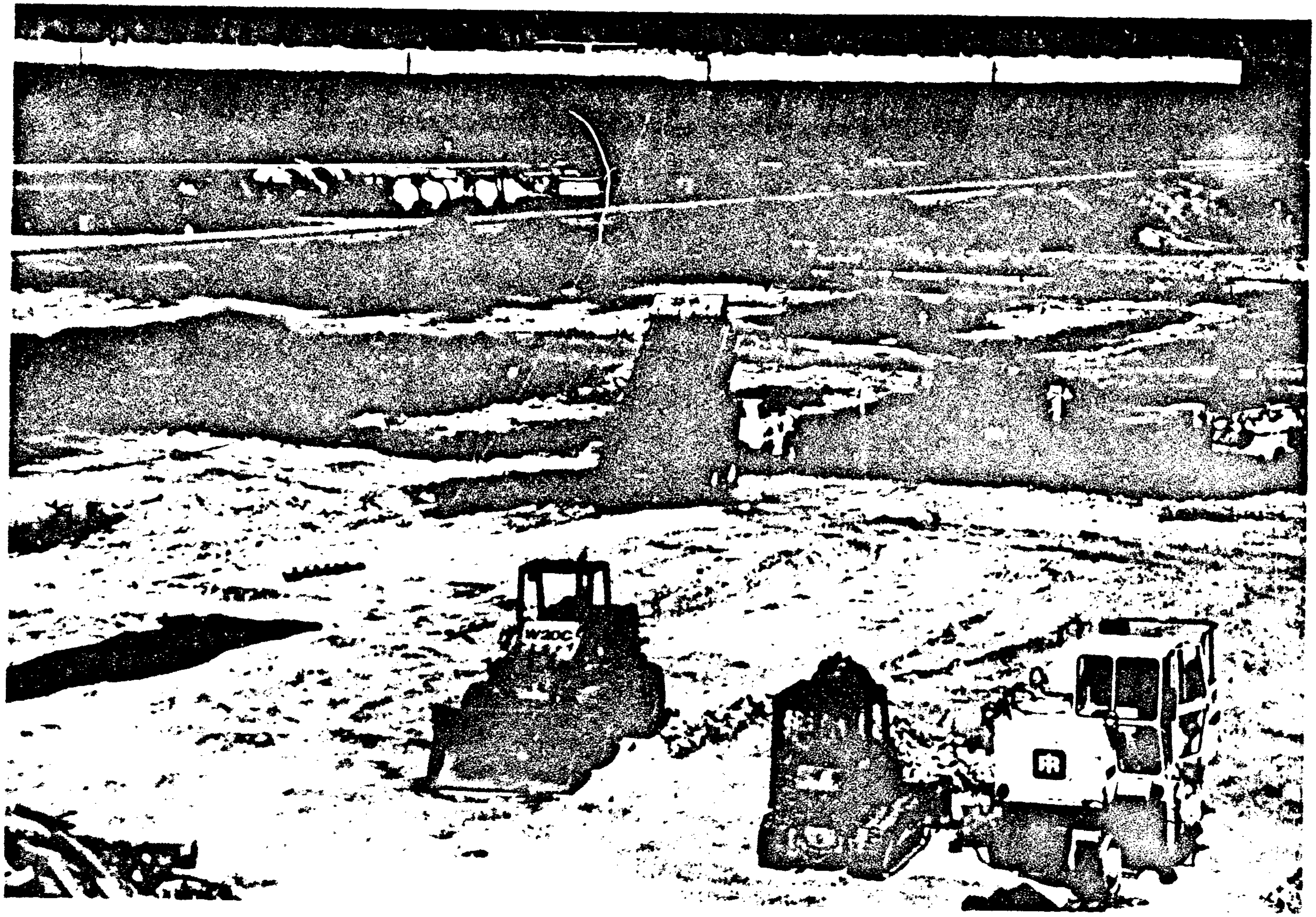

Figure 7. Excavation Equipment.

The cleaning of the equipment was done by the excavation crew workers and recorded in the excavation logbook. After cleaning and inspection of the equipment, the pieces were wipe sampled using clean sterile gauze pads and hexane. The wipe samples were taken per the sampling procedures in Attachment B-5 of the Quality Assurance Plan (see Appendix B) and witnessed by Versar personnel to comply witn the EPA permit criteria.

2. Soil Storage Tents

The three soil storage tents were taken down and the metal ribs were cleaned on the decontamination pad. The ribs were wipe sampled after cleaning to verify that their 2,3,7,8-TCDD concentration was less than 40 ng/m^2 before they left the site. The tent fabric and the wooden structure along the tent sides that had been constructed by the excavation crew to contain the soil inside the tent fabric were processed through the incinerator.

3. Permanent Plot Markers

Sixteen permanent metal markers were placed on selected plots in Areas A, B, and C to identify the plots by their grid location. The markers were small circular metal discs set in concrete at the center of the plot as shown in Figure 8. Each marker had the plot grid location stamped in the metal disc. These markers were left so that the 20- by 20-foot plot grid could be established again after the plot stakes were removed. The location of the permanent plot markers are shown on Figure 9.

4. Scrap Steel

All of the carbon steel scrap and field-fabricated carbon steel parts that had been exposed to contaminated soil were cleaned with high-pressure hot water on the steel decontamination pad. The steel was

Figure 8. Permanent Plot Markers.

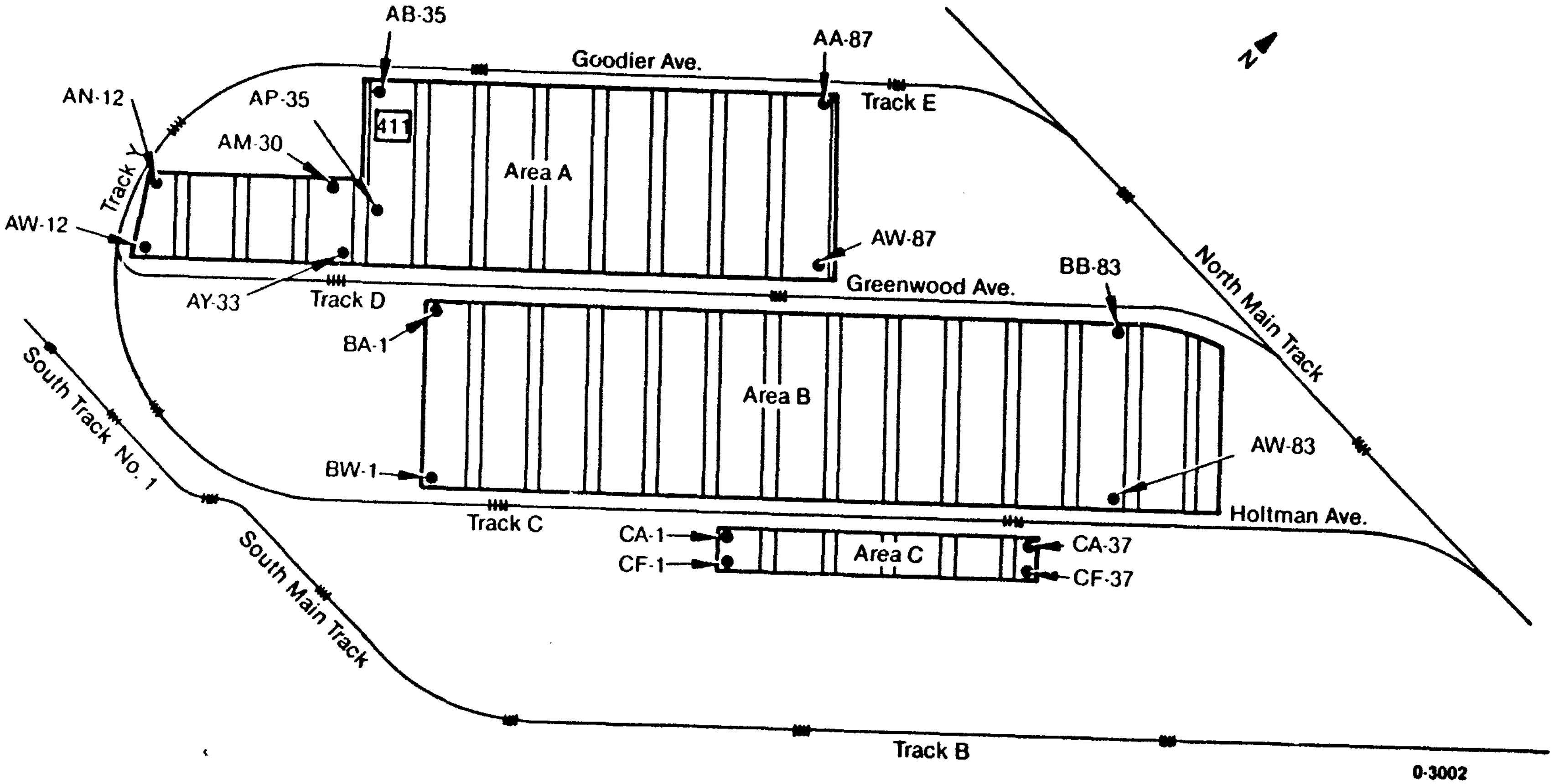

Figure 9. Permanent Plot Marker Locations.

wiped and stored in the staging area until the wipe sample results came back from the laboratory, indicating a concentration less than 40 ng/m^2.

5. Rock Crusher

The rock crusher was moved to the staging area where a bermed plastic lined containment was built under the rock crusher to catch all the washwater and soil removed from the rock crusher (see Figure 10). The water was collected and pumped into barrels that were transported to the incinerator and processed through the kiln burner. The soil was also burned in the incinerator along with the plastic containment liner.

The rock crusher had to be cleaned two times before the wipe samples from the wobbler rolling cams were found to be below 40 ng/m^2.

6. Decontamination Pad

After all the equipment had been cleaned on the decontamination pad, the pad itself was cleaned with high-pressure hot water. The tent fabric and plastic pipe supporting the fabric were processed through the incinerator. The steel decontamination pad base (see Figure 11) and grating were wipe sampled.

After the wipe sample results came back "clean" from the laboratory, the steel base was cut up into smaller sections for trucking offsite.

7. Charcoal Bed Tank

The charcoal bed was removed from the charcoal tank and processed through the incinerator. Figure 12 shows the charcoal being removed from the tank. The tank was also cleaned with high-pressure hot water and wipe sampled.

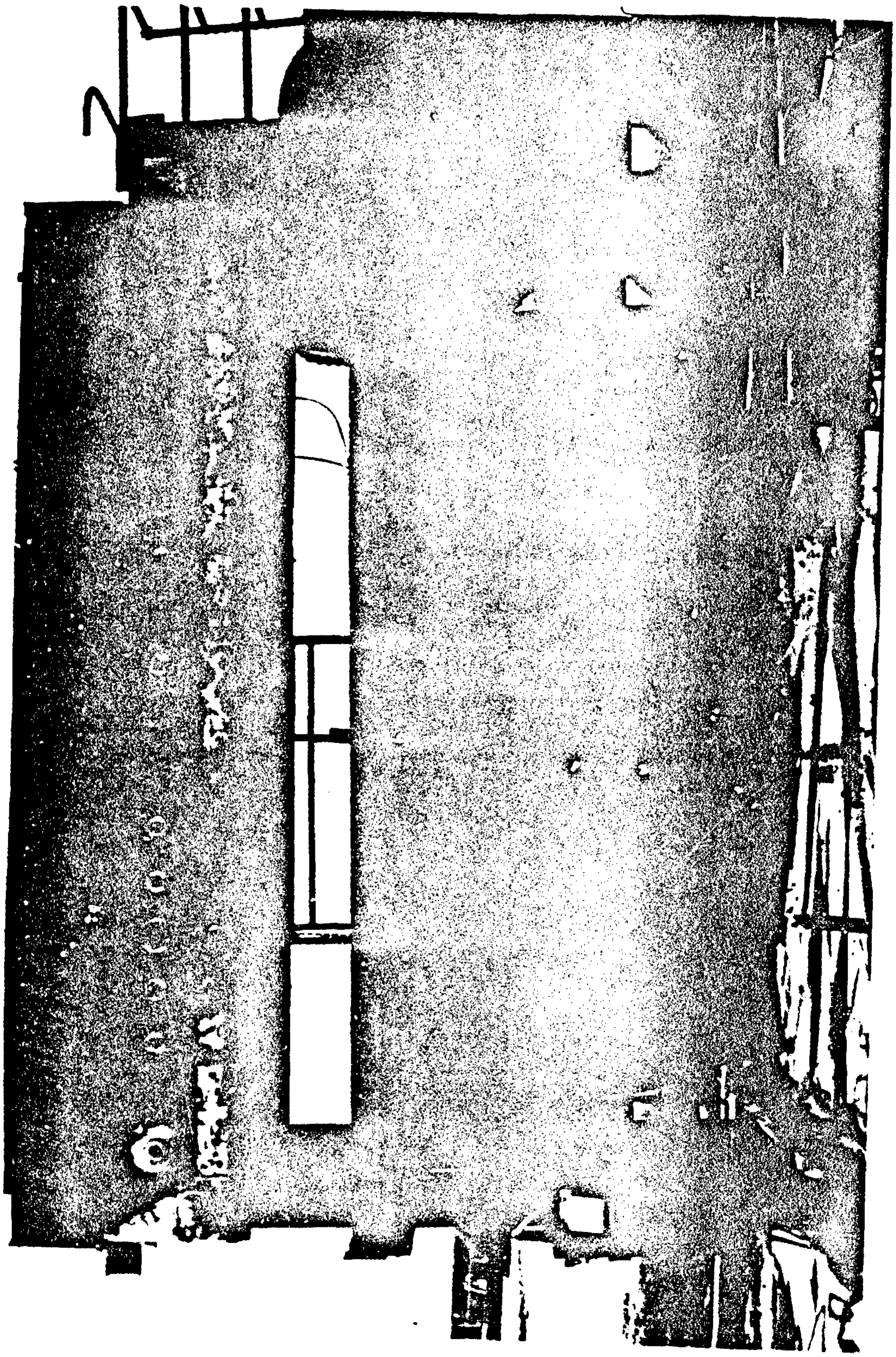

Figure 10. Decontamination of Rock Crusher.

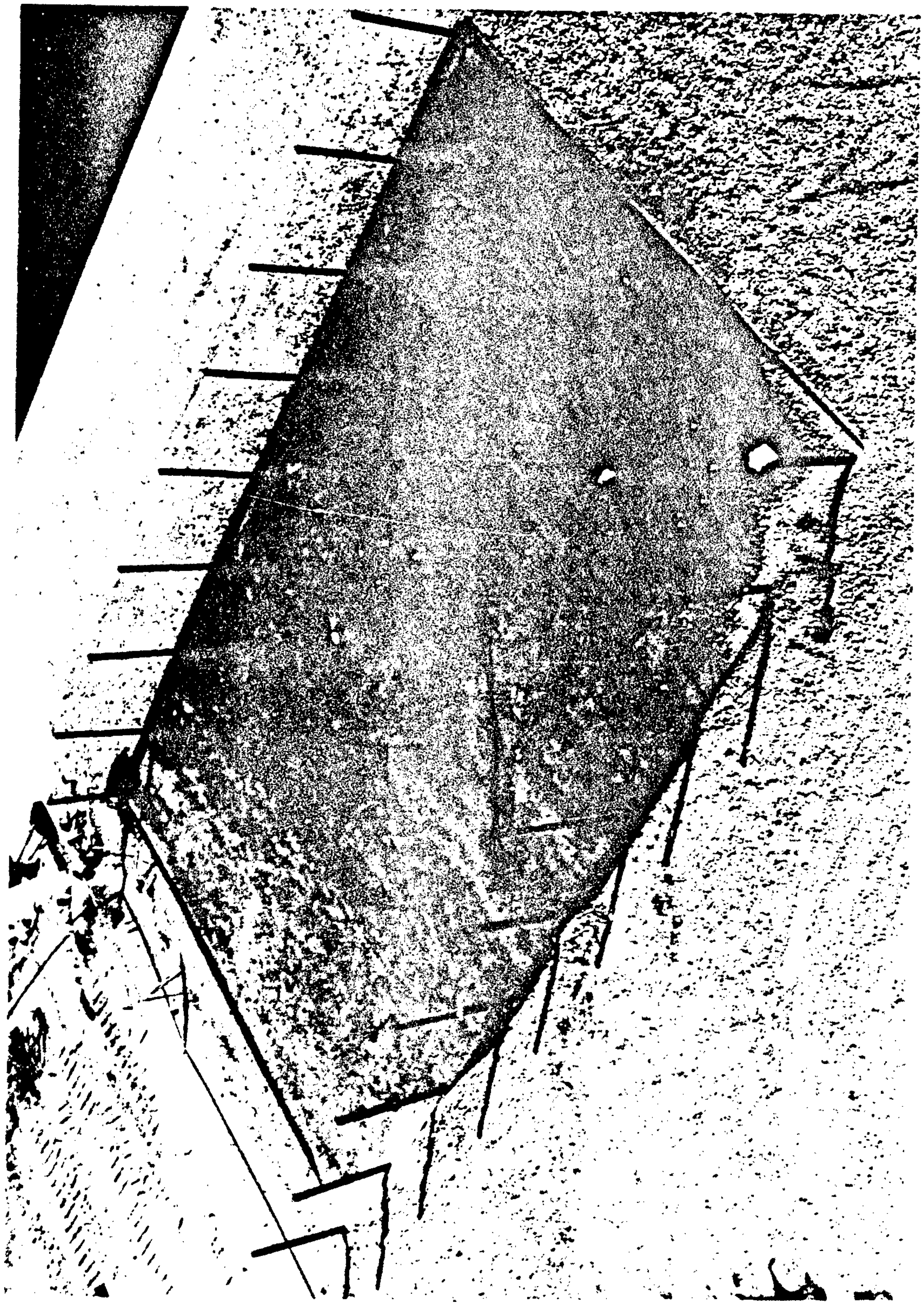

Figure 11. Decontamination Pad Base.

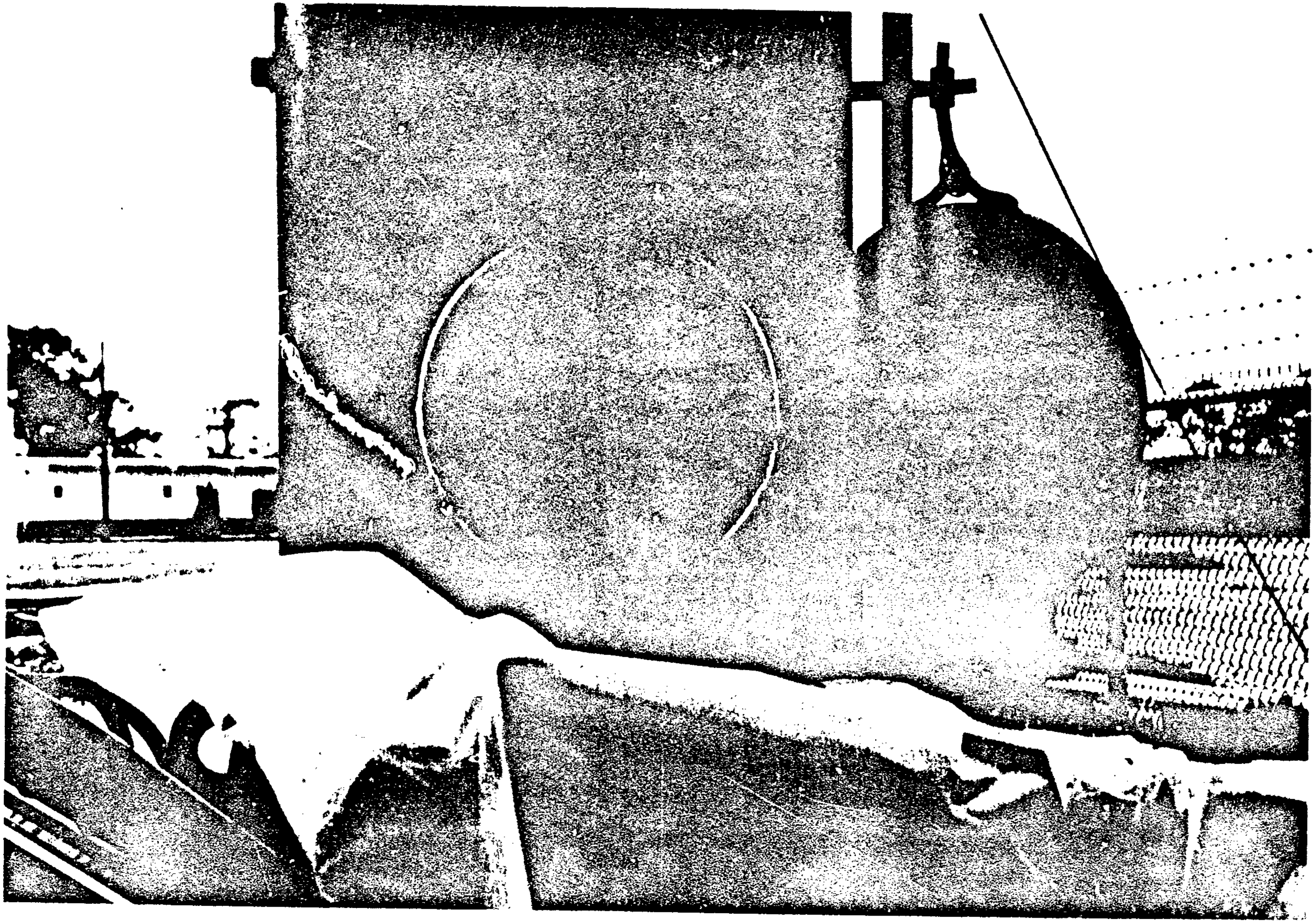

Figure 12. Charcoal Bed Removal.

After the wipe results came back clean from the laboratory, the tank was taken offsite as surplus.

8. Wipe Sampling

After all soil excavation activities were completed, all of the potentially dioxin-contaminated equipment was cleaned. The wipe sampling to verify the clean conditions and the wipe sampling of all decontamination material and equipment were performed by ENSCO and Versar employees. The wipe sampling as shown in Figure 13 was witnessed by Versar employees on the NCBC site during decontamination to ensure that the work was performed according to the permit requirements.

Because cross-contamination was considered to be a potential problem, glove blanks were obtained to detect any sampling problems. The glove blanks were obtained in the same manner as normal samples; however, no equipment was sampled, just the gloves. One glove blank was taken for every 10 wipe samples.

D. AMBIENT AIR MONITORING

The ambient air sampling at the NCBC site was performed by Versar under contract to EG&G Idaho. See Appendix C for the standard operating procedure used for obtaining the samples.

1. Equipment

Because soil excavation was the most likely activity to result in movement of dust offsite, all air monitoring (with the exception of background air monitoring) was performed during soil excavation activities. Air monitoring was performed using two different types of air monitors: a PUF monitor and a Hi-Vol monitor. The PUF monitor used a two-stage filtration system consisting of a particulate air filter and a PUF filter. The particulate filter was intended to capture solid particles, while the PUF cartridges adsorbed semivolatiles that may have been present in the air

Figure 13. Wipe Sampling Roll-Off Boxes.

or may have been stripped off the solid particles. To minimize the chance of stripping semivolatiles off of the two-stage filter, the PUFs were operated at a low volumetric flow rate of approximately 10 ft^3/min. The Hi-Vol air sampler drew ambient air through an 8- by 10-inch borosilicate filter at a rate of approximately 40 ft^3/min. Hi-Vol samples were used to determine particulate loading, while PUF samples were used to determine dioxin concentration.

During Phase 1 of this work, five PUF monitors and two Hi-Vol monitors were used on each day of excavation for this sampling activity. Figure 14 shows the samplers and generators on a small trailer. The number of monitors used each day was later reduced because of favorable analytical results. Initially four trailers were used to monitor the air upwind and downwind of the excavation site.

2. Action Levels and Permit Conditions

EPA Region IV mandated that the USAF collect air samples, such that the detection limit was below an action limit of 3 pg/m^3 of 2,3,7,8-TCDD of air collected. Taking into account the analytical capabilities of the laboratory, this required a minimum sample time of 24 hours for PUF ambient air monitors.

At the start of the project, the monitors began sampling before excavation started for the day and continued for a minimum of 24 hours. After data from the first 30 days of sampling proved to be negative, a less rigorous schedule of sampling only during the hours of excavation was employed. To meet the 24-hour minimum sample time for PUF samples, the particulate air filters and the PUF filters were not changed until they had accumulated 24 hours of operating time. The Hi-Vol air samplers were changed each day.

3. Laboratory Analysis

Hi-Vol air filters required preparation before use. Since the filters were used to determine total particulate concentrations,

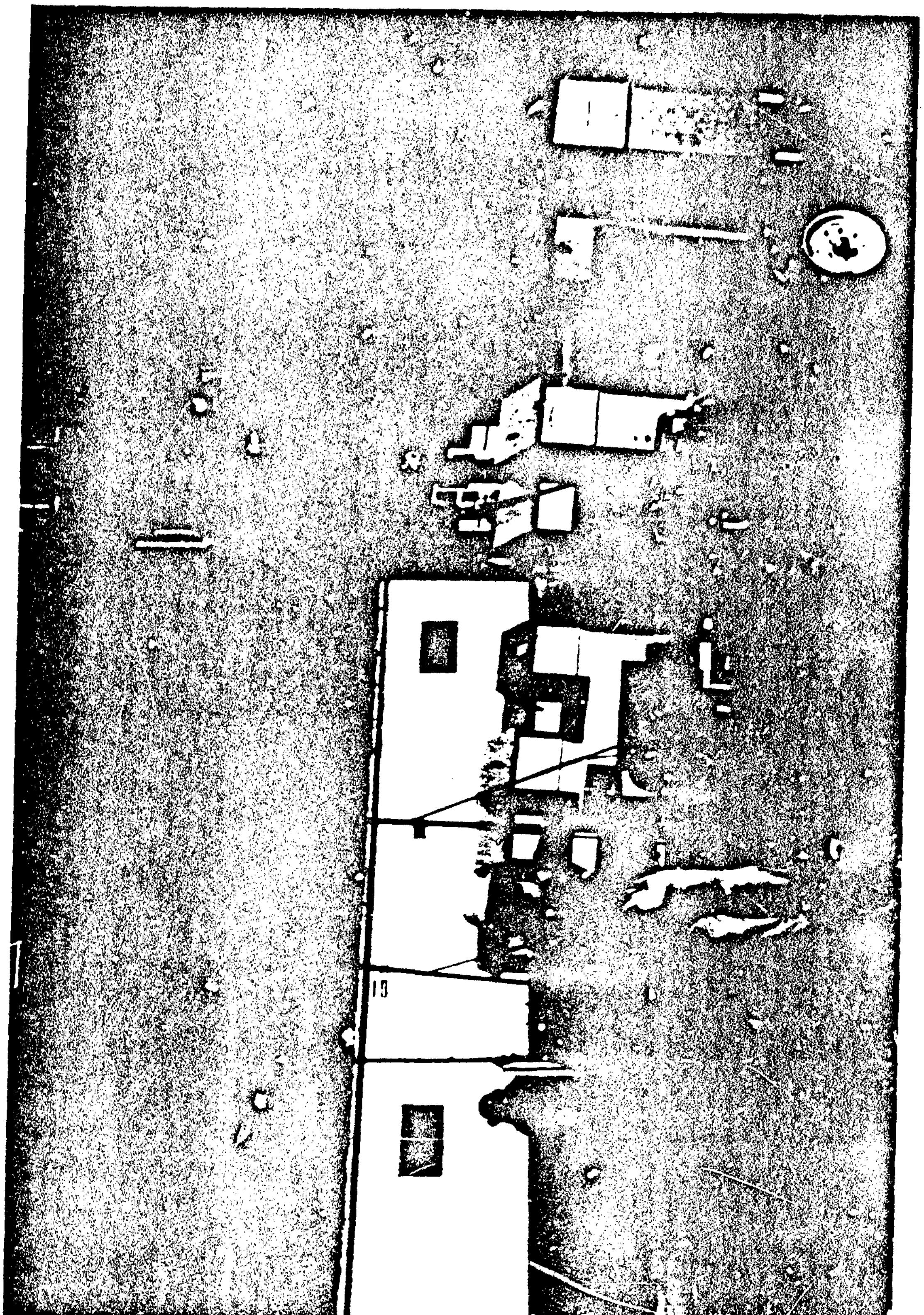

Figure 14. PUF and High Volume Samplers on Trailer.

they had to be desiccated and weighed before being installed in the Hi-Vol samplers. Initially, Burmah Laboratories in Gulfport was used to desiccate and weigh all filters. A supply of filters was taken to Burmah for initial desiccation and weighing. Each filter was identified before being delivered to Burmah by assigning a unique filter number and writing that number on a corner of each filter. When the filter was used, the filter number was recorded in the Versar field notebook and used to track the filter. When loading/unloading the Hi-Vol filter, care was taken to handle the filter with either clean, stainless steel tweezers, and/or clean, surgical gloves to ensure that no additional weight was added to the filters. The filter and any sample pieces of filter remaining on the filter holder were placed in clean aluminum foil large enough to fold around the filter. The sample number was written on the outside of the foil enclosing the sample. The aluminum foil and filter were then placed in a plastic bag, sealed, and taken to the laboratory for weighing. The sample number, filter number, and volume of air were recorded on the chain-of-custody form accompanying the filter to the laboratory.

During the NCBC operations, Versar analyzed the Hi-Vol filters onsite. Versar obtained a desiccator and analytical balance to perform the suspended particulate analyses. Before use, the clean filters were numbered and desiccated for 20 hours in preparation for weighing. Versar maintained a stock of numbered and weighed filters at the site for use on the samplers. The filters were handled with clean surgical gloves during numbering, desiccating, weighing, and sample use operations. After use, the filters were placed back in the desiccator for 24 hours of drying before reweighing the filters. Versar maintained a log of initial and final weighings at NCBC.

The average total suspended particulates from the Hi-Vol filter analyses was calculated by dividing the difference of the before and after masses (in grams) by the volume of air sampled (in cubic meters) and multiplying the result by 1,000 to convert the grams into milligrams. The results were reported in milligrams per cubic meter.

The samples recovered from the PUF monitors were the particulate filter and three PUF cartridges. The PUF cartridges were cleaned by Versar personnel using a hexane extraction procedure and were stored in clean jars before use. The cartridges were loaded into the PUF module by first unscrewing the bottom of the top of the modules, and then removing the glass cartridge holder from the unit. After putting on clean, surgical gloves, a 1-inch cartridge was placed on the glass holder until there was approximately 2 inches from the PUF cartridge to the edge of the glass holder. There was approximately 1 inch between the cartridge and the wire mesh on the bottom of the glass holder. The cartridge was not smashed, but expanded as much as possible. The next two cartridges were worked similarly into the holder. The top of the last cartridge and the edge of the glass of the holder were flush.

The particulate filter was placed on the PUF module using clean, stainless steel tweezers. The top retaining ring of the module was removed by loosening the thumbscrews, flipping down the screws, and lifting the ring. There were two Teflon rings in this section of the module: one on the retaining ring side, and one on the base support. The filter was grasped on the edge just firmly enough with the tweezers to hold the filter without damaging the delicate borosilicate fibers, then centered on the bottom Teflon ring. The retaining ring was reattached to the unit, and the module was ready to be connected to the sampler.

At the completion of each run, the module from each PUF monitor was removed and transported to the Versar field trailer. Before removal, the top of each module was covered with clean aluminum foil to prevent any additional particulate accumulation on the filter. During transport, the module was carried in an upright position so that no particulate was lost. Upon removal, the cartridges and filters were placed in clean, prelabeled 8-ounce sample jars.

4. Data Collection and Storage

The Ambient Air Monitoring Plan (AAMP) (Reference 2) specifies the criteria to be followed concerning where the monitors were to be placed and when they were to be moved. The criteria are briefly summarized in Table 5 and a standard identification scheme is presented. Basically, a combination of five PUF and two Hi-Vol monitors were used at four different locations to obtain air samples.

TABLE 5. AIR SAMPLER IDENTIFICATION SCHEME.

Location Designation	Location Description
A	One PUF and one Hi-Vol, located 100 meters upwind of excavation.
B*	One PUF, located 30 meters downwind of excavation.
C	One PUF and one Hi-Vol, located at a position nearest the downwind site boundary of the HO storage area. One additional PUF at this location, as a QA sample. As required by EG&G Idaho, the QA PUF was moved to location B or D.
D	One PUF, located 150 meters downwind of the HO site boundary or the NCBC base boundary, whichever was closer.

Identification of the PUFs and Hi-Vol was according to the following methodology: format = SXN where:

S	=	P designated PUF and H designated Hi-Vol air monitors. QA indicated that the monitor was the PUF quality assurance monitor.
X	=	A, B, C, or D indicated the location of the monitors, as per the above descriptions.
N	=	1 through the number of times the monitors were moved during sampling. N was not required when the QA monitor was being described.

* This sampler was discontinued after the data from the first 30 days of sampling proved to be negative.

As described in the AAMP, the monitors were placed at the above locations so that all were on an imaginary line parallel to the direction of the wind and passing through the point of excavation. Originally, a compass was used to line up the samplers after the proper wind direction was determined. This was stopped because the large trucks and equipment to the north of the site were interfering with the magnetic readings. After this interference was detected, the site chart was used to determine locations of the samplers after the proper wind direction was determined. Although not discussed here, the AAMP presented instances when placement of the monitors was different from the guidelines presented above (i.e., when obstructions were encountered), and it was referenced when unusual circumstances occurred.

At the beginning of each shift, the Versar employee entered his/her name in the field notebook, along with the time and date the shift began. At this time, the wind direction, wind speed, temperature, relative humidity, and barometric pressure were recorded, along with a brief summary of the weather conditions.

Every hour during the shift, the wind speed, direction, and ambient temperatures were recorded in the field logbook. In those instances when the monitors required movement, this was not always possible and was indicated in the logbook. As was convenient after the monitors were moved, the hourly log of data would resume.

If movement of the monitors was required, the data used to determine that the move was required was then entered into the logbook (i.e., the wind direction and time of wind change). In addition, the time the monitor was moved was recorded, along with a brief narrative indicating which monitors were moved and their new locations (i.e., monitor PA was moved to location PA2, which was about 25 feet away from location PA1 along an arc toward the east). In addition, the new location of the monitors was also labeled on the site map.

Versar calibrated the PUF and Hi-Vol monitors each month. Calibration was performed according to the procedure presented in Appendix D. To keep calibration activities from impacting normal sampling, Versar personnel performed calibrations when sampling was not being performed (i.e., during a weekend or other downtime). A separate field logbook was maintained to record calibration data.

At the completion of each 24 hours of sampling, the following data package was given to EG&G Idaho:

- Ambient Air Monitoring Data Sheet (AAMD)
- Site map showing locations of monitors during sampling
- Strip chart showing wind direction and speed
- Copies of Versar's field logbook for sampling period
- Copies of chain-of-custody form for samples recovered.

This data package was given to EG&G Idaho within 8 hours after sampling was completed. Care was taken to complete all of the required information on the AAMD, including the dates and times when sampling began and ended. The sample number and location description were also included on the AAMD so EG&G Idaho could determine what type of sample was calculated by using an average volumetric flow rate, which was determined by using an average flow rate over the course of sampling. The sample flow rate on the PUFs could be adjusted upward if the rate fell too low. If an adjustment was made, it was noted in the field logs. The average of the recorded flow rates from the field logbook was used to calculate the volume of air sampled during a 24-hour period.

Locations of the monitors during excavation were indicated on a site map with the wind direction and excavation area marked. Each wind shift requiring the movement of samplers was marked on the site map. The weather station strip chart recording indicated wind speed and direction for each 8-hour period in which sampling occurred. The times when monitors required movement were indicated on the chart, as were the periods of time when the wind changed direction, which required movement of the samplers. The chart was also dated and several clock times were written on it as reference points.

5. Laboratory Analysis

The chain-of-custody form for samples indicates which samples were to be analyzed and those to be archived. Unless otherwise instructed, the PUF sample taken at Location C was always analyzed for TCDD; all other samples were archived at Envirodyne Laboratory.

6. Mini-Ram Dust Monitoring

The Mini-Ram dust monitoring was performed hourly during excavation and recorded on a daily safety log sheet.

7. Sample Identification and Packaging

The identifying number for a Hi-Vol sample was a nine-digit alphanumeric identification. The following is an example of this identification system:

Sample HC3012788 where:

H = High Volume
C = Sampler Station C
3 = Number of times the station was moved during the course of sampling

012788 = Date of sample commencement (e.g., 27 January 1988).

The filters and cartridges were placed in clean 8-ounce sample jars and sealed, and the seals were signed and dated by the packaging person. These jars were then placed in 1-gallon metal paint can(s) and the free space in the can(s) was filled with vermiculite. The lid(s) were taped into place and two Versar seals were placed on opposing sides of the lid(s). These samples were composite samples, since they reflected a time weighted average, not a point source; consequently, the custody-of-custody record had the composite column checked, instead of the grab column. The remarks section was to note any anomalies, which may have been of interest to those conducting the sample analysis.

The metal can(s) were packed either in a box or a cooler for shipment to Envirodyne Laboratory for analysis. Before the container was closed, the chain-of-custody form was signed by the Versar person packing the samples and the top two copies went in the package with the sealed metal can(s). The chain-of-custody form reflected the field sample number, which sample would be analyzed first for 2,3,7,8-TCDD, which sample would be archived, and the total air volume sampled for each sample. The pink copy of the record was given to EG&G Idaho, and Versar personnel made a copy for their own records. With the copies in the box or cooler, the container was closed and taped shut.

The samples were shipped to Envirodyne via Federal Express. The bottom of the Federal Express form relating to the nature of the hazardous substance was also filled out. The samples were considered a hazardous substance, Solid N.O.S. under shipping class ORM-E. The UN ID# was NA9188 and the total net quantity was the mass of the samples themselves, not the weight of the package. If the samples were packaged correctly, they were shipped by passenger air, so that the Cargo Aircraft Only statement on the label was crossed off. The radioactive material restriction was also crossed off, since these samples were not radioactive. The package also required three brown ORM-E labels applied to the container for proper labeling; one on the top, one on the front, and one on the back of the package.

During the initial sampling, the Hi-Vol filters were wrapped in foil and placed in zip-lock plastic bags with the Versar sample number clearly visible through the bag. These samples were delivered to Burmah Technical Services Laboratory in Gulfport. These samples were generally delivered on an every-other-day basis to Burmah, as there were only two filters from each day's work, and the laboratory was only a 15-minute drive from the site. The samples were hand delivered to Burmah, and the chain-of-custody form was completed by a representative of the laboratory.

The samples were packed according to the following: the zip-lock bags were sealed with Versar seals and placed in a box, which would comfortably hold the bags without crumpling the foil-wrapped filters in the bags. The filters were kept as flat as possible throughout their handling so that the trapped particulates were not knocked off the filters.

The chain-of-custody form was filled out similarly to that for the PUF samples. The record contained the field sample number, the total volume of air sampled, and the filter number associated with the field sample number. These samples were also composite samples. The samples were analyzed for total suspended solids or total particulates, which are marked in the first column of the parameters section. The chain-of-custody form did not go in the packed box, as with the PUF samples.

The box was closed and Versar seals were applied to the box ends before the box was taped shut. Upon delivery of the samples, the laboratory representative signed the chain-of-custody form. The pink sheet was given to EG&G Idaho, and a copy was made for Versar files.

During the operations phase of this work, the chain-of-custody forms and packaging procedure were not used since Versar personnel were the only people to handle the samples.

8. Equipment Maintenance

The generators' recommended maintenance schedule indicated that the equipment oil be changed every 100 hours of operation. The oil in the generators was changed while the sampling stations were still in the field. To facilitate quick oil changes, the generators were equipped with flexible hoses and ball valves. The samplers and generators at the station were turned off during an oil change. The used oil was collected for later disposal.

The monitors themselves required very little maintenance and were serviced on an as-needed basis. One spare Hi-Vol sampler and one spare PUF sampler were on hand, if a replacement unit was required. Versar also maintained spare motors and motor brushes to eliminate or minimize downtime attributable to the samplers.

9. 30-Day Summary Report

A 30-day summary report was prepared and sent to EPA for review. Because the PUF sampler at Station C did not detect 2,3,7,8-TCDD migration from the site, no correlation of data or dispersal studies could be made. The conclusions reached in the report were that dust-suppression techniques employed in the excavation operations appeared adequate and that sampling changes could be made in the following areas:

- Eliminate the use of Hi-Vol samples
- Eliminate the B Sample Station
- Sample only during excavation periods
- Analyze the QA PUF sample on a percentage basis of the total C Station analyzed rather than on a two-per-week frequency.

SECTION V
COST AND DATA ANALYSIS

A. PLANER COSTS

The planer was a complex piece of excavation equipment that required consistent preventive maintenance and occasional repairs due to operator errors. The repairs made on the planer are itemized in Table 6.

TABLE 6. PLANER REPAIR COSTS.

	Item	Total Engine Hours	Cost (Parts & Labor)
1.	Grade sensor boards repair	64.3	$224.05
2.	Grade sensor control arms repair	73.9	15.00
3.	Grade sensor ski replaced with a wheel	79.4	63.75
4.	Replaced grade sensor control arms	81.2	555.00
5.	Replaced two cutter drum drive belts	85.0	318.24
6.	Ladder straightened	97.6	3.75
7.	Removed bent grade sensor wheel	100.6	11.25
8.	Water valve replaced	124.3	15.00
9.	Replaced 20% of cutter drum carbide teeth	132.1	120.00
10.	Replaced 80% of cutter drum carbide teeth	134.7	150.00
11.	Replaced alternator	139.3	15.00
12.	Replaced U-joint	149.5	30.00
13.	Replaced hydraulic pump and V-belts	158.9	326.51
14.	Replaced three cutter drum drive belts	198.8	612.36
15.	Replaced three cutter drum drive belts and idler bearing	201.5	833.71
16.	Hydraulic control valve repair	225.5	31.00
17.	Steering control arm repair	239.0	150.00
	Total		$3,474.62

At the completion of the excavation, the planer was completely refurbished and returned to Tyndall Air Force Base. The cost for refurbishment was $12,855.23.

B. EXCAVATION COSTS

The excavation of the cement-stabilized soil was not a regular 5-day-per-week function. The frequency of excavation depended on the operation of the incinerator. If the incinerator was down for repairs or maintenance, excavation was not necessary.

1. Equipment

The equipment used to excavate was leased, rented, or loaned. Thus, the monthly expenses for the excavation equipment were the same whether it was used 1 day or 30 days. The project equipment costs for excavation are shown in Figure 15.

2. Labor

The excavation crew maintained and repaired the incinerator when they were not excavating. They were also the main cleanup and decontamination crew for equipment cleaning. The excavation crew labor for excavation is shown in Figure 16.

The excavation equipment cost per ton excavated is not meaningful because the excavation time is limited by the rate at which the incinerator processes the soil. The labor per ton excavated is a more precise and accurate number. The labor dollars per ton excavated is $5.62. This rate is a function of the weather, labor wage rate, length of haul, etc.

3. Laboratory Analysis

The costs for laboratory analysis of the soil samples taken during excavation are shown in Table 7.

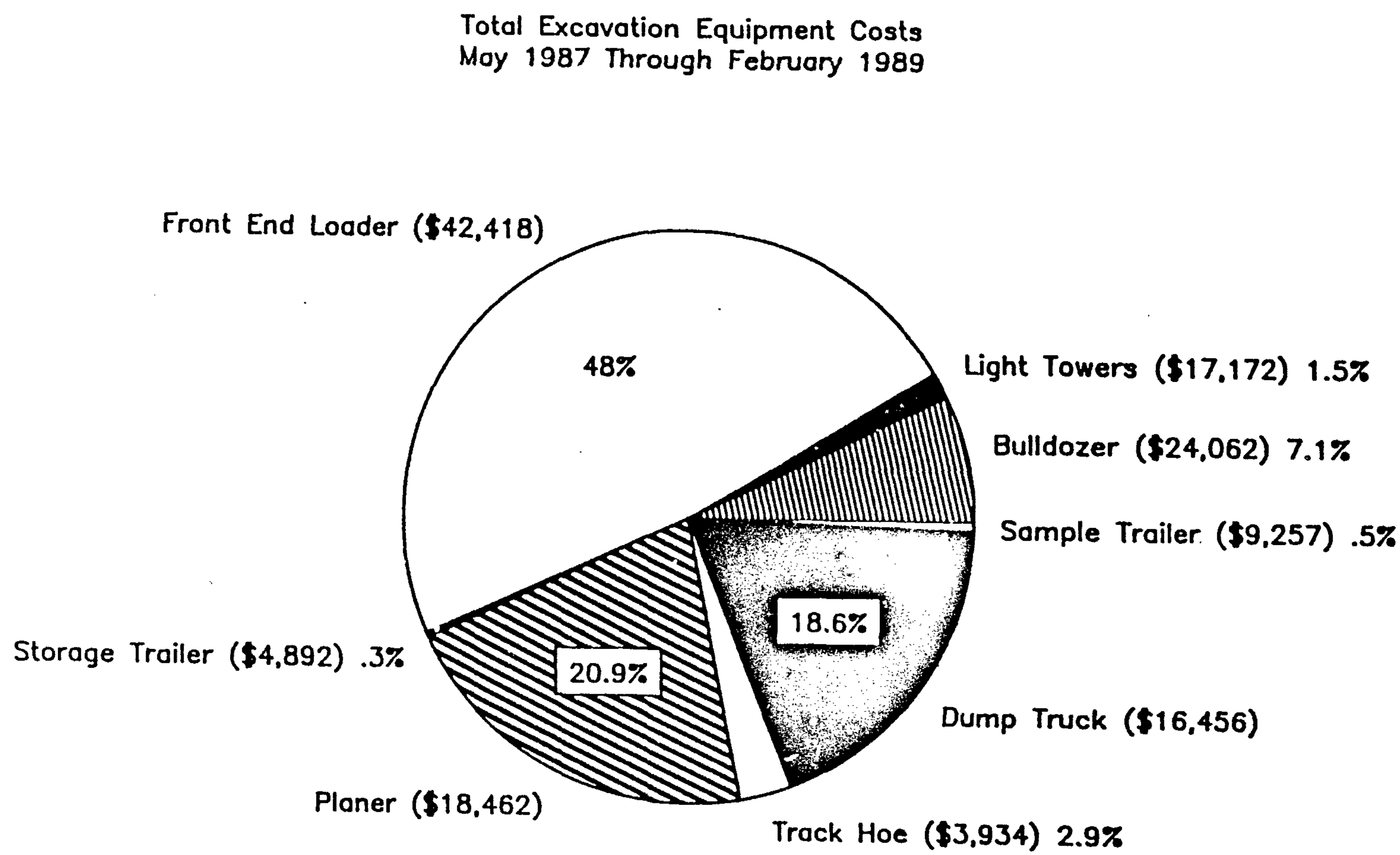

Figure 15. Total Excavation Equipment Costs - Pie Chart.

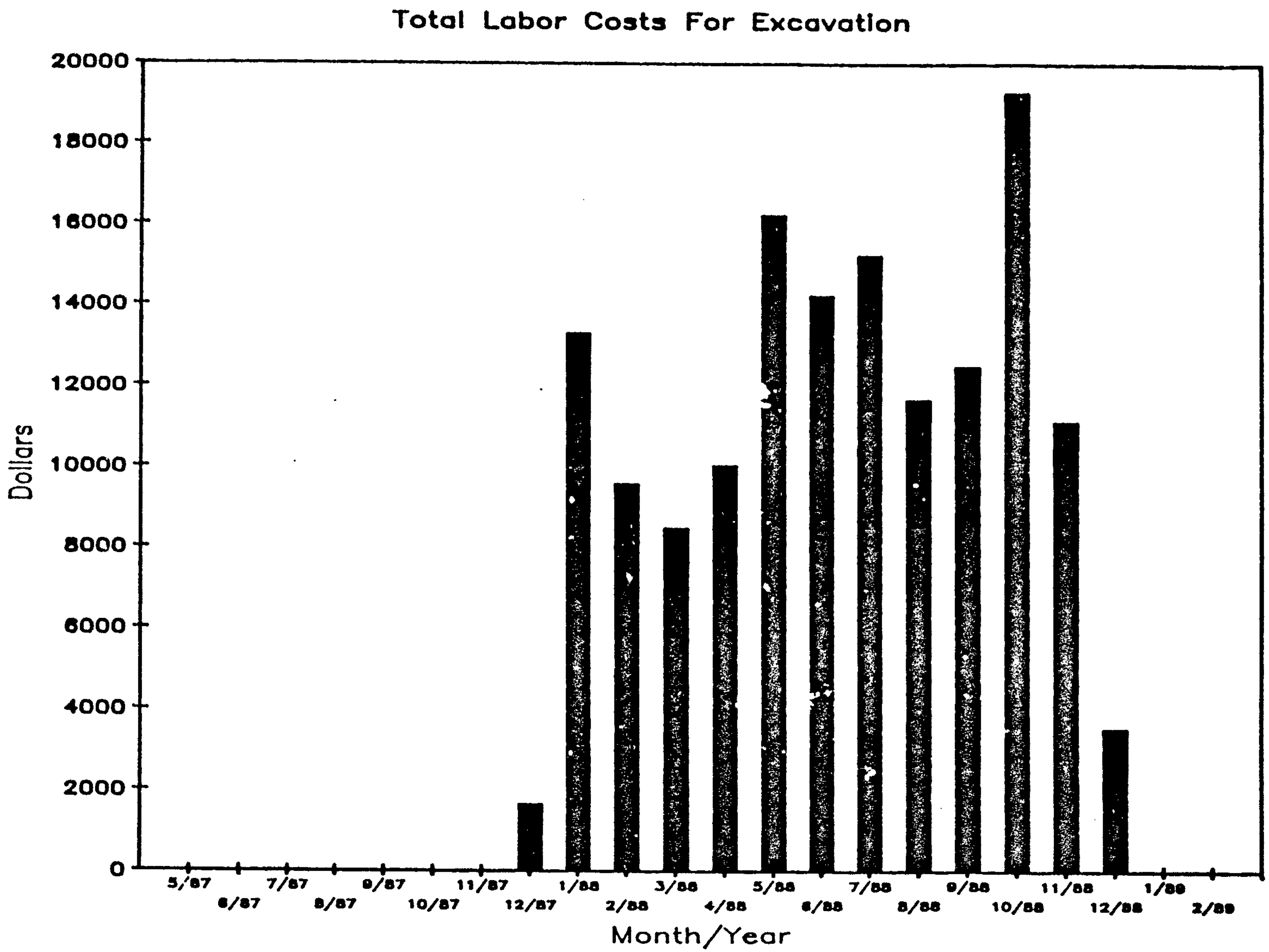

Figure 16. Total Labor Costs for Excavation - Monthly.

TABLE 7. LABORATORY ANALYSIS COSTS.

Laboratory	Laboratory Analysis Costs
1. Envirodyne	$486,129
2. U.S. Testing	$532,308
3. Twin Cities	$67,593
4. International Technologies	$100,655

4. Miscellaneous

The fill dirt, laboratory analysis, and other materials (plastic, geotextile, etc.) used for excavation are included in Figure 17. The cost of the fill dirt was $10,208 and the materials cost was $46,190.

C. ROCK CRUSHER COSTS

The rock crusher (Universal Engineering Corp. 1016 RBSL Jaw Crusher with a 48-inch by 18-bar by 9-inch pitch wobbler feeder) was purchased for $26,000 by ENSCO. It required extensive modification and set up work onsite before it was operable. The cost required to get the rock crusher in operation was $1,752 (labor) and $2,073 (material). The rock crusher was used on an occasional basis to break up the chunks of cement-stabilized soil and rocks. The freight charge to get the rock crusher to the NCBC site was $2,073.

1. Equipment Operation

The operation of the rock crusher required two front-end loaders. One would feed the chunks to the wobbler on top of the crusher; the other would pick up the crushed material as it piled up at the conveyor drop point.

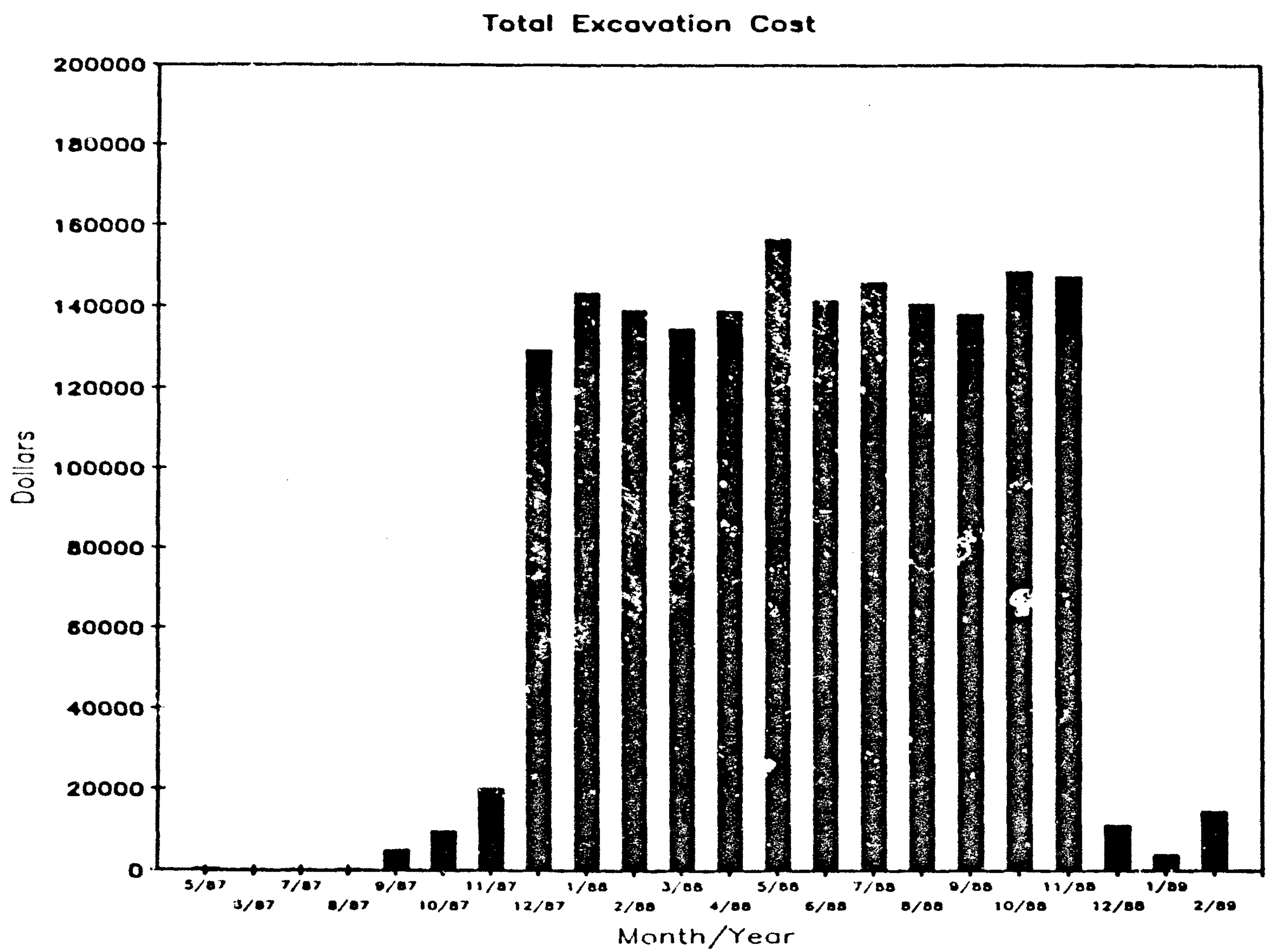

Figure 17. Total Excavation Cost - Monthly.

The height of the wobbler above the ground (about 20 feet) required construction of a soil ramp for the front-end loader to drive up providing the required bucket height for dumping the rocks onto the wobbler. The front-end loaders were the same ones used for excavation and moving soil from the soil storage tents to the incinerator.

2. Labor

Besides the two front-end loader operators, the rock crusher required one laborer to break up the large chunks of cement-stabilized soil that were too large to drop down into the jaws of the crusher. This person was positioned at the end of the wobbler with a sledgehammer to break the chunks before dropping the chunks into the jaws. The labor for operation of the rock crusher was $7,313.

The volume or tons of material processed through the rock crusher is not known because there were no weigh scales in the contaminated area. The costs for the rock crusher are shown in Figures 18 and 19. The lease rate for the rock crusher from ENSCO back to the project was set at $3,922 per month.

D. AMBIENT AIR MONITORING COSTS

Ambient air monitoring was performed by Versar personnel with some of the equipment supplied by EG&G Idaho.

1. Equipment

The items used for air monitoring and the costs are shown in Figure 20.

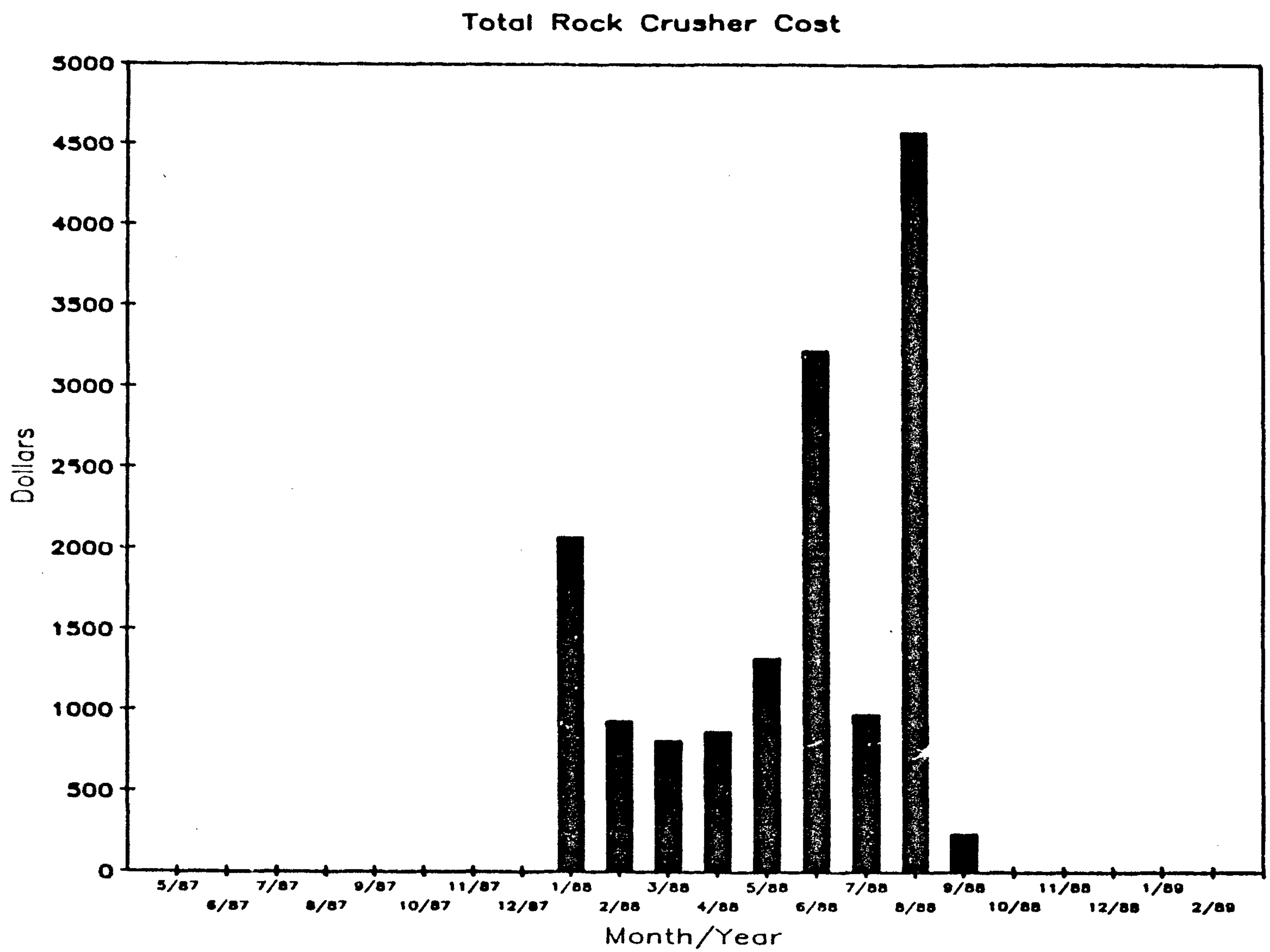

Figure 18. Total Rock Crusher Costs - Monthly.

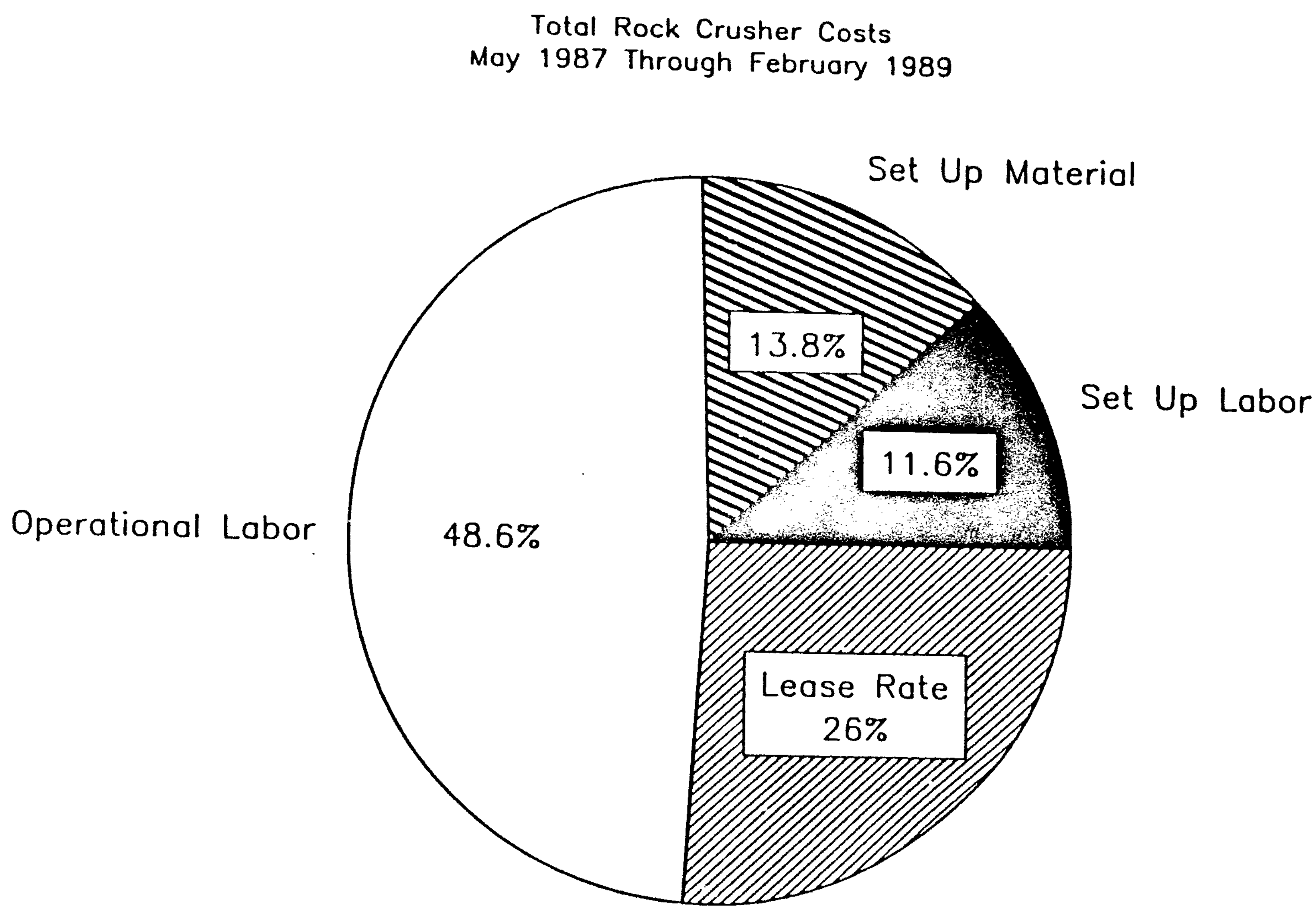

Figure 19. Total Rock Crusher Costs - Pie Chart.

Total Air Monitoring Costs
May 1987 Through February 1989

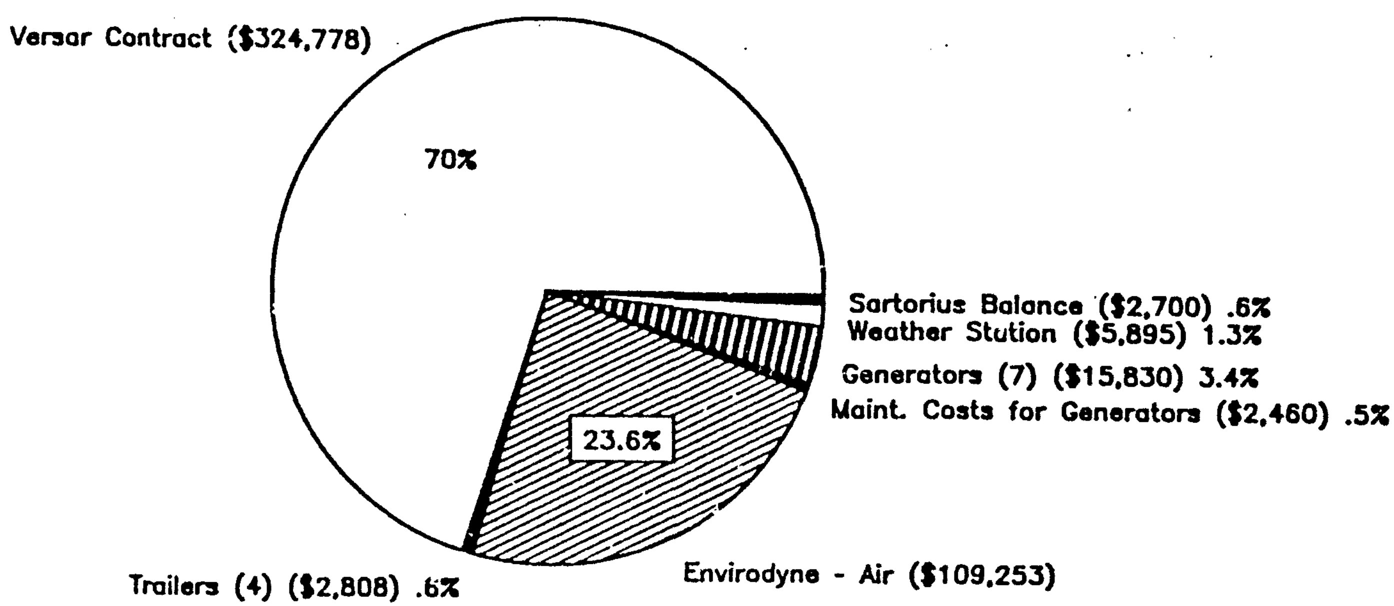

Figure 20. Total Air Monitoring Costs - Pie Chart.

2. Labor

The air monitoring initially required two Versar people to run the samplers 24 hours a day. After March 1988, the samplers were only operated during the excavation of soil; thus, one person was able to do the air sampling. The monthly costs of Figure 21 reflect this labor change.

E. ASH STORAGE COSTS

The ash was stored in roll-off boxes leased from BFI. The lease rate of the 50 ash roll-off boxes was $8,480 per month. Initially a truck was rented from BFI to pick up the roll-off boxes and off-load the ash back in Area A. The lease rate on the truck was $2,650 per month. The truck was sent back to BFI after the first few months because it could not pick up a roll-off box that was full of ash. The water content of the ash made the total weight of the box greater than the lifting capacity of the truck (the front wheels of the truck came off the ground, thus, the box could not be winched onto the truck bed). The roll-off boxes were filled by a front-end loader and emptied by the track hoe and dump truck. The rental on the track hoe averaged $2,981 per month and the dump truck rental averaged $1,250 per month. The ash storage costs are shown in Figures 22 and 23.

F. SOIL STORAGE COSTS

The soil storage costs consist of the cost of the three storage tents and labor to erect and maintain them. Three tents were necessary to store enough soil for the incinerator to operate through the weekend and on rainy days when excavation could not take place.

The tents cost $2,095 each and required approximately 84 man-hours each to erect. This cost for erecting the tents includes the construction of wood sideboards 4 feet high for each tent. The tents were constantly being damaged by front-end loaders that were operated by workers in anticontamination clothes and full face respirators. The tent fabric

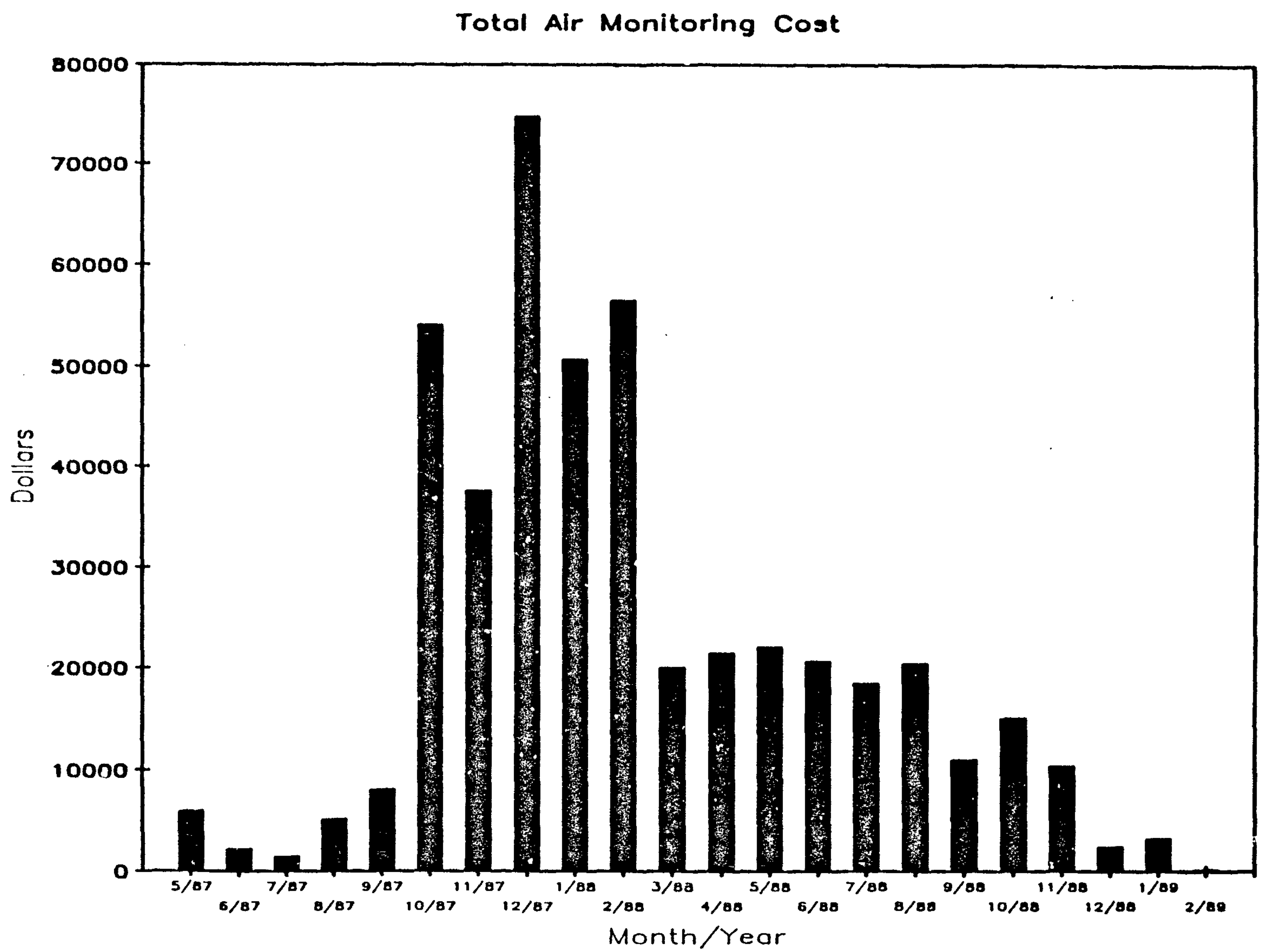

Figure 21. Total Air Monitoring Costs - Monthly.

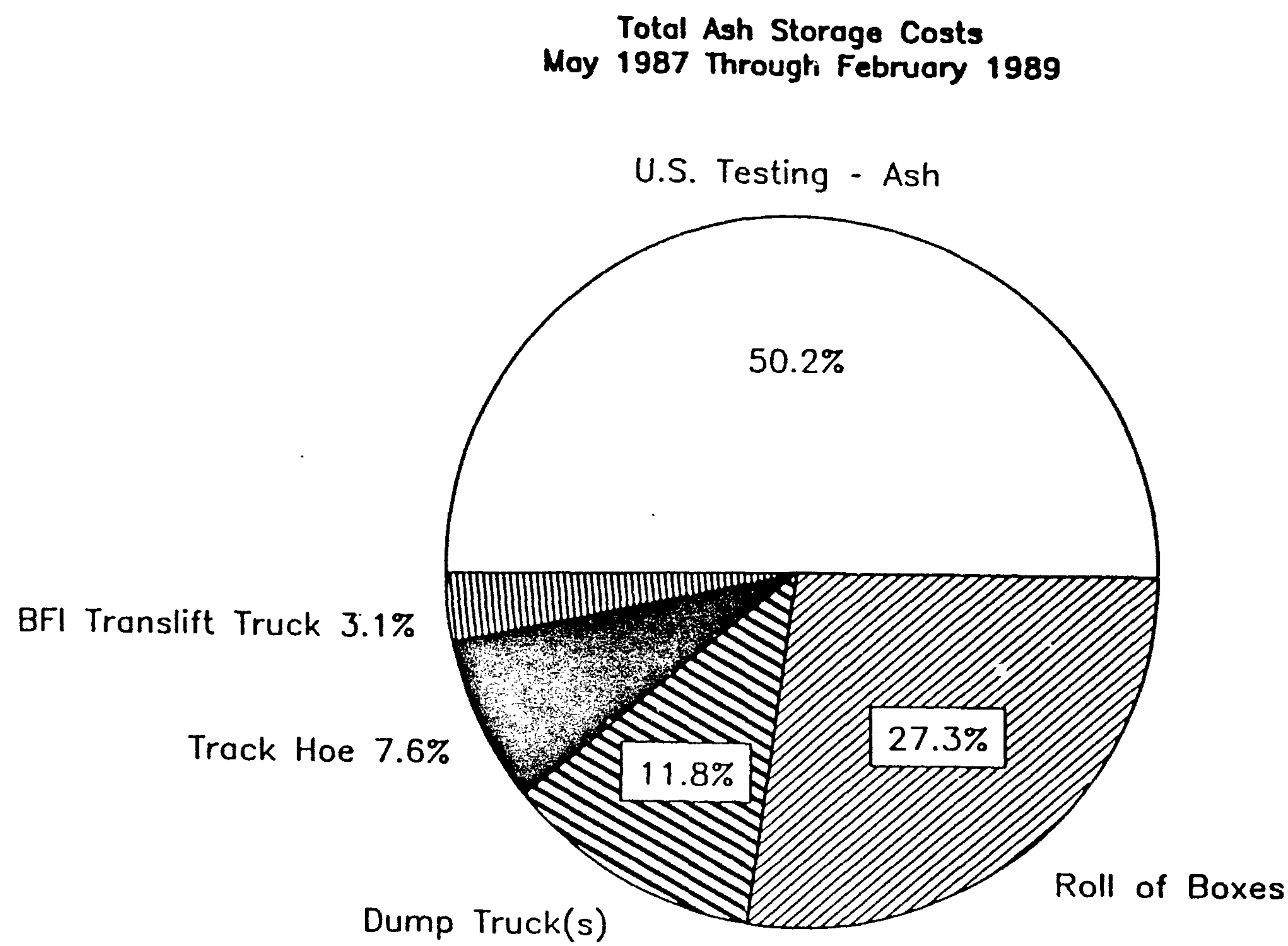

Figure 22. Total Ash Storage Costs - Pie Chart.

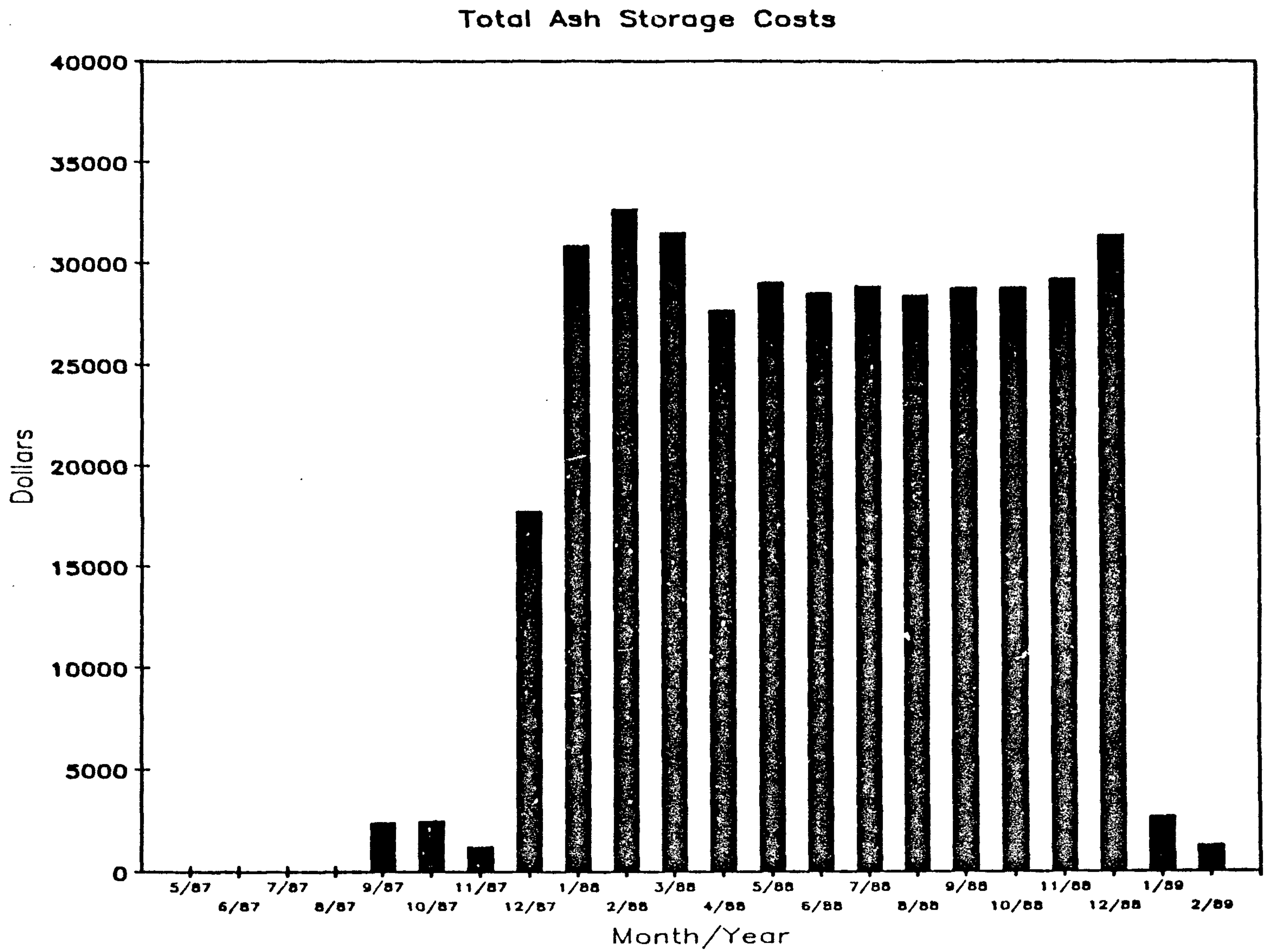

Figure 23. Total Ash Storage Costs - Monthly.

and ribs were also damaged many times during the hurricane season by high winds. The tent repairs are estimated to be 10 man-hours per month and $50 per month for materials. The soil storage costs are shown in Figures 24 and 25.

G. DATA CORRELATION OF 2,3,7,8-TCDD TO TOTAL TCDD AND TCDF

The data in Table 8 shows the laboratory results for soil samples that had positive detections for 2,3,7,8-TCDD and total TCDD. The difference between the 2,3,7,8-TCDD concentration and the total TCDD concentration for the 39 samples ranged from +.18 to -.78 ppb. The 2,3,7,8-TCDD concentration was normally higher than the total TCDD concentration. These very low levels of TCDD in soil are difficult for the low resolution GC/MS to detect accurately. The laboratory procedures have a certain amount of variability in them, which would account for small discrepancies. The difference between the two laboratory results is sometimes large when compared to the individual laboratory result, but these results are at the low end of the scale for this laboratory procedure. Therefore, the result has an error band that is near the same magnitude as the result.

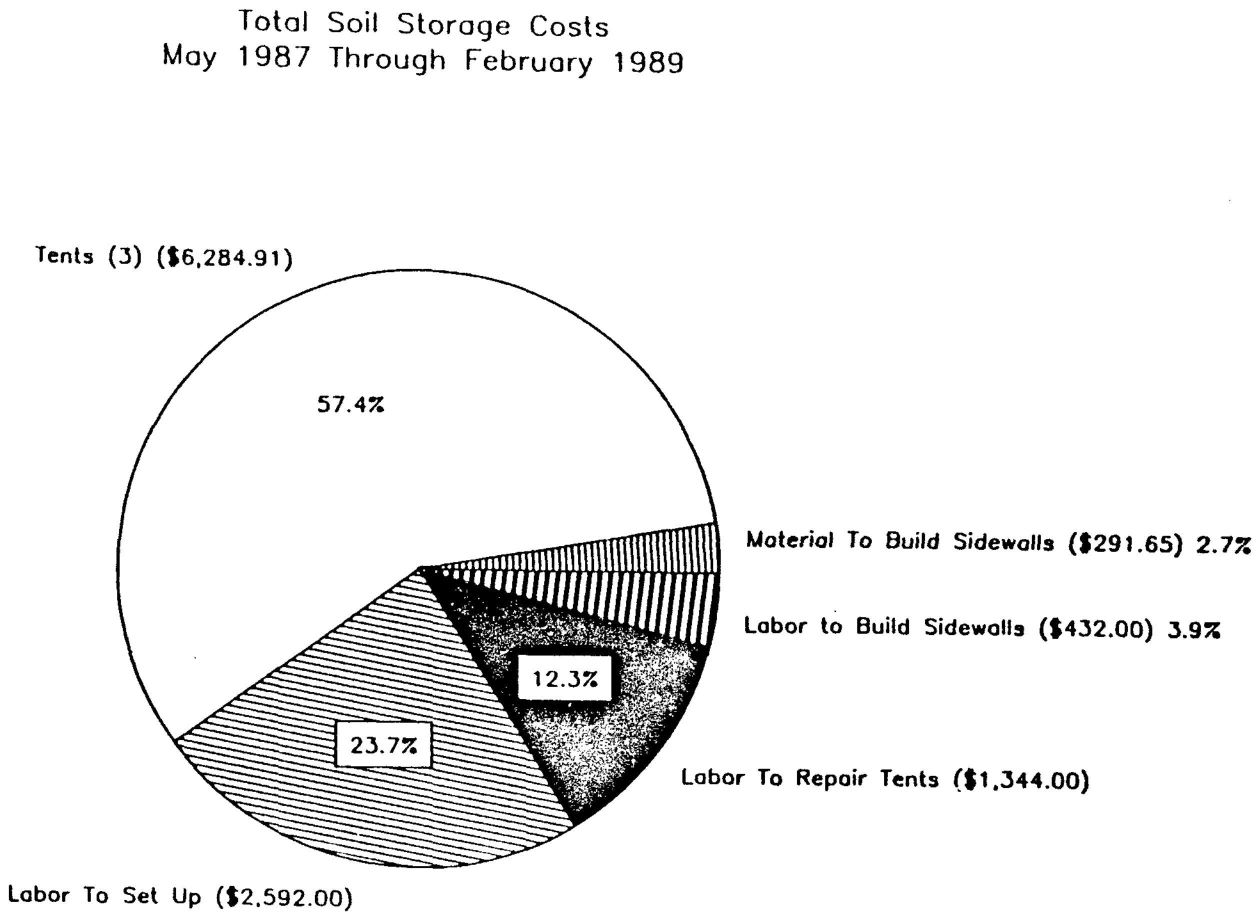

Figure 24. Total Soil Storage Costs - Pie Chart.

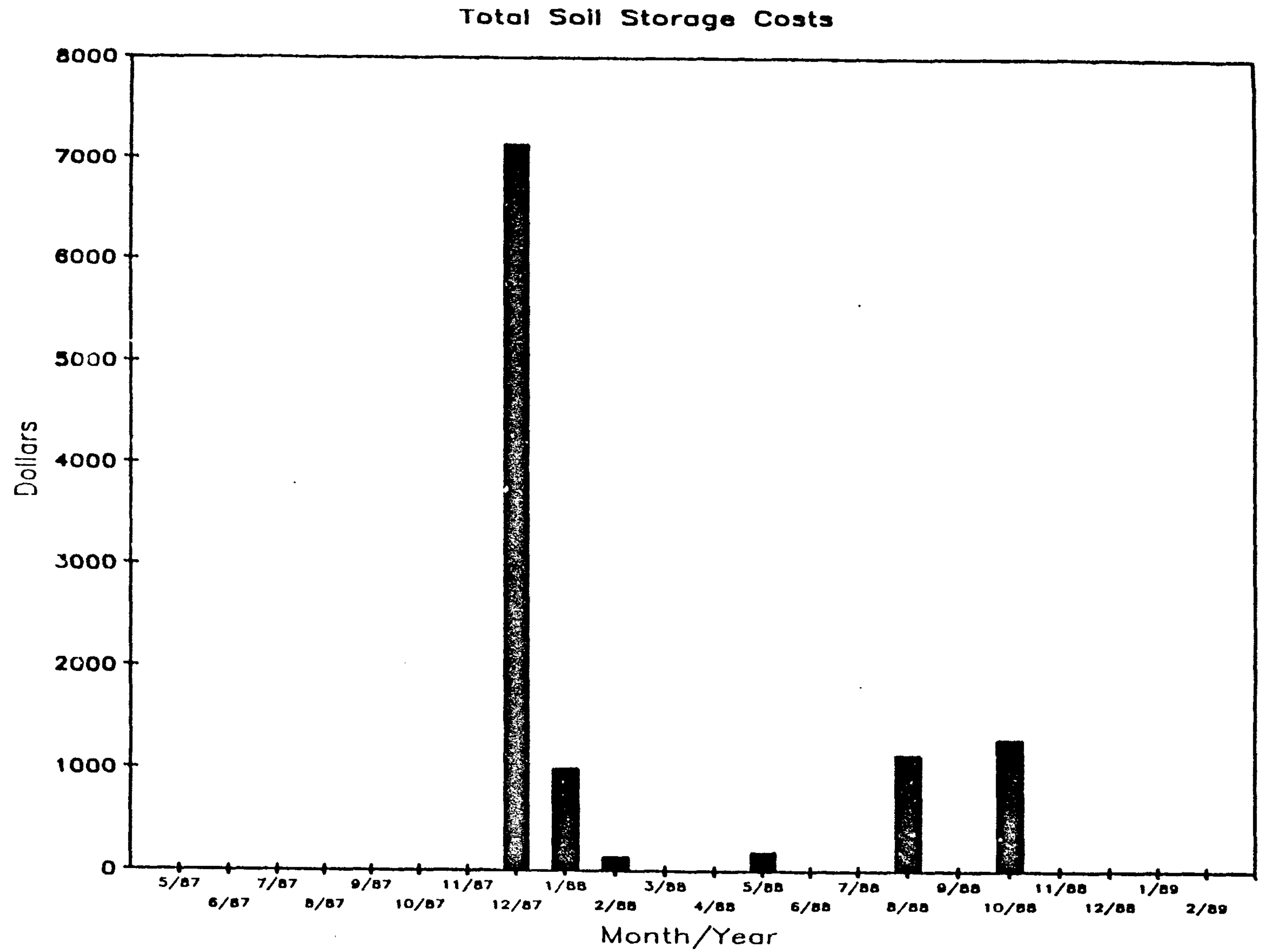

Figure 25. Total Soil Storage Costs - Monthly.

TABLE 8. LABORATORY RESULTS FOR SOIL SAMPLES WITH POSITIVE 2,3,7,8-TCDD AND TOTAL TCDD DETECTION.

		Concentrations (ppb)		
Item	Sampling Location	2,3,7,8-TCDD	Total TCDD	Difference (Total-2378)
1	AB 53	0.88	0.60	-.28
2	AB 63	0.93	0.72	-.21
3	AB 86	0.85	0.66	-.19
4	AC 55	0.77	0.95	+.18
5	AD 56	0.72	0.43	-.29
6	AD 86	0.71	0.48	-.23
7	AE 39	0.83	0.10	-.73
8	AE 52	0.70	0.48	-.22
9	AG 35	0.76	0.40	-.36
10	AH 49	0.78	0.57	-.21
11	AH 59	0.94	0.54	-.40
12	AJ 50	0.87	0.75	-.12
13	AJ 51	0.95	0.97	+.02
14	AJ 57	0.37	0.40	+.03
15	AP 58	0.86	0.50	-.36
16	AP 26	0.73	0.45	-.28
17	AP 39	0.91	0.41	-.50
18	AS 15	0.82	0.40	-.42
19	AS 32	0.87	0.60	-.27
20	AC 14	0.88	0.10	-.78
21	AU 20	0.93	0.80	-.13
22	AV 48	0.80	0.90	+.10
23	AV 75	0.84	0.91	+.07
24	AW 11	0.89	0.60	-.29
25	AW 32	0.84	0.50	-.34
26	AW 39	0.75	0.88	+.13
27	AW 45	0.75	0.80	+.05
28	AW 46	0.92	0.95	+.03
29	AY 22	0.80	0.50	-.30
30	AY 49	0.82	0.78	-.04
31	BB 27	0.73	0.35	-.38
32	BD 03	0.95	0.98	+.03
33	BR 31	0.87	0.85	-.02
34	BS 31	0.77	0.60	-.17
35	BU 31	0.95	0.50	-.45
36	BV 10	0.69	0.30	-.39
37	BV 16	0.62	0.18	-.44
38	BV 31	0.73	0.58	-.15
39	BW 28	0.73	0.70	-.03

The data in Table 9 show the laboratory results that had positive detections for both 2,3,7,8-TCDD and total TCDF in the NCBC soil sample data base. The differences between the two concentration values for one sample vary from +.29 to -.82 ppb. Since only four samples were positive for both analyses, no conclusions can be drawn.

TABLE 9. LABORATORY RESULTS FOR SOIL SAMPLES WITH POSITIVE 2,3,7,8-TCDD AND TOTAL TCDF DETECTION.

Item	Sampling Location	Concentrations (ppb) 2,3,7,8-TCDD	Total TCDF	Difference (Total-2378)
1	AD 56	0.72	0.13	-.59
2	AE 52	0.70	0.99	+.29
3	AJ 51	0.95	0.13	-.82
4	AV 48	0.80	0.99	+.19

H. EXCAVATION DEPTH

The data in Table 10 show the excavated plots grouped by surface concentration range. The maximum, minimum, and average depth of excavation for each group is also shown. The average depth of excavation generally increases with increasing surface concentration, but the maximum depth of excavation for each group does not.

TABLE 10. PLOT EXCAVATION DEPTH DATA.

Group Number	Plot Surface Concentration Range 2,3,7,8-TCDD (ppb)	Number of Plots in Group	Excavation Depth (in.) Max.	Min.	Avg.
1	1.000 - 1.500	141	24	3	6.6
2	1.501 - 2.500	146	36	3	7.0
3	2.501 - 4.000	132	18	2	6.3
4	4.001 - 6.000	108	24	2	6.8
5	6.001 - 10.000	110	51	2	8.2
6	10.001 - 20.000	115	24	3	8.9
7	20.001 - 50.000	108	36	2	9.5
8	50.001 - 100.000	45	30	3	13.5
9	100.001 - 200.000	37	48	3	10.9
10	200.001 - 650.000	12	30	6	18.5

SECTION VI

EVALUATION AND DISCUSSION

A. EVALUATION OF EXCAVATION TECHNIQUES

1. Planer

The excavation of the cement-stabilized soil using the planer was the most desirable method of excavation because this fine homogeneous soil did not require any preprocessing before it was fed to the incinerator. The planer was used primarily to excavate large continuous areas excavated to a depth of 6 inches. The planer did not have sufficient traction and power to negotiate the soft soil areas to be excavated without help from the bulldozer, therefore the planer was limited to excavating the cement-stabilized soil.

2. Track Hoe

The soil excavated by the track hoe had to be processed through the rock crusher and/or shredder before feeding it to the incinerator. The track hoe excavation rate was slower than the planer excavation. The track hoe was normally used to excavate individual isolated plots and for deep excavations.

B. STORAGE ALTERNATIVES

1. Soil Storage

The storage alternatives for soil at the NCBC site were very limited. Building 411 had been used to store soil during the test burn, but it was too small to adequately store the soil volume required for normal operation. It was necessary to protect the soil from the wind and rain because additional water in the soil only increased the amount of natural gas that was burned in the kiln to maintain the permit conditions on the kiln exit gases. The feed rate to the kiln was limited during the rainy weather because the soil would not dry after excavation and the natural gas burner in the kiln was at its maximum capacity because of the high water content of the soil.

It would be advisable to have a covered soil storage area with adequate floor space to spread the wet soil for drying and with drainage channels in the floor for draining the free water away from soil piles.

2. Ash Storage

The roll-off boxes for the ash were adequate, but they required a lot of maintenance to keep the gasket seals around the end gate from leaking water. The roll-off boxes also required tarps to cover the ash to prevent the wind from blowing the ash out of the boxes and to keep the rain from flooding the roll-off boxes. Smaller roll-off boxes with self-contained covers would facilitate the ash storage and off-loading process.

C. AMBIENT AIR MONITORING

Ambient air monitoring became efficient after the change to air monitoring only during excavation. The 24-hour air monitoring at the beginning of the project was dictated by EPA and required additional personnel and materials to comply with.

Versar personnel performed the air monitoring duties and were not required to be on the NCBC site except during excavation. There were frequently several days when there was no excavation. Since the Versar workers' home base was in the Washington, D.C., area, they could not be called out on an as-needed basis. The cost of air monitoring could be decreased significantly by employing a local firm to do the work.

D. DISCUSSION OF EXCAVATION CRITERIA

The soil at NCBC was excavated if the concentration level of 2,3,7,8-TCDD was 1.0 ppb or greater. This criterion was somewhat arbitrary.

Higher or lower dioxin levels may be justified for excavation criterion. The excavation criterion must be presented to EPA with justification for its approval. Since this project was an RD&D project and the incinerator was leased and on the NCBC site before the permit application, the excavation criterion was set at a level that would not prolong the permit approval process. A larger commercial project might be able to justify using a different excavation criterion.

SECTION VII
CONCLUSIONS AND RECOMMENDATIONS

A. LESSONS LEARNED

1. Air Monitoring

Use a local firm and personnel to perform air monitoring. A local firm would be less expensive because of travel costs and could respond to changing personnel needs faster than a firm that is farther away.

The generators supplying power to the air samplers require frequent maintenance. In order to keep the air samplers running, there were two spare generators ready to support the four active generators. For future remediation projects, a minimum of two spare generators is recommended to support an active fleet of 4 to 10 generators. Larger fleets of active generators should have 25% spare generators. Regular scheduled maintenance of the generators must be done per the manufacturer recommendation, thus the spares must be rotated into use on a regular scheduled basis. The spare and active generators must be maintained in excellent running condition. This requires a good local repair shop, or spare parts and an employee who is trained to maintain the units.

The 24 hour per day air monitoring strategy initially used was not the best strategy because of the expense of running the generators (higher maintenance because generators wear out faster) and the additional manpower required to operate them 24 hours a day. The best and most logical air monitoring strategy is to monitor the air only during excavation, which was done at the NCBC Demonstration Project starting in March 1988.

2. Soil Storage

A large covered soil storage area is a necessity for drying and maintaining the necessary backlog of soil for weekend operation and operation through the times that excavation is not possible. Equipment breakdown and weather are the major factors contributing to excavation downtime. Wet, rainy weather did stop excavation for 2 to 4 days in succession. Maintaining several alternative excavation areas can minimize this downtime, but this is not always possible. It is probable that concurrent bad weather and weekend operation would require 7 days of soil in storage to maintain continuous full operation of the incinerator. Based on these circumstances, it is prudent to have a soil storage area to house at least a 7-day supply of soil for the incinerator. If the incinerator is located in an area that does not have significant rainy periods, then less soil storage would be required.

3. Excavation Equipment

Most of the equipment required for excavation and handling of the soil was rented. The use of rental equipment is justified for short-term use. If excavation or operation of equipment is long term, then a lease with option to buy is the more economical approach. The length of this excavation project was not predicted to last longer than 6 months, therefore, most of the equipment was rented. The duration of the project must be realistically projected and the necessary equipment rented or purchased based on the projection.

If the project duration cannot be predicted with a high degree of confidence, rent or lease contracts with options to purchase are recommended.

4. Excavation Techniques and Soil Processing

The planer was limited to excavating the cement-stabilized soil to a maximum depth of 6 inches. The planer produced a very homogeneous soil that was fed through the weigh hopper and shredder without difficulty. Soil excavation by other equipment contained cement-stabilized chunks, rocks, metal rods, and large wood chunks that would periodically get caught in the weigh hopper, shredder, or conveyor belt. This caused incinerator processing delays while a worker would have to climb into the weigh hopper to remove the debris. These delays could be minimized by separating the shredder from the weigh hopper. The shredder should be a separate preprocessing step that all soil (except planer excavated soil) should go through prior to weighing and feeding to the incinerator.

The planer used at NCBC was not equipped with the proper attachment for excavating soil; it was designed to operate on hard surfaced roads. It is recommended that the planer be equipped with large lugged wheels or tracks to make it maneuverable on soft ground and to provide the traction to pull itself out of areas excavated to a depth of 1 to 2 feet. The planer should also be equipped with a conveyor belt that would convey the excavated soil into a trailing dump truck.

5. Sampling

Designate one person to be in charge of all sampling and recordkeeping. Have several laboratories on contract to analyze samples because one laboratory might be overloaded or have equipment and/or labor problems. Have a second person involved in the sampling paperwork who is ready to take over if the person in charge is unavailable.

6. Rock Crusher

Do not set up equipment on areas that must be excavated. This complicates the work by requiring removal of contaminated equipment to a clean area prior to excavation.

7. Ash Storage

The ash from the incinerator rotary kiln was stored in metal roll-off boxes until the ash laboratory analysis results were received onsite. The ash was then off-loaded on a specified area of the excavation site. Storage and containment of the ash is critical until the ash sample results are known. Nonleaking covered ash storage containers are required. Specify and test ash storage containers for leak tightness prior to acceptance and use.

8. Ash Backfilling

The placement of incinerator ash on the excavation site may not be feasible or desirable. If the ash must be delisted, storage on another site or landfilling may be more desirable. Negotiate the placement of ash with regulators prior to start of incineration.

9. Decontamination Pad

The final decontamination pad at NCBC was made with a carbon steel base and plastic tent top. This construction allowed the contaminated plastic to be burned in the kiln and the steel base to be steam or high-pressure water cleaned. The contaminated water was processed through the kiln. A previous decontamination pad was built with a concrete base that would have been very difficult to decontaminate if the contamination had penetrated the concrete surface. Decontamination pads should be built of combustible materials and/or materials with nonporous surfaces that can be decontaminated easily.

B. ALTERNATIVES

Before excavation and incineration of a site is undertaken, all of the possible site treatments must be investigated to determine the most feasible method. Engineering estimates for the alternatives (monitor, cap and seal, immobilize, etc.) should be obtained to compare the costs and end usability of the remediated site. If excavation is selected as the method of remediation, the plan for excavation should provide flexibility and daily alternative excavation sites. These alternative sites will probably allow the excavation to continue immediately following bad weather, accident, hurricanes, unforeseen occurrences, etc.

C. AMBIENT AIR MONITORING

An ambient air monitoring plan should be written and approved by the people who will be doing the work on the excavation site. The plan and permit must be approved by EPA before the start of work on the site. The ambient air monitoring should be started before the start of excavation on the site to work out all the details of the procedure.

D. BACKFILLING

The status of backfilling and ash delisting at NCBC was not known during the incinerator operation. The delisting of the incinerator ash is treated separately by EPA from the permit to excavate and incinerate. Every effort should be made to convince EPA to grant a permit to delist the ash and a permit to excavate and incinerate before initiation of work on the site. If this is not done, the costs and scope of work for the project cannot be accurately projected.

SECTION VIII
REFERENCES

1. EG&G Idaho, Inc., Herbicide Orange Site Characterization Study at the Naval Construction Battalion Center, ESL-TR-86-21, January 1987.

2. EG&G Idaho, Inc., Ambient Air Monitoring Plan for the NCBC Full-Scale Demonstration Project, Gulfport, Mississippi, EGG-HWP-7996, Naval Construction Battalion Center, Gulfport, MS, 1987.

3. EPA ID Number MS2 170 022 626, EPA Research, Development, and Demonstration Permit for Hazardous Waste Treatment at NCBC, Naval Construction Battalion Center, Gulfport, Mississippi, 4 August 1987.

APPENDIX A

OPERATIONAL SAMPLING PLAN
FOR FULL-SCALE INCINERATION SYSTEM DEMONSTRATION
AT NAVAL CONSTRUCTION BATTALION CENTER, GULFPORT, MISSISSIPPI
REVISION 2, 31 MAY 1988

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APPENDIX A

OPERATIONAL SAMPLING PLAN
FOR FULL-SCALE INCINERATION SYSTEM DEMONSTRATION
AT NAVAL CONSTRUCTION BATTALION CENTER, GULFPORT, MISSISSIPPI
REVISION 2, 31 MAY 1988

A. INTRODUCTION

This document is in support of the Research, Development, and Demonstration Project at the Naval Construction Battalion Center (NCBC), Gulfport, Mississippi. The area of concern is a former Herbicide Orange (HO) storage site.

In this document, plans are established for collecting samples of surface soil, bottom-of-the-hole soil, processed soil (ash), and scrubber discharge water. Air sampling is addressed in a separate plan, "Ambient Air Monitoring Plan for the NCBC Full Scale Demonstration Project." Subjects addressed include a description of the site, the entire sampling process to be used, and the Quality Assurance (QA) methodology.

B. SITE DESCRIPTION

HO was originally stored in barrels at the north end of the NCBC. Leakage from the barrels caused contamination of the soil in many areas.

The levels of concentration of 2,3,7,8-tetrachlorinated dibenzo diozin (2,3,7,8-TCDD) are shown in Figure A-1, along with the grids that have been identified. Each grid is 20 ft^2.

For tracking purposes, the areas have been identified as A, B and C as shown in Figure A-2. Area A was the initial sample site with the majority of tests being performed there. Area B follows in quantity of tests performed, and Area C has the least. Area A was used for long-term storage, whereas Areas B and C were used for short-term storage.

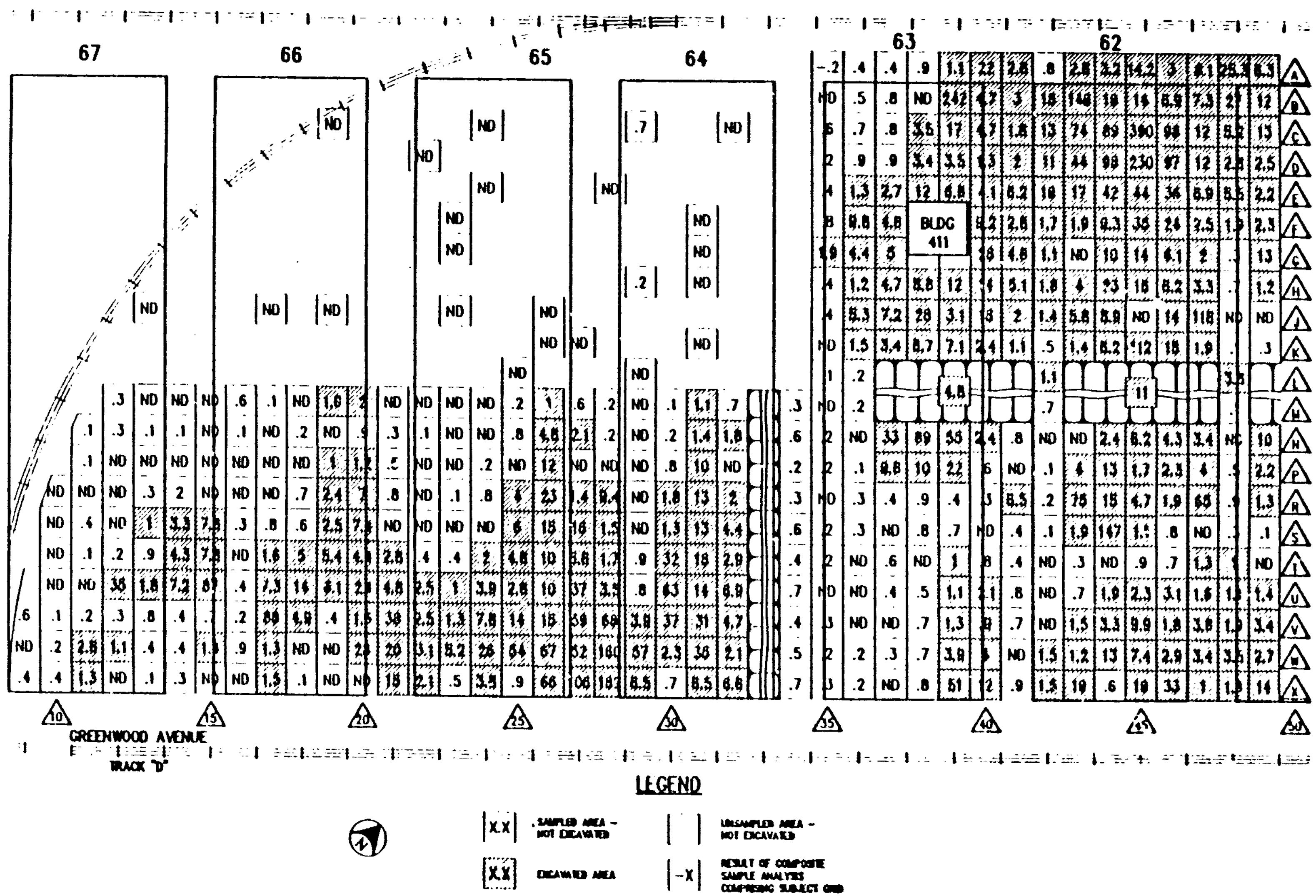

Figure A-1. Sampling Results at Naval Construction Battalion Center.

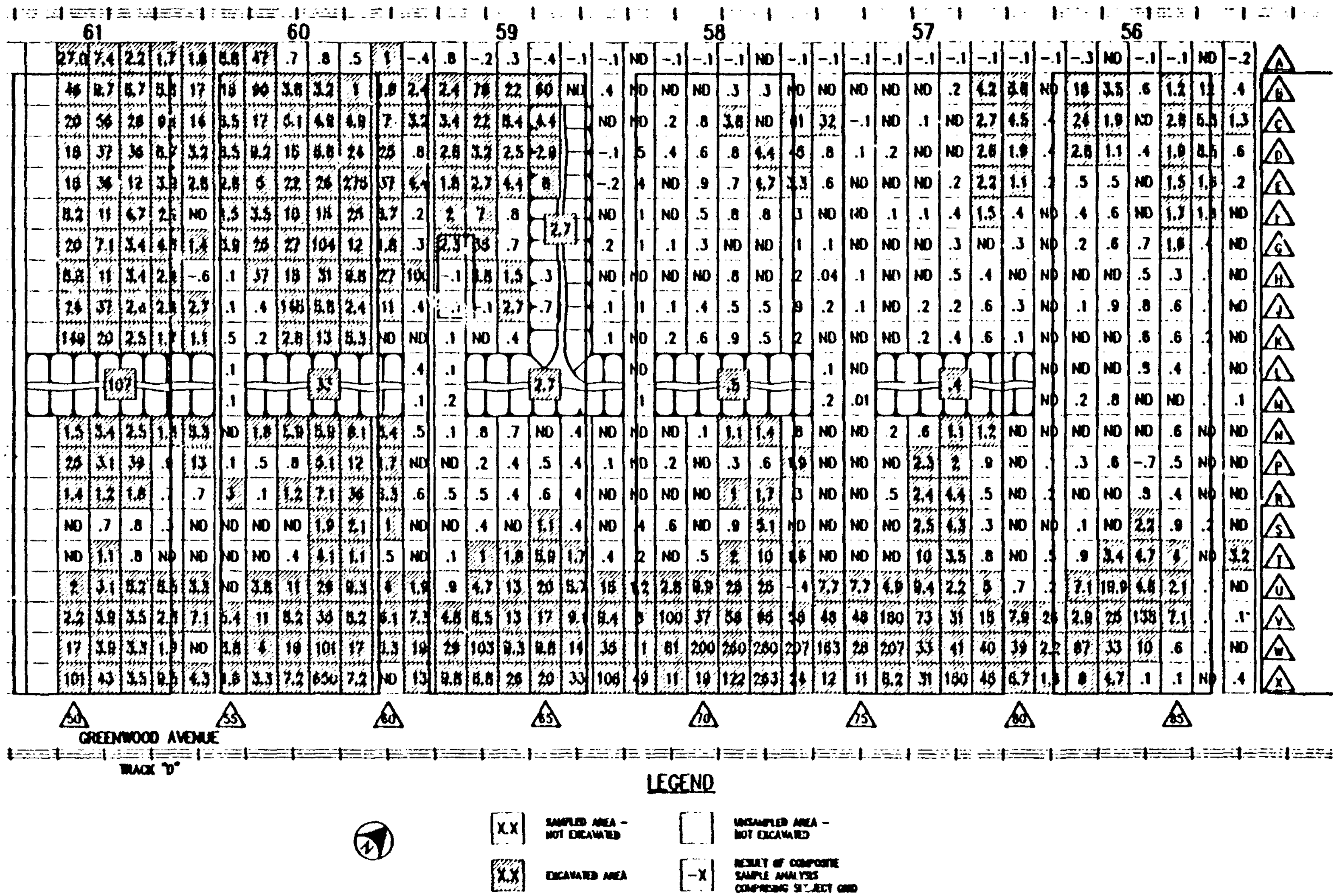

Figure A-1. Sampling Results at Naval Construction Battalion Center (Continued).

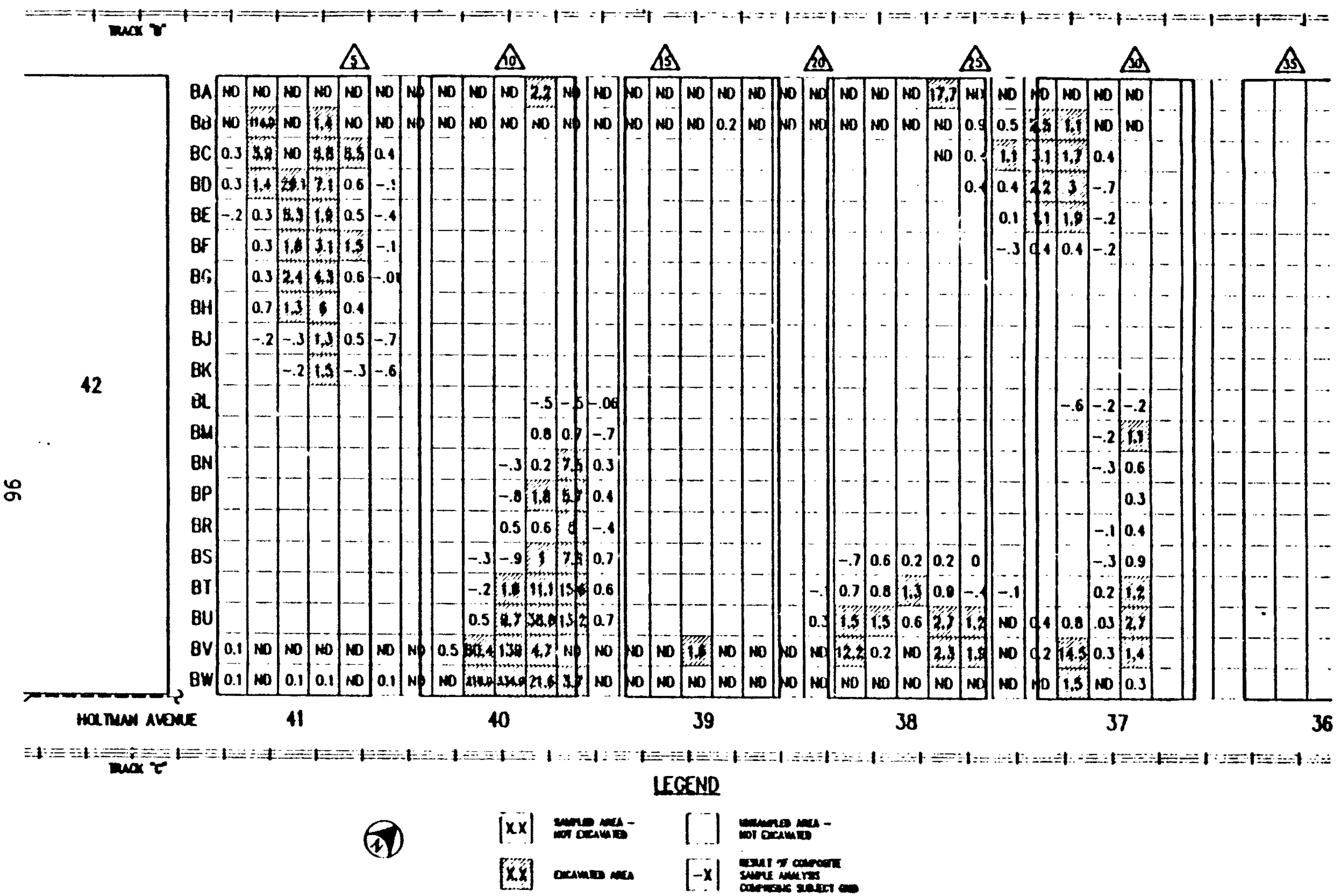

Figure A-1. Sampling Results at Naval Construction Battalion Center (Continued).

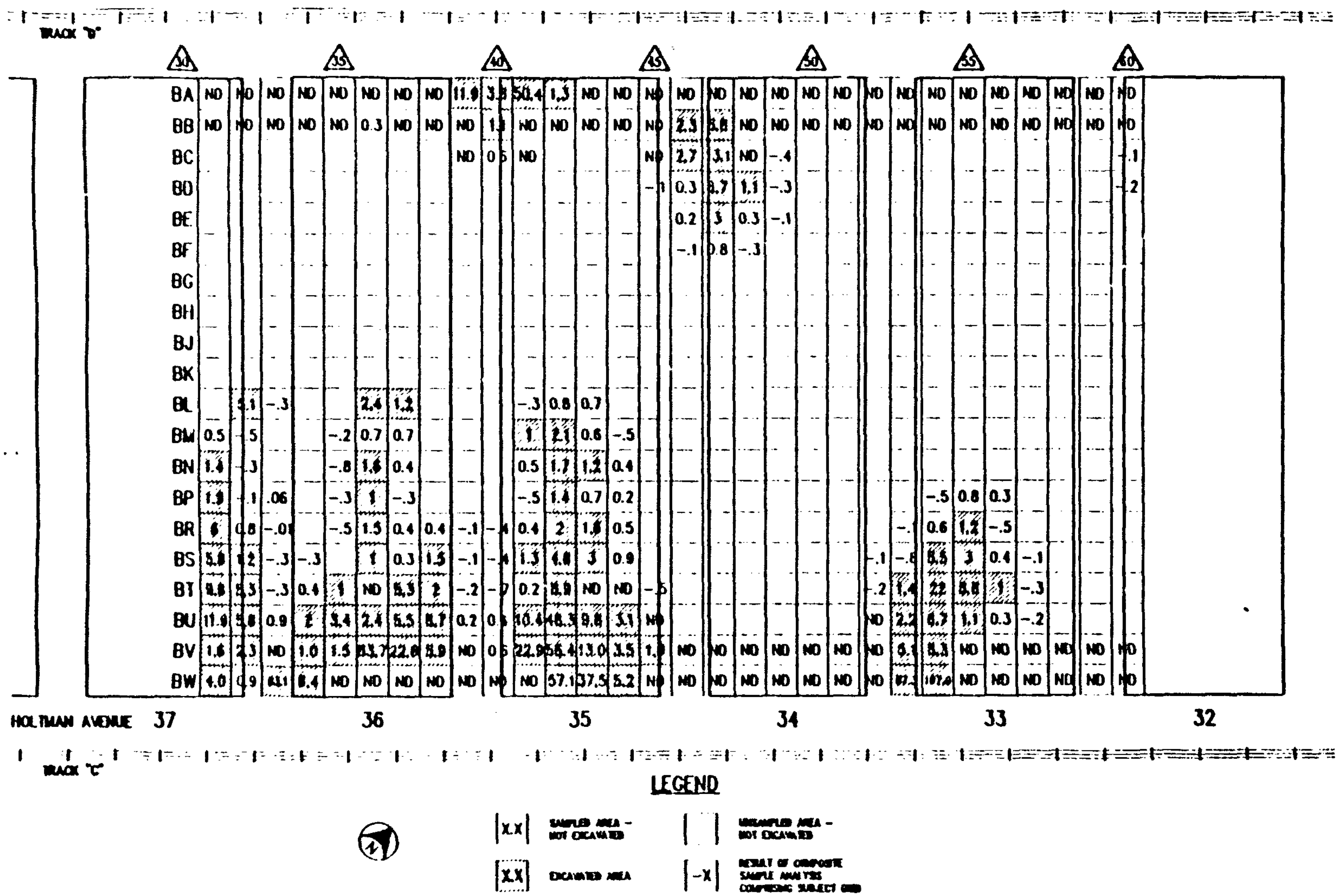

Figure A-1. Sampling Results at Naval Construction Battalion Center (Continued).

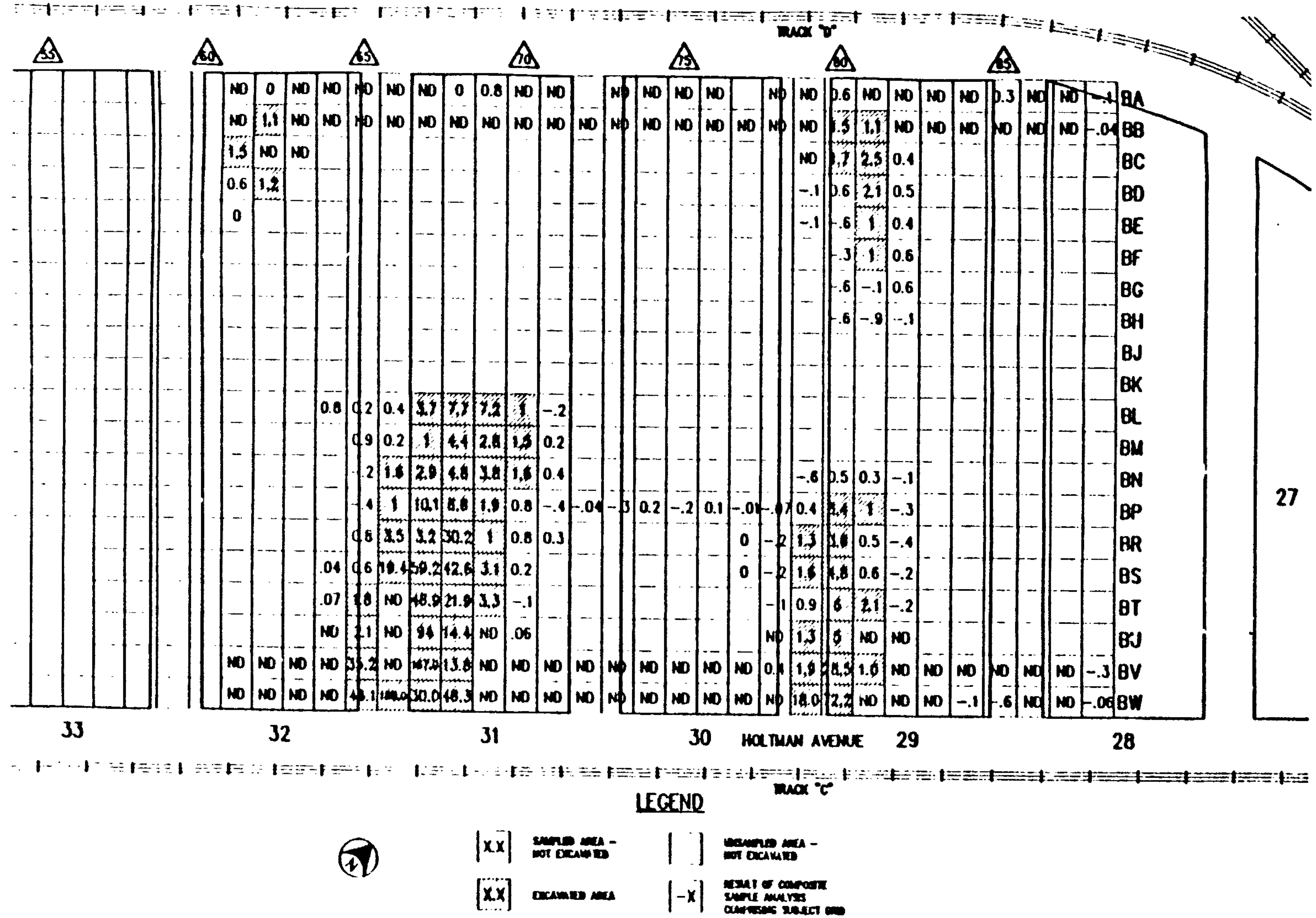

Figure A-1. Sampling Results at Naval Construction Battalion Center (Continued).

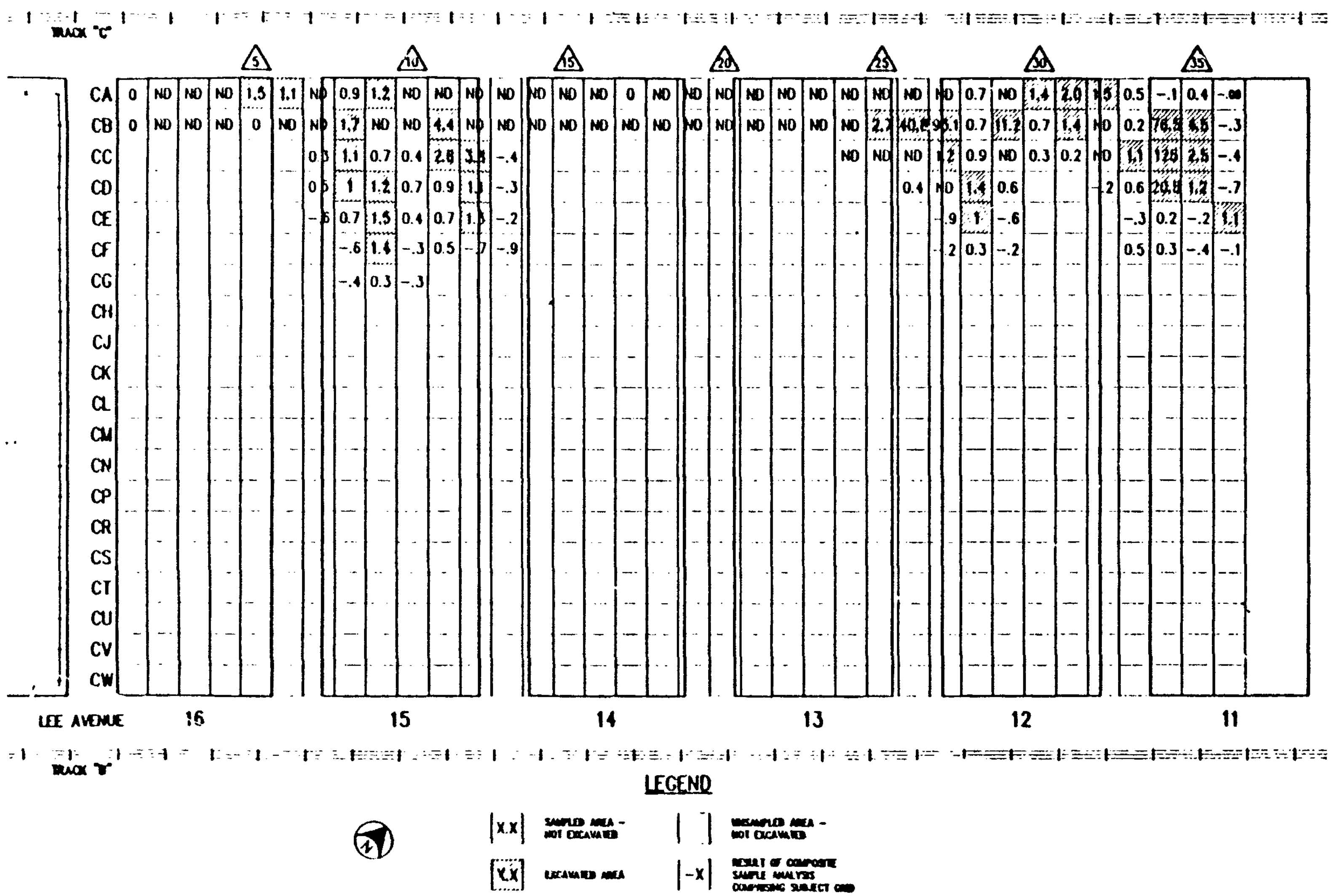

Figure A-1. Sampling Results at Naval Construction Battalion Center (Concluded).

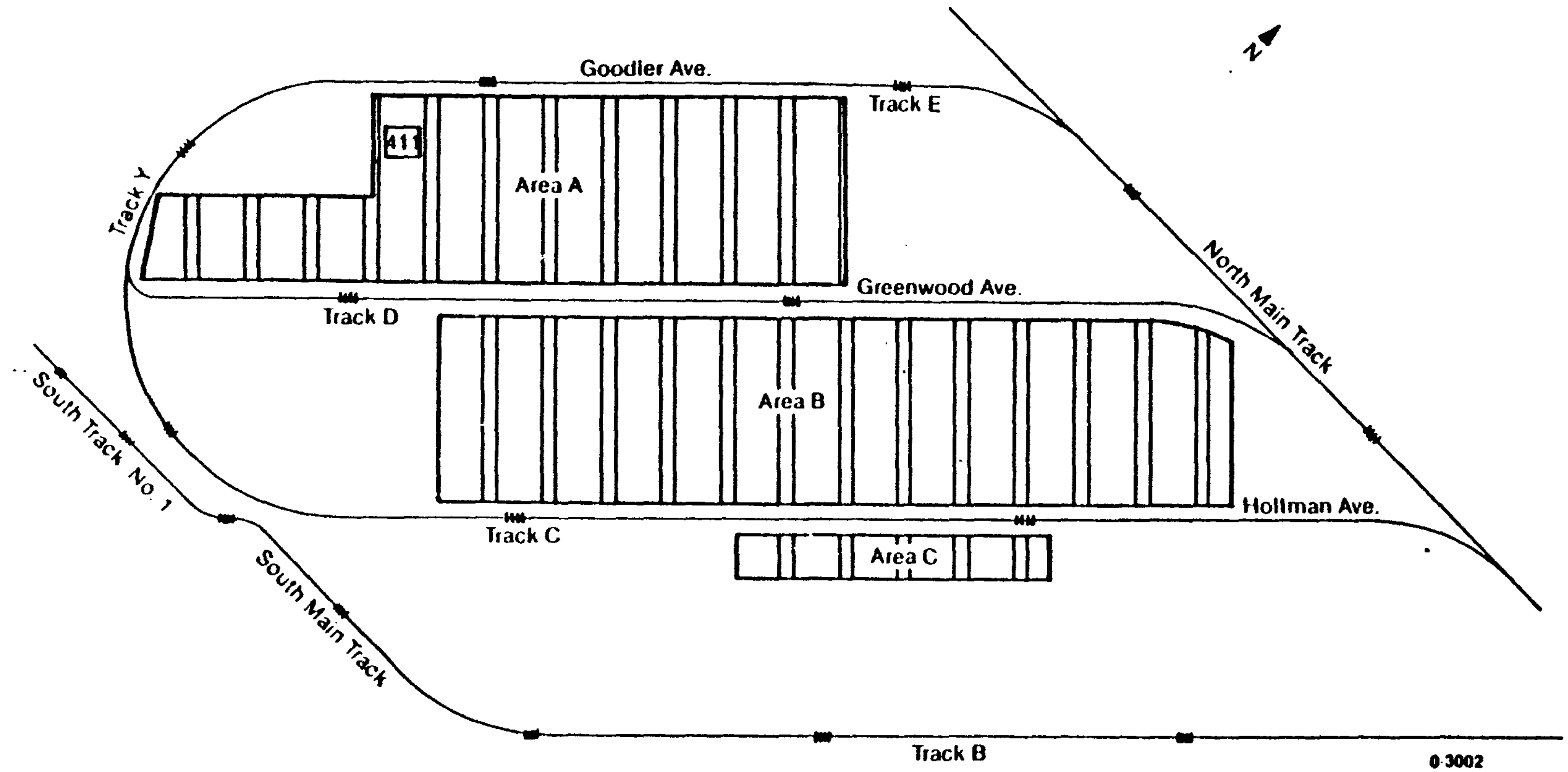

Figure A-2. Three Main Areas of Sampling Sites at NCBC.

C. SOIL SAMPLING EQUIPMENT AND CLEANING

The sampling equipment required and the cleaning procedures to be used during soil sampling have been identified in Attachment A-1, "Soil Sampling Procedures Code Orange Project, Gulfport, Mississippi."

D. SOIL SAMPLING PROCEDURES

Sampling of surface grids will involve a single sample from each grid and an analysis for 2,3,7,8-TCDD. If the surface sample analysis results show a 2,3,7,8-TCDD concentration of less than 1.0 ppb, the grid is considered clean and will not be excavated or resampled.

If the surface sample shows 1.0 ppb or greater 2,3,7,8-TCDD, the grid will be excavated, and the bottom of the hole will be sampled. The sample from the bottom of the hole will be split in the field, and one sample will be sent for analysis of 2,3,7,8-TCDD. The other sample (i.e., the sister sample) will be archived at the NCBC for possible later use.

Analytical results showing less than 1.0 ppb of 2,3,7,8-TCDD on a bottom-of-the-hole sample will cause the archived sample of the same plot to be composited with others, or analyzed alone, for total tetrachlorodibenzo dioxins (total TCDD) and total tetrachlorodibenzo furans (total TCDF). The following guidelines apply:

- If the 2,3,7,8-TCDD analysis shows the concentration of the bottom of the hole to be greater than or equal to 0.70 ppb and less than 1.0 ppb, then the archived sister sample will not be composited with any other samples. Instead, the archived sister sample will be sent as an individual sample and analyzed for total TCDD, total TCDF, and 2,3,7,8-TCDD. (The measurement of 2,3,7,8-TCDD will help to gauge interlaboratory variability of analysis.)

If the total TCDD, total TCDF, and the 2,3,7,8-TCDD analyses each show the concentrations to be less than 1.0 ppb, then that plot will be declared clean and may be backfilled.*

- If the 2,3,7,8-TCDD analysis on a single plot shows the concentration to be less than 0.70 ppb, then a composite shall be made, which consists of equal portions of up to 10 other plot samples that were in archived storage at the NCBC. The plots shall all come from the same geographical area on the site. For example, do not combine samples from plot AY-80 with a sample from plot AA-40.

  A sister sample of the composite shall be archived onsite.

If the analysis is 1.0 ppb or greater, a decision on further excavation, or individual grid analysis, for dioxins and furans will be made.

If a bottom-of-the-hole sample analyzed for 2,3,7,8-TCDD is 1.0 ppb or greater, the archived sample from that grid may be discarded (i.e., placed in the contaminated trash for incineration).

E. ROUTINE ASH SAMPLING

Samples will be taken from up to five separate holding bins. These samples will be halved and homogeneously mixed for a sixth sample for analysis. A negative result on the sixth sample will remove the need to analyze the first five. A positive on the sixth sample will cause the original five to be analyzed separately to determine which bin(s) is contaminated. The procedure for ash sampling and equipment cleaning is presented in Attachment A-2.

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* As of 24 March 1988, the process ash shall not be backfilled until further notice. When this ban is lifted, an intersite memorandum will be issued to all cognizant personnel and this footnote stricken from the sample plan.

F. WATER SAMPLING

Water samples are sent for analysis from the 10,000 gallon tanks when they are nearly full. The tanks hold the scrubber discharge water after it has passed through the charcoal filters and before .ischarge to the Publicly Owned Treatment Works (POTW) system. A tank sample will be collected from the tank each time water is discharged to the tank. The composite collection is the basis for the sample to be analyzed.

The sample must be between 5.5 and 9.5 pH and show nondeductible for 2,3,7,8-TCDD, 2,4-D, and 2,4,5-T to allow discharge of the tank contents to the POTW system. The water tank sampling procedure is included as Attachment A-3.

G. TRAINING

ENSCO is responsible for the complete training of all the personnel who will be involved in sampling. Training records of all employees who have been trained for this project shall be maintained.

As sampling techniques are refined, ENSCO will ensure that all procedures are immediately updated and that all appropriate employees are kept abreast of these changes.

H. SAMPLING FREQUENCY

During routine sampling, approximately 20 soil samples, including QA samples, will be taken during an average 8-hour day. These 20 samples will consist primarily of eight bottom-of-the-hole samples, one field blank, one field split a day, six ash samples, and one water sample a week. If it is determined that sample frequency should be increased, systems and materials will be made available to accommodate the additional processing.

I. SAMPLING DOCUMENTATION

The sampling documentation maintained by EG&G Idaho, Inc., will encompass the full spectrum of data generated from the soil sampling activities. Additionally, a backup D-Base file will be kept at the EG&G Idaho offices at the Idaho National Engineering Laboratory (INEL).

1. Chain-of-Custody Forms

Chain-of-custody forms, as shown in Figure A-1-2 of Attachment A-1, will be generated by ENSCO's personnel during its sampling process. The two top copies are sent with the samples to the lab and the third copy is retained by EG&G Idaho and filed.

2. Federal Express Forms

Prior to soil samples being sent to the laboratory for analysis, ENSCO will generate a Federal Express shipping form. Those forms, in addition to the previously mentioned chain-of-custody forms and any other pertinent records or information needed for the shipping of samples, will be maintained by ENSCO and audited by EG&G Idaho.

3. Soil Sampling Data Sheets

While in the field obtaining soil samples, ENSCO will complete soil sampling data sheets containing vital information on samples number, etc. At the end of each workday, ENSCO will give EG&G Idaho a copy of each data sheet completed that day.

J. QUALITY ASSURANCE

To ensure that all procedures are being followed and standards maintained at both the actual sampling site and within the laboratory, EG&G Idaho will establish QA programs for all necessary areas, monitor the results, and contact appropriate personnel if problems arise.

A factor of 10% quality control soil sampling will be implemented, based upon Environmental Protection Agency (EPA) recommendations.

1. Splits and Methods Blanks

The laboratory QA program will consist of submitting approximately 10% of all soil samples for QA verification. Seventy-five percent of the QA samples will be sample splits; 25% will be field blanks. The split samples will be sent to a secondary laboratory for consensus analysis.

2. Equipment Blanks

(Original section deleted because use of a jackhammer was replaced with the use of a handheld drill and disposable drill bits.)

3. Field Procedures

Random visits will be made to the sampling area by EG&G Idaho personnel to ensure that all procedures are being followed in obtaining the soil samples. Any discretions noted will be brought to the attention of the ENSCO site manager. EG&G Idaho shall note all discretions in the project records.

K. SAMPLE PACKAGING AND SHIPPING

Procedures for the packaging and shipping of soil samples have been addressed in Attachment A-1.

L. SAMPLING DATA BASE

All pertinent data to sampling will be kept by EG&G Idaho in a computer data base. This information will include the date the sample was taken from a grid location, the sample number assigned, the date the analysis information was received from the laboratory, and the date the analysis results were validated.

1. Laboratory Results Input

A temporary procedure has been developed at this time to use a telefax machine between the laboratory and the EG&G Idaho NCBC field office. The laboratory will transmit the sample test results as soon as they are available via the telefax system.

2. Data Base Backup

The computer used to compile the information will have a hard drive for storage. Once a week all the current data will be copied to another floppy disk and sent to EG&G Idaho's Hazardous Waste Projects Office at the INEL.

3. Sample Analysis Validation

Laboratory analysis data will be verified and validated by the EG&G Idaho Chemical Sciences group. Analysis results that have been validated will be entered in the computer data base.

ATTACHMENT A-1

SOIL SAMPLING PROCEDURES
CODE ORANGE PROJECT
GULFPORT, MISSISSIPPI
27 April 1988

Note: This procedure may be used for both surface soil sampling and bottom-of-the-hole soil sampling. The only difference between the two is that the bottom-of-the-hole samples do not require the use of masonry drill bits or the portable drill.

A. Required Supplies and Equipment

1. Required for Sampling

a. 8-oz I-Chem glass sample jars with Teflon-coated lids and with labels
b. Plastic sandwich bags
c. Rubber bands
d. Chain-of-custody forms
e. 8-mesh screens
f. Aluminum pans
g. Metal scoops
h. Trash bags
i. Paper towels
j. Zip-lock plastic bags
k. Electric drill with masonry bits.

2. Required for Sample Shipment

a. Gallon paint cans with lids
b. Vermiculite
c. Large plastic coolers
d. Duct tape
e. Shipping labels
f. Custody seals
g. Federal Express forms.

B. Preparation of Sampling Equipment

1. Sample Jars

a. Stick a sample label on each sample jar. With a permanent marking pen, write a four-digit Field Sample Number on the label.

Note: Begin numbering with 0001. Do not repeat numbers.

b. Secure the label on the jar with clear plastic tape.

c. Record the Field Sample Numbers on the chain-of-custody record sheet. Put all the chain-of-custody records on a clipboard to take to the field.

d. Place each jar in a plastic sandwich bag. Secure the bag to the jar with a rubber band. Remove the lid from each jar and place all the lids in a plastic bag. Place each jar in its plastic bag, back in its box, upside down.

2. Sample Scoops

a. A new aluminum scoop will be used for each grid plot that is sampled (applies to both surface and subsurface sampling).

3. Digging Tools (Surface Sampling Only)

a. A new masonry bit will be used for each surface sample that is collected.

b. Place each clean bit in a plastic sandwich bag and secure with a rubber band.

c. Be sure that the power cord from the generator is completely encased in a plastic sleeve where it crosses contaminated grids or grids that are to be sampled.

4. Cart

a. Place the prepared sample bottles, screen, pans, scoops, trash bags, zip-lock bags, bag with jar lids, paper towels, and chain-of-custody forms on their clipboard on the cart.

b. Take the loaded cart, the generator, cord, and drill (if applicable) to the area where sampling is to occur.

C. Sample Collection

1. Grids to be Sampled

a. For excavated grids or grids about to be excavated, a list of grids for the day will be prepared before the start of the sampling shift. It will be given to the shift operations supervisor who will keep a copy and give two copies to the sampling crew.

2. Grid Identification and Measurement

a. A composite of five aliquots will be taken from each grid. For each grid, one clean sample jar, one new scoop, one new screen, and one new pan are required.

b. The measurement of sampling points is done from the center of each grid. If the grid has been excavated, it will have to be reidentified and a new center stake driven.

c. The sample points are located as shown in Figure A-1-1 (not as instructed by Versar). After locating the corners and center of the grid to be sampled, the sample points are:

(1) Six inches to the left of the center stake (looking toward the bauxite pile)

(2) At the four ends of an X, 9 feet 6 inches from the center toward each corner of the grid. Use knotted string or rope to measure from the center of grid.

3. Taking Samples

a. At each of the five sample points, use the drill and clean bit to loosen the soil down to about 3 inches below the surface. Use a clean bit for each plot; only one bit per plot is needed. Drilling is only needed for surface sampling.

b. Take the screen and fold up the sides to contain the sample dirt. Beware of the sharp end of the screen wire.

c. Place the screen in a clean aluminum pan and set the assembly on the ground near the sample location.

d. Take a new scoop and remove two scoops of soil from the loosened area at the sample location. Put each scoopful in the screen and work it back and forth on the screen with the scoop to break up the large particles.

e. After as much of the sample as possible has dropped through the screen into the pan, return the large particles left on the screen to the hole and tamp them into the hole with your foot.

f. Take all five samples from the plot in the same way as Steps c-e. After all five have been collected together in the pan, mix all the fine dirt well, using the scoop.

g. Take the sample jar and scoop it full of dirt from the pan. Because duplicate samples are required, fill both jars from the pan. Note the Field Sample Number on each jar. Record the grid number next to the Field Sample Number on the chain-of-custody form.

h. Dispose of the extra dirt in the pan back on the grid. Place the scoop, the drill bit, and the screen in the trash bag.

i. Repeat Steps 2a to 3h above for each successive grid that is to be sampled.

4. Removing Collected Samples to Clean Area

a. Take each sample to the border between the contaminated (or suspect) area and the clean area.

b. The person on the clean side takes a jar lid and screws it onto the sample jar, while the person on the contaminated side holds the jar in its sandwich bag.

c. The person on the clean side holds the jar by the lid while the person on the contaminated side removes the plastic sandwich bag and rubber band from the jar.

d. The person on the clean side places the jar in a zip-lock bag.

e. The chain-of-custody form is placed in a separate plastic bag and taken with the sample.

D. Preparing Sample for Shipment

1. Chain of Custody

a. The sample is legal evidence. To ensure that the sample is not tampered with and that it retains its correct identity, it is necessary to complete the chain-of-custody form. To complete the chain-of-custody form, the sample must be either:

(1) In possession of the sample crew

(2) In view of the sample crew

(3) In a secure location to where there is only limited access. Before releasing the samples from its possession, the sample crew must complete the chain-of-custody form that is with the samples at all times (see Figure A-1-2).

b. Before shipping the samples, make two copies of the chain-of-custody form. (Be sure to keep the original in its plastic bag when making the copies; the original is potentially contaminated).

c. Retain the second copy of the chain-of-custody form in the serially-numbered file. Discard the original in its plastic bag for burning in the incinerator.

d. Cross out any blank areas on the chain-of-custody record. When you cross it out, initial it.

2. Packing the Samples

a. Check Field Sample Numbers against the numbers on the chain-of-custody record. Make sure all samples are accounted for.

b. Take an empty 1-gallon paint can, and put a little vermiculite in the bottom of it to cushion the sample jars.

c. Place three or four sample jars in the can (as many as will go in and leave room for some vermiculite all around).

d. Mark the Field Sample Numbers on the outside of the paint can.

e. Fill the void spaces in the paint can with vermiculite and put the lid on it tightly.

f. Verify the Field Sample Numbers against the numbers on the chain-of-custody record.

g. Repeat Steps a-f for all samples listed on the chain-of-custody record. Make sure that only those samples listed on the chain-of-custody record--none other and no less than all of them--are included in the shipment.

h. Sign the "Relinquished By" space on the chain-of-custody record, and record date and time in the adjacent spaces.

i. Pass the (colored) copy to the EG&G Idaho data tracker person.

j. Put the original chain-of-custody record in a plastic bag and tape it to the inside of a cooler box.

k. Put the paint cans in the cooler box and fill the spaces around the cans with plastic or vermiculite to prevent the cans from rolling around. If more than one cooler box is to be shipped, label the box that contains the chain-of-custody record with the words "Chain of Custody Enclosed."

l. Tape the cooler box shut using duct tape.

m. Sign the custody seals and place on the lid of the cooler (not on the duct tape).

n. On the front, back, and sides of each cooler box place a label which says, "Hazardous Substance Liquid, ORM - E RQ No. 9188." Cross out the "Liquid" and write in "Solid."

o. Ship samples via Federal Express to the designated laboratory. Use the shipper's Certification for Restricted Articles form as a manifest. Laboratory addresses are as follows:

ENVIRODYN
12161 Lackland Road
St. Louis, MO 63146
ATT: Margaret Winter
Phone: (314) 434-6960

U.S. TESTING
1415 Park Ave.
Hoboken, NJ 07030
ATT: RICHARD POFNER
Phone: (201) 792-2400

IT CORPORATION
5815 Middlebrook Pike
Knoxville, TN 37921
ATT: SNELL MILLS
Phone: (615) 588-6401

p. Record the airbill number on the chain-of-custody record.

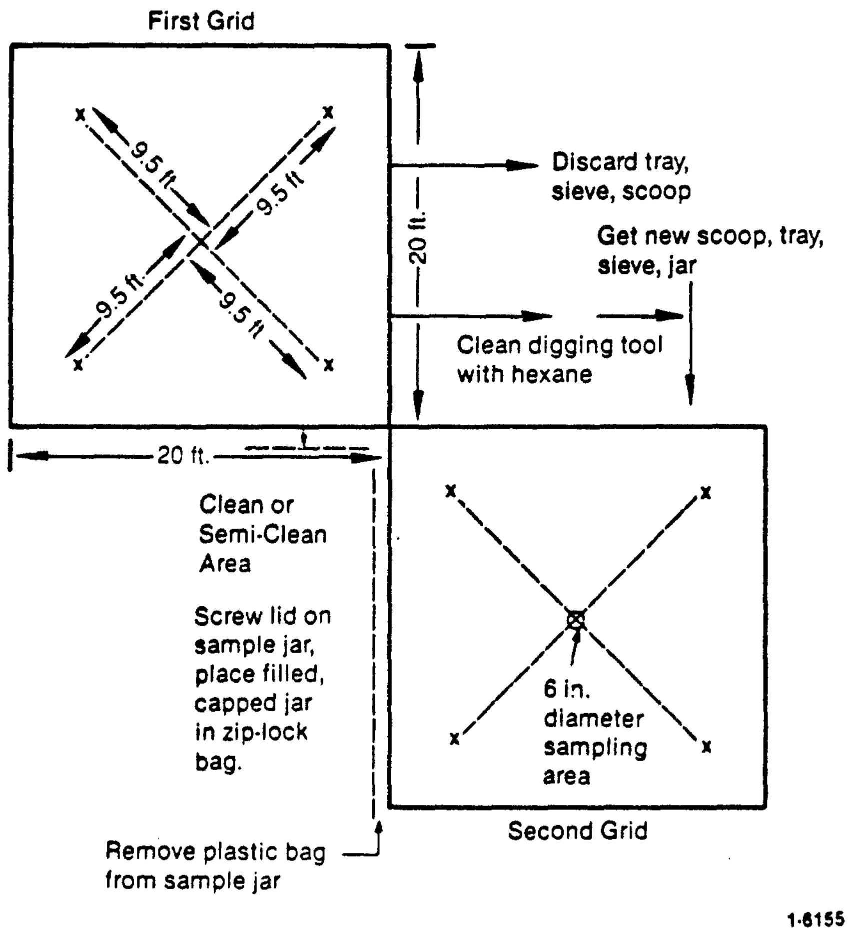
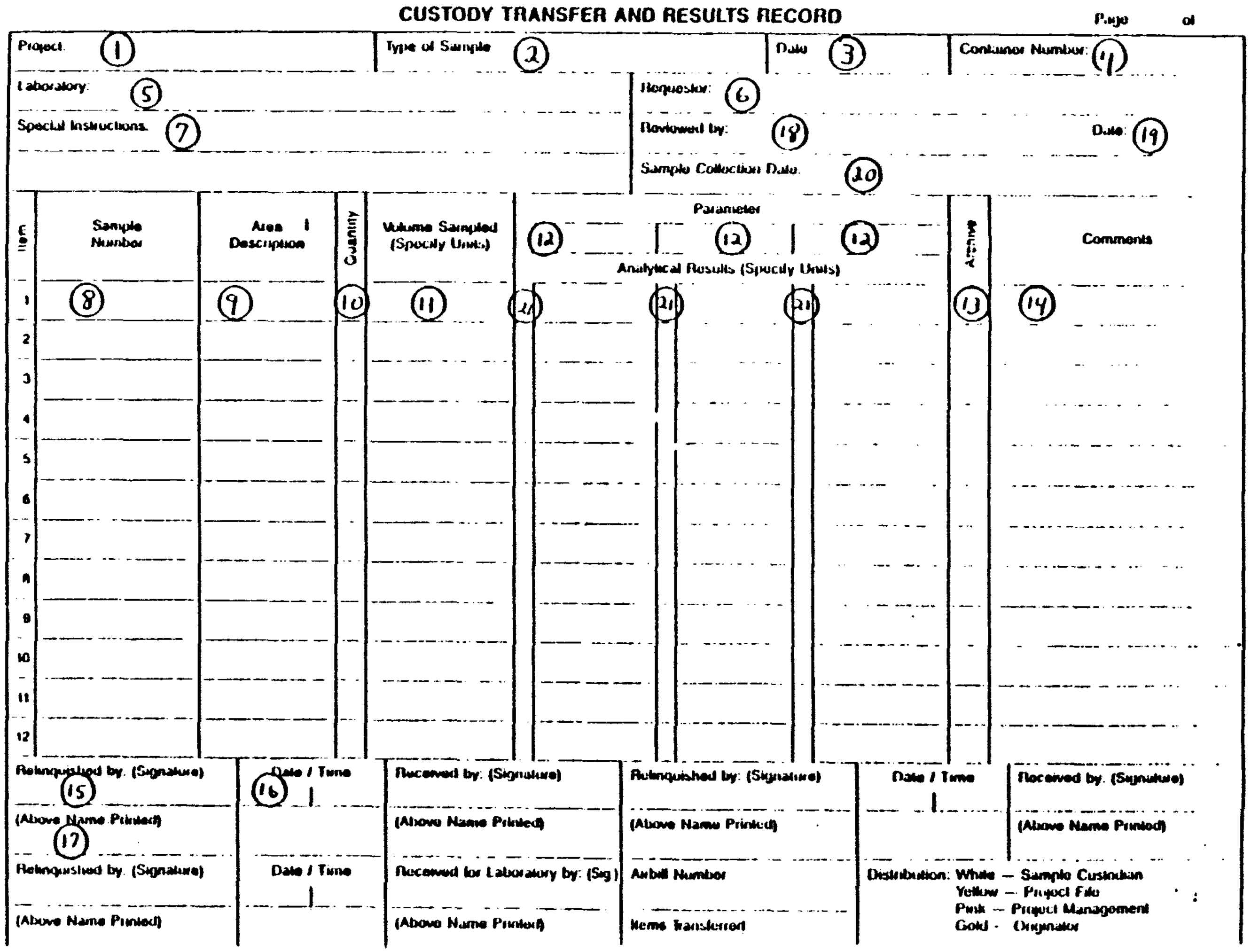


Figure A-1-1. Sample Points within Grids.


CUSTODY TRANSFER AND RESULTS RECORD

Page ___ of ___

Project: (1) | Type of Sample (2) | Date (3) | Container Number: (4)

Laboratory: (5) | Requestor: (6)

Special Instructions: (7) | Reviewed by: (18) | Date: (19)

Sample Collection Date: (20)

Item	Sample Number	Area Description	Quantity	Volume Sampled (Specify Units)	Parameter (12) / Analytical Results (Specify Units)	Parameter (12)	Parameter (12)	Archive	Comments
1	(8)	(9)	(10)	(11)	(21)	(21)	(21)	(13)	(14)
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									

Relinquished by: (Signature) (15)	Date / Time (16)	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
(Above Name Printed) (17)		(Above Name Printed)	(Above Name Printed)		(Above Name Printed)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Sig)	Airbill Number	Distribution: White — Sample Custodian Yellow — Project File Pink — Project Management Gold - Originator	
(Above Name Printed)		(Above Name Printed)	Items Transferred		

Figure A-1-2. Chain-of-Custody Form.

1. Code Orange

2. Soil, Ash, Air, etc.

3. Date sample was collected

4. Optional

5. The name of the laboratory the samples are being sent to

6. EG&G Idaho, Inc.

7. Notes concerning sample turnaround, etc.

8. Sample number from sample jar

9. Area from which sample was taken

10. How many containers make up the sample

11. Units in which the sample is being analyzed

12. What the sample is to be analyzed for (i.e., 2,3,7,8-TCDD, total TCDD, total TCDF, etc.)

13. Check here if the sample is to archived

14. Comments concerning the samples

15. Whoever is responsible for the samples at NCBC

16. The date and time the samples were released

17. Relinquisher's name (printed)

18. This area is to be completed by the EG&G Site Representative reviewing the results received from the lab.

19. This refers to the reviewed date, Item 18, and should be filled with the date the results were reviewed.

20. Helps to clarify instances where the shipping date is different from the sample collection date and should always be completed.

21. Check here if the associated sample is to be analyzed for the parameter indicated in Item 12.

Figure A-1-2 (Concluded).

ATTACHMENT A-2

ASH SAMPLING PROCEDURE
CODE ORANGE PROJECT
GULFPORT, MISSISSIPPI
REVISED 20 NOVEMBER 1987

A. GENERAL

Each batch of ash must be sampled and held pending satisfactory analytical results before the ash can be removed from the roll-off bins and returned to the excavated area for backfilling. Approximately 15 to 20 yd^3 of ash will be placed into each roll-off bin. In a normal day's operation, it is projected that 5 or 6 roll-off bins will be filled with ash each day. A composite sample will be obtained from each roll-off bin. To reduce analytical costs, a portion of each roll-off bin composite sample will be composited to form a daily composite sample.

The daily composite and the samples from each of the bays will all be sent to the laboratory, but the daily composite will be analyzed first; if it is "clean," the individual bay samples will not be analyzed. If the daily composite shows a concentration in excess of 1.0 ppb of 2,3,7,8-TCDD, total tetrachlorinated dibenzo dioxins, or total tetrachlorinated dibenzo furans, then the samples from the individual roll-off bins will be analyzed to determine where the contaminated ash is stored. If a sample is rejected on high contaminant level, the entire contents of the roll-off bin from which the sample was taken will be reprocessed in the incinerator.

B. REQUIRED SUPPLIES AND EQUIPMENT

1. 8-oz I-Chem glass sample jar with Teflon-coated lid and numbered label
2. 32-oz I-Chem glass sample jar with Teflon-coated lid and label
3. Aluminum pan
4. 8 mesh screen

5. Aluminum or plastic scoop

6. Soil Sample Data Sheet

7. Quart-size zip-lock plastic bag

8. Plastic trash bag.

C. SAMPLING PROCEDURES

1. Use a clean scoop for the sampling of each roll-off bin.

2. As a minimum, wear the disposable rubber boots and gloves that are required for Level C protection.

3. Scoop up four scoopfuls of ash from each side of the ash in the bay. Dump each scoopful through the screen in the aluminum pan as you scoop it up.

The location of the scoops should be equally spaced in order to obtain a more representative sample. Due to the mixing of the soil in the kiln and during ash transport to the roll-off bin, the process soil will be well mixed, thus providing a homogeneous ash product.

4. Mix the sample thoroughly in the pan and pour from the pan into the small sample jar. Dump one scoopful of the roll-off bin sample into the large composite sample jar.

5. Clean any excess ash off of the sample jars and put the lids tightly on the jars.

6. Log all required information on the Field Sample Data Sheet.

7. When samples have been collected from all roll-off bins filled during the day's operation, the composite sample from the large sample jar is dumped out into a clean aluminum pan and mixed thoroughly with a clean scoop.

An 8-oz or larger sample jar is to be filled with the daily composited mixture. It must be clearly marked "Ash Composite" on the Soil Sample Data Sheet, and the roll-off bins from which the composite sample was taken noted in the remarks section so there is no mistake as to which roll-off bins the composite was made.

8. Put each filled small jar in a zip-lock bag and carry it to the sample trailer.

9. Collect the large sample jar and all used scoops and pans in the trash bag for disposal.

D. PREPARATION FOR SHIPMENT

Follow Section D of the Soil Sampling Procedures (see Attachment A-1), except that all ash samples must be noted as being for three-day turnaround by the laboratory and they must go out in the very next shipment of samples. Mark the chain-of-custody form accordingly. Identify the ash composite sample as such on the chain-of-custody form, and note the individual sample numbers that make up the composite.

ATTACHMENT A-3

POTW WATER OPERATING AND SAMPLING PROCEDURES
NCBC FULL SCALE DEMONSTRATION PROJECT
GULFPORT, MISSISSIPPI
9 JUNE 1988 REVISION 0

A. GENERAL

Effluent water from the MWP-2000 Unit is pumped through an adsorption bed of activated carbon and accumulated in one of the two POTW storage tanks. The adsorber is used to remove trace quantities of organics from the water discharged to the Base Waste Treatment Plant.

B. Operations

1. Transfer from the Unit

a. Transfer can be made from either the Effluent Neutralization Tank (ENT), using the effluent pumps, or from the settling tank using its return pump. Set up the piping system for whichever pump is to be used to go through the sand filter and then to POTW storage tank.

b. Start the pump that is to be used and open LV405 to a point that the pressure downstream of it is about 50 psig with the valves open all the way to the POTW tank. This should give you an operating rate of about 50 gpm. Pump as long as is necessary to drop the level in the ENT or the settling tank to the desired level. At that time, stop the pump and shut in the system.

c. Whenever the POTW storage tank becomes about three-fourths full, it must be sampled and the sample analyzed to ensure that no dioxin, 2,4-D or 2,4,5-T, is in the water. Sampling procedure is in Section 2 below.

d. While the sample is out for analysis, no more effluent water can be put in that tank. Any transfers from the unit must be made to the alternate tank. Close and tag the inlet and outlet valves on the full tank.

e. When analysis results are returned showing that the water can be allowed to leave the area without further treatment, isolate the alternate tank to ensure that no water goes into or out of it. Untag and open the outlet valve on the tank to be dumped and allow it to gravity drain through the sand filter, then to the POTW at a maximum rate of 5 gpm. When it is empty, shut it until the next time it is necessary to discharge effluent water.

2. Sampling Procedures

a. For sampling, the accumulated water in the POTW tank must be circulated for at least 5 hours using the recirculation pump. More circulation may be required if the pH is out of bounds (see paragraph b below). Before starting circulation, be sure that all valves are set properly so that no water can enter or leave the system.

b. Testing for pH: After 2-1/2 to 3 hours of circulation, collect a small sample of the water and check its pH with litmus paper. The pH must be between 5.5 and 9.5.

(1) If the pH is higher than 9.5, enough hydrochloric acid must be added to the system to decrease the pH to within limits. This is very unlikely, since the cycle at the ENT is normally somewhat acidic.

(2) If the pH is lower than 5.5, enough caustic will have to be added to raise the pH to within limits. If the quench cycle pH is maintained at 5.6 to 6.0, it should not be necessary to add caustic to the POTW water.

NOTE: If acid or caustic addition is required, a separate procedure will be developed and followed. That procedure must be approved by the ENSCO onsite safety office.

(3) If either acid or caustic is added, the system must be circulated for about 2-1/2 hours and the pH rechecked. This may have to be repeated until the pH is satisfactory.

c. Circulate the POTW water from the tank through the sand filter prior to circulating it through the charcoal bed at a rate of 50-80 gpm, and take hourly aliquot samples of water after one pass through the charcoal bed. A total of 2 gallons of water should be collected as a composite sample in a chemically clean jar. If a 2-gallon jar is unavailable, several clean jars may be used.

The volume of each aliquot should be calculated by the following formulas:

$$\frac{\text{(Volume of Water in POTW, gallons)}}{\text{(Recirculation flow rate, gpm)} \times 60} = \text{Number of aliquots to obtain}$$

$$\frac{\text{(2 gallons of sample)}}{\text{number of aliquots}} = \text{Volume of each aliquot (gallons)}$$

When opening the sample valve, allow the standing water in the valve and associated piping to drain to another container. Once the valve and piping are clear of standing water, you may obtain the required sample. The standing water that was collected shall be returned to the ENT or the settling tank or to the POTW tank; it shall be treated as though it is contaminated.

Note: Remember that the water must be considered as contaminated until the analysis proves that it is not.

d. Tag the sample jar or jars with lab sample tags and prepare the samples for shipment with all the precautions and procedures that the soil samples require. Samples are to be analyzed for 2,3,7,8-TCDD, 2,4,5-T, and 2,4-D.

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APPENDIX B

QUALITY ASSURANCE PLAN
RD&D CLOSURE OPERATIONS SAMPLING AND REPORTING
RD&D PERMIT NO. MS2-170-022-626

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APPENDIX B

QUALITY ASSURANCE PLAN
RD&D CLOSURE OPERATIONS SAMPLING AND REPORTING
RD&D PERMIT NO. MS2-170-022-626

NOTE: This report was prepared for the U.S. Air Force Engineering and Services Center by Versar, Inc., of Springfield, Virginia. Revision 1 was issued 22 November 1988.

1. INTRODUCTION

This Quality Assurance Plan (QAP) provides the basis for closure operations sampling and reporting as part of completion of Research, Development, and Demonstration (RD&D) Permit No. MS2-170-022-626. The RD&D permit was obtained by the Air Force Engineering Services Center (AFESC) from EPA Region IV so that AFESC could evaluate the performance of a mobile rotary kiln for processing soil contaminated with Herbicide Orange (HO) located at the Naval Construction Battalion Center (NCBC) in Gulfport, Mississippi. HO contains 2,3,7,8-TCDD (dioxin) and as such the contaminated soil is classified as a RCRA hazardous waste (F027).

After the soil is processed in the mobile rotary kiln, it is also a RCRA hazardous waste (F028); however, AFESC is petitioning EPA/OSW to delist the treated soil. AFESC's intent is to process all soil at NCBC with a TCDD content above 1 part per billion (ppb). In December 1988, soil processing at NCBC will be completed and RD&D closure procedures will begin. This QAP describes the procedures to be followed so that a professional engineer can properly provide AFESC, EPA Region IV, and other interested parties with a written report detailing specific cleanup activities that were performed during the closure of the RD&D permit.

Attachment B-1 contains the "Closure and Equipment Decontamination Plan" from the RD&D permit that states the intent of the closure plan is to leave the site with pre-test contours and no listed waste as a result of the RD&D activity. In addition, the equipment leaving the site is to be cleaned to acceptable levels.

The following sections of this QAP provide guidelines for identifying any listed wastes that may result during cleanup activities and a procedure for their identification and tracking until final disposition. Also provided is identification of the cleanup criteria that AFESC will follow for equipment decontamination and the associated sampling and reporting requirements.

2. IDENTIFICATION OF ITEMS FOR DISPOSAL OR DECONTAMINATION

Besides recontouring the site, the RD&D permit closure plan is intended to track the fate of the following cleanup items:

- Any listed wastes generated as a result of cleanup activities
- Equipment that may have been contaminated with soil containing TCDD.

Table B-1 summarizes the residuals that are anticipated to be generated during RD&D closure activities. As noted in the RD&D permit closure plan, the decontamination activities will be performed in such a manner as to eliminate any hazardous waste that will have to be taken offsite for disposal. Because the items listed in Table B-1 are the most likely sources of generation of hazardous waste, this QAP specifies that these items will be identified as they are generated and tracked until proven nonhazardous. Specific reporting requirements for these items are presented in Section 6 of this QAP.

Table B-2 summarizes the equipment destined for decontamination during RD&D closure activities. If additional pieces of equipment require decontamination, this list should be modified accordingly. The list was developed by identifying those items that have or may have come in contact with TCDD-contaminated soil during RD&D activities and therefore must be decontaminated prior to removal from the site.

TABLE B-1. RESIDUALS GENERATED DURING RD&D CLOSURE ACTIVITIES.

Item	Disposal Method (see note)
1. Soil fines removed from kiln	1
2. Soil fines removed from SCC and boiler	1
3. Soil fines removed from ENT and scrubber sump	1
4. Water from ENT after final shutdown	2
5. Water from boiler after final shutdown	3
6. Other treated water residuals left onsite after final shutdown	TBD

Note: 1 - Sample and return to site after verified to be clean.

2 - Filter through sand/activated carbon filter. Send to POTW after verified clean.

3 - Measure pH, BOD, and COD, and send to POTW if within acceptable limits.

TBD - To be determined.

TABLE B-2. INDUSTRIAL EQUIPMENT TO BE DECONTAMINATED.

Quantity	Equipment	Model	Approximate Size (ft)
1	Dump truck	Ford	21 x 8 x 8
1	Dump truck	Chevrolet	21 x 8 x 8
1	Dump truck	GMC	21 x 8 x 8
1	Water truck	GMC	30 x 8 x 10
1	Trackhoe	Case 880D	12 x 10 x 9 + 20-ft arm
1	Backhoe	Case 580E	15 x 6 x 8
1	Generator	Detroit Allison Diesel	3 x 6 x 10
1	Air compressor	XAS 85	3 x 3 x 6
2	Portable standard light	AMIDA 5080D 4MWHW	3 x 5 x 6
1	Front loader	John Deere 544D	10 x 15 x 6
1	Dozer	Case 450C	5 x 8 x 10
1	Front loader	Case W20C	10 x 15 x 6
1	Planer	Ingersall Rand MW 5517	8 x 10 x 15
1	Wood splitter	--	2 x 3 x 10
1	Forklift	Clark GPS 25	4 x 6 x 8
1	High press washer	LANDA	3 x 3 x 4
50	Ash bins	BFI roll-off boxes	4 x 7 x 21
1	Generator	Portable for welding	2 x 2 x 3
2	Charcoal filter steel drums	--	3 x 4
Batch	Tent ribs and misc. steel	--	Volume - 50 ft^3 Surface areas - 1100 ft^2
4	Air monitoring trailers and equipment	--	4 x 4 x 9
1	Decontamination pad (steel)	--	20 x 30
1	Enclosure (tent fabric)	--	33 x 40
1	Rock crusher	--	6 x 12 x 20

TABLE B-2. (CONTINUED).

Quantity	Equipment	Model	Approximate Size (ft)
7	ENSCO roll-off boxes	--	16 yd^3
2	POTW holding tanks	--	--
4	Replacement generators for ambient air monitors	--	--
1	Charcoal filter tank	--	--
1	Sand filter tank	--	--
1	MWP-2000	Kilns	30 x 8
1	MWP-2000	Ash drag	3 x 4 x 32
1	MWP-2000	Ash pan	8-ft square box
1	MWP-2000	Cyclones	15 x 2
1	MWP-2000	Crossover duct	15 x 3 x 3
1	MWP-2000	SCC	40 x 8
1	MWP-2000	Divert	12 x 5
1	MWP-2000	Boiler	30 x 5
1	MWP-2000	Quench elbow	10 x 4
1	MWP-2000	Packed tower	14 x 6
1	MWP-2000	ENT	25 x 8 x 4-1/2
1	MWP-2000	Steam drum	10 x 3
1	MWP-2000	Deaerator	8 x 4
1	MWP-2000	Raw water tank	12 x 25
1	MWP-2000	Caustic tank	4 x 4
1	MWP-2000	Treated water tank	12 x 20
1	MWP-2000	Jet scrubber	2 x 25
1	MWP-2000	Demister	8 x 8
1	MWP-2000	Scrubber sump (tank)	3 x 4 x 6

TABLE B-2. (CONCLUDED).

Quantity	Equipment	Model	Approximate Size (ft)
1	MWP-2000	Desilicizer	3 x 6
1	MWP-2000	Shredder	3 x 5 x 1
1	MWP-2000	Weigh hopper	4 x 4 x 8
1	MWP-2000	Conveyor housing	1 x 2 x 40
1	MWP-2000	Feed hopper	2 x 3 x 5
1	MWP-2000	Auger	1 x 6
1	MWP-2000	Auger chute	14 x 7
1	MWP-2000	Control room	40 x 8 x 10
1	MWP-2000	Tool and parts trailer	40 x 8 x 10
1	MWP-2000	Decontamination trailer (personnel)	40 x 8 x 10

3. DISPOSAL AND DECONTAMINATION PROCEDURES

The following section provides a description of the disposal and decontamination procedures that will be used during RD&D closure activities. The intent of this QAP is not to develop or approve these procedures, rather to verify that the procedures were followed as described.

3.1 Disposal

Any items removed from the site must be proven to be nonhazardous. If, after completion of all closure activities, any hazardous cleanup residuals require disposal, these items will be identified and addressed in the final report for RD&D closure certification. As is described in the RD&D closure plan, it is anticipated that no hazardous material will require disposal.

3.2 Decontamination Procedures

Decontamination procedures for equipment located in Zone 1 and the POTW holding tanks have been developed by ENSCO and are provided in Attachment B-2 of this QAP. Zone 1 is defined by ENSCO as the area in which equipment is most likely to come into contact with TCDD-contaminated soil, and is therefore considered contaminated. The POTW holding tanks should not contain any TCDD contamination (only water filtered through sand and activated carbon was placed in these tanks); however, because a conservative approach is being taken for decontamination activities, these will also be verified as clean.

4. CLEANUP CRITERIA

Cleanup criteria have been established for water that will be removed from the site and for TCDD surface contamination on equipment.

4.1 Cleanup Criteria for Processing Wastewater

The process wastewaters resulting from treatment of the contaminated soil will be discharged to a POTW under Mississippi Permit Number PT90249. A copy of this permit is contained in Attachment B-3 of this QAP. The permit states that, among other constituents, the water must be tested and verified to have less than 10 parts per trillion (ppt) 2,3,7,8-TCDD before it can be discharged into the POTW.

4.2 Cleanup Criteria for Equipment

The RD&D permit does not specify a particular cleanup criteria, rather it states that "representative surface wipe samples will be taken and analyzed to determine the adequacy of decontamination before the equipment is allowed to go offsite." AFESC has decided to use the same cleanup criterion as was used when EPA Region IV allowed other equipment to be decontaminated at NCBC during October/November 1986. The cleanup criterion was to wipe sample the equipment to show that the surface sampled had a 2,3,7,8-TCDD concentration below a threshold limit of 10 ng/0.25 m^2 (or 40 ng/m^2) of surface sampled.

Attachment B-4 of this QAP contains the specific equipment decontamination criteria developed by EG&G Idaho for use at NCBC. As is described, the EG&G Idaho decontamination criteria employs the policy that any equipment showing a positive 2,3,7,8-TCDD wipe sample after decontamination effort shall be cleaned again in the appropriate areas, even if the concentration is below the threshold concentration of 10 ng/0.25 m^2.

5. SAMPLING

At a minimum, sampling will be required for all of the items identified in Section 2 of this QAP.

5.1 Disposal

Currently, it is foreseen that only incinerator wastewater (from the ENT and boiler) and soil fines from cleaning the secondary combustion chamber (SCC), effluent neutralization tank, ash drag sump, and boiler face will require special handling.

Prior to discharge into the POTW, samples of the wastewater will be obtained and analyzed for the required constituents in the POTW permit (see Attachment B-3). A sampling procedure has been developed by EG&G Idaho for obtaining samples of water temporarily stored in the POTW holding tanks. A copy of this sampling procedure is contained in Attachment A-3. Specific sampling locations and sample volumes are described in the procedure. As is the case during routine operations, water samples must be obtained and analyzed before being released into the POTW.

As soil fines are removed from the incinerator during disassembly, they will be placed in storage bins and sampled. After results of these grab samples show that the soil contains less than 1 ppb total TCDD using low resolution GC/MS (Method 8280), it will be placed in a verified clean spot on the site.

5.2 Equipment Decontamination

After the equipment has gone through equipment decontamination procedures, it must be sampled to verify that the surface does not contain any 2,3,7,8-TCDD. So a constituent sampling procedure will be used for all sampling, this QAP provides a recommended wipe sampling procedure that is to be used to verify the cleaned equipment meets the cleanup criteria of

10 ng/0.25 m^2. The recommended wipe sampling procedure is contained in Attachment B-5 of this QAP.

The wipe sampling procedure has provisions for sampling rusted surfaces. It is suspected that the formation of rust on equipment surfaces may retain small soil particles containing TCDD, which could then be transferred to potential receptors via skin contact. To confirm that the rusted surfaces have been properly decontaminated, a specific sampling procedure was developed for rusted surfaces. Rather than sample all rusted surfaces on all of the equipment to be decontaminated, several pieces of equipment with rust spots that have known to be in contact with contaminated soil (i.e., the cover plates on the soil feed conveyor) will be decontaminated and the rust spots will be sampled for TCDD. If these pieces show no detectable TCDD, then further rust sampling may not be required.

5.3 Sampling Requirements

Because there will be many different pieces of equipment and each will have different surface areas, guidelines are presented here to help determine the number of samples required when each piece is wipe sampled.

The wipe sampling procedures in Attachment B-5 recommend that the minimum sample size consists of sampling one 0.25 m^2 surface area. For the purposes of this QAP, this will be defined as "one" sample. After each sample is obtained, it is placed in a sample jar that has been labeled with a unique sample number. A sample jar can contain any number of samples up to a maximum of four (i.e., four samples would indicate that a full square meter surface area has been sampled). The wipe sample result is then determined by dividing the amount of TCDD found in the jar (tracked using the unique sample number) by the surface area that was sampled (a maximum area of 1 m^2 can be sampled for each jar/sample number).

Table B-2 summarizes the equipment that is to be decontaminated and subsequently wipe sampled. Also shown in Table B-2 are the overall gross dimensions of each piece of equipment. These approximate sizes were used in determining the total number of samples to be obtained for each piece of equipment. Also considered was the type of service in which the equipment was used. For instance, if the equipment was in daily contact with contaminated soil, the number of wipe samples required were more than for a similar-sized piece of equipment that was not used in such a highly contaminated area. The guidelines for the number of wipe samples required for each piece of equipment identified in Table B-2 are summarized in Table B-3.

Care should be exercised when determining the exact locations where samples will be obtained. For instance, every effort should be made to choose locations that are most likely to come in contact with personnel. Examples of these locations are the insides of vehicles and external surface areas that are easily accessible. Samples should also be obtained from other hard-to-reach locations to verify that the entire piece of equipment is properly cleaned.

Of particular note is the sample to be obtained from the tent fabric material. Because it cannot be confirmed that this material is not porous, a 10 x 10-cm swatch of the fabric should be cut from the tent after cleanup operations are completed and sent to the laboratory for analysis. A total of two swatches should be obtained for analysis to verify that the fabric is not contaminated with TCDD.

One of the last items to be incinerated will be the air and oil filters from machinery used in Zone 1. Again, this measure is being taken to mitigate the possibility of generating any hazardous residues during RD&D closure activities.

If other equipment not identified on Table B-2 requires cleaning, the number of wipe samples required should be determined using Table B-3 as a guide (i.e., obtain the same number of samples from a comparably sized piece of equipment in Table B-3).

TABLE B-3. WIPE SAMPLES REQUIRED FOR INDUSTRIAL EQUIPMENT TO BE DECONTAMINATED.

	Equipment Description	Approximate Size (ft)	Required Number of Wipe Samples Per Piece
1.	Dump truck, Ford	21 x 8 x 8	8
2.	Dump truck, Chevrolet	21 x 8 x 8	8
3.	Dump truck, GMC	21 x 8 x 8	8
4.	Water truck, GMC	30 x 8 x 10	12
5.	Trackhoe, Case 880D	12 x 10 x 9 + 20 ft arm	8
6.	Backhoe, Case 580E	15 x 6 x 8	4
7.	Generator, Detroit Allison Diesel	3 x 6 x 10	4
8.	Air compressor, XAS 85	3 x 3 x 6	2
9.	Portable standard light, AMIDA 5080D 4MWHW	3 x 5 x 6	2
10.	Front loader, John Deere 544D	10 x 15 x 6	8
11.	Dozer, Case 450C	5 x 8 x 10	8
12.	Front loader, Case W20C	10 x 15 x 8	8
13.	Planer, Ingersall Rand MW 5517	8 x 10 x 15	8
14.	Wood splitter	2 x 3 x 10	2
15.	Forklift, Clark GPS 25	4 x 6 x 8	4
16.	High press washer, LANDA	3 x 3 x 4	2
17.	Ash bins, BFI roll-off boxes	4 x 7 x 21	4
18.	Generator, portable for welding	2 x 2 x 3	2
19.	Charcoal filter steel drums	3 x 4	2
20.	Tent ribs and misc. steel	Volume - 50 ft^3 Surface areas - 1100 ft^2	8 (total)
21.	Air monitoring trailers and equipment	4 x 4 x 9	4
22.	Decontamination pad (steel)	20 x 30	8
23.	Enclosure (tent fabric)	33 x 40	10 x 10 cm swatch
24.	Rock crusher	5 x 12 x 20	8
25.	ENSCO roll-off boxes	--	4
26.	POTW holding tanks	--	4

TABLE B-3. (CONTINUED).

Equipment Description	Approximate Size (ft)	Required Number of Wipe Samples Per Piece
27. Replacement generators for ambient air monitors	--	4
28. Charcoal filter tank	--	4
29. Sand filter tank	--	4
30. MWP-2000, Kilns	30 x 8	8 (4 near feed area)
31. MWP-2000, Ash drag	3 x 4 x 32	8
32. MWP-2000, Ash pan	8 square box	4
33. MWP-2000, Cyclones	15 x 2	4
34. MWP-2000, Crossover duct	15 x 3 x 3	4
35. MWP-2000, SCC	40 x 8	8
36. MWP-2000, Divert	12 x 5 (Both horizontal and vertical)	4
37. MWP-2000, Boiler	30 x 5	4
38. MWP-2000, Quench elbow	10 x 4	4
39. MWP-2000, Packed tower	14 x 6	4
40. MWP-2000, ENT	25 x 8 x 4-1/2	8
41. MWP-2000, Steam drum	10 x 3	4
42. MWP-2000, Deaerator	8 x 4	4
43. MWP-2000, Raw water tank	12 x 25	4
44. MWP-2000, Caustic tank	4 x 4	4
45. MWP-2000, Treated water tank	12 x 20	4
46. MWP-2000, Jet scrubber	2 x 25	4
47. MWP-2000, Demister	8 x 8	4
48. MWP-2000, Scrubber sump (tank)	3 x 4 x 6	4
49. MWP-2000, Desilicizer	3 x 6	
50. MWP-2000, Shredder	3 x 5 x 1	8
51. MWP-2000, Weigh hopper	4 x 4 x 8	8

TABLE B-3. (CONCLUDED).

Equipment Description	Approximate Size (ft)	Required Number of Wipe Samples Per Piece
52. MWP-2000, Conveyor housing	1 x 2 x 40	16
53. MWP-2000, Feed hopper	2 x 3 x 5	8
54. MWP-2000, Auger	1 x 6	4
55. MWP-2000, Auger chute	14 x 7	8
56. MWP-2000, Control room	40 x 8 x 10	4 (interior also)
57. MWP-2000, Tool and parts trailer	40 x 8 x 10	4 (interior also)
58. MWP-2000, Decontamination trailer (personnel)	40 x 8 x 10	4 (interior also)

6. REPORTING REQUIREMENTS

As required for the final report that documents the RD&D closure activities, the EG&G Idaho site manager should maintain a daily log that describes when each piece of equipment is cleaned. The daily log should also record when each critical incinerator disassembly activity occurs (i.e., when water is removed from the system and filtered, sampled, and subsequently sent to the POTW, when the 48-hour burn is performed, etc.). To assist in providing EPA Region IV with documentation of the critical RD&D closure activities that were performed, EG&G Idaho GANTT and PERT charts should be updated after RD&D closure activities are completed to reflect the actual dates and time periods when these activities occurred.

The following information should also be available for inclusion in the final report:

- Copies of the NCBC Equipment Decontamination Form for each piece of equipment that has been cleaned

- Chain-of-custody forms for all RD&D closure samples obtained and the associated analytical results

- Descriptions of the analytical procedures used for all analyses performed

- Any other information describing RD&D closure activities.

ATTACHMENT B-1

CLOSURE AND EQUIPMENT DECONTAMINATION PLAN

This section describes the closure procedures that will be followed when the soil-processing activities at the NCBC are completed and before the MWP-2000 is removed from the site. In general, the intent of this closure plan is to leave the site with pre-test contours and no listed waste as a result of the RD&D activity. In addition, equipment leaving the site will be cleaned to acceptable levels. The following is a description of the equipment decontamination procedures.

Equipment Decontamination Procedures

Equipment used in a Zone 1 will be decontaminated before it leaves that zone to enter into either a Zone 1 or 2. However, equipment being used to transfer wastes from Zone 1 to Zone 2 staging units will not have to be decontaminated before making each delivery when the movement of this equipment is restricted to dedicated traffic routes. Equipment used in a Zone 2 to handle wastes before incineration, including equipment used for the staging and processing of wastes to be fed to the MWP-2000, will be decontaminated before it leaves that zone to enter into a Zone 3.

Equipment will be decontaminated by being thoroughly washed with clean diesel oil followed by water wash. The dirty oil and the wash water will be burned in the MWP-2000. If the equipment is to be returned to nonhazardous waste service, representative surface wipe samples will be taken and analyzed to determine the adequacy of decontamination before the equipment will be allowed to go offsite. Each sample will be taken from a 100 cm^2 area with a cotton swab saturated with an appropriate solvent and will be analyzed for the significant contaminants in the waste that had been handled by the equipment.

At the end of a project, emptied roll-off boxes that had been used for holding solid residuals generated by the system will be decontaminated with high-pressure water and the wash water incinerated in the MWP-2000. The waste staging and processing equipment and other equipment used to handle wastes before incineration will be decontaminated, as described above. The MWP-2000 then will be operated for 48 hours on clean fuel. Following this operation, treated soil, solids, waters in the several sumps and tanks of the system, and effluents in staging units will be removed from the system, sampled, and analyzed. The several sumps and tanks of the system and the effluent staging tanks will be flushed with high-pressure water, and this water will be sampled and analyzed. The MWP-2000 will then be disassembled for removal from the site.

Wastes generated by decontamination activities will be incinerated whenever possible. Treated soil and solids will be sampled and analyzed before placement in a verified clean spot on the HO site. Liquid wastes (decontamination wash waters, scrubber water, etc.) will be incinerated whenever possible. Otherwise the liquids will be filtered through activated carbon, held in a tank for sampling and analysis, then discharged to the POTW.

A more detailed description of these activities is presented below.

Waste Staging and Processing Units

It will be possible to remove and incinerate all of the wastes and contaminated materials in the waste staging and processing units. The equipment in these units will then be decontaminated for removal by following the steps below:

1. All wastes in the Loose Solids Staging Unit will be transferred to the Solids Processing Unit and processed in that unit. The resulting wastes either will be fed directly to the incinerator or will be transferred to the Bulk Solids Staging Unit for subsequent incineration.

2. The equipment in the Solids Processing Unit will be triple-rinsed with kerosene before removal. Kerosene will be collected and incinerated.

MWP-2000 and Auxiliary Units

The MWP-2000 and its auxiliary units will be decontaminated before removal from the site. The procedures that will be used to accomplish this are delineated below:

1. The weigh hopper, feed hopper, and solids feed conveyor will be steam cleaned and then swabbed with kerosene or diesel fuel. The ram or screw feed will be swabbed with the same type of fuel as will support structures. The steam condensate and dirty fuel will be collected and incinerated.

2. Solids will be removed from the treated receiving bin, secondary combustor, sumps in the air pollution control train, and other points in the system. They will be placed in roll-off bins and tested. Based on the test results, they will be transferred either to the incinerator if contaminated or the site if clean.

3. After all wastes and contaminated materials are incinerated, the MWP-2000 will be operated on clean fuel at full thermal loading and required thermal destruction operating conditions for at least 48 hours. It will then be normally shut down.

4. Water will be removed from the treated soil receiving bin of all the sumps in the air pollution control train and held in storage tanks. It will be tested for verification of meeting criteria for TCDD of <10 ppt, then discharged to the POTW.

5. Refractory in the system will not be removed unless required by an abnormal event. If refractory is removed from the system, it will be incinerated as a minimum in the cleanup run in Step 3 above.

6. The system will then be dismantled and removed from the site.

Residual Staging Units

The tanks, erected basins, roll-off boxes, and other containers used in these staging units will be cleaned with water and removed.

ATTACHMENT B-2

ENSCO EQUIPMENT DECONTAMINATION PROCEDURES

Description of ENSCO Procedure for

Decontamination of Zone 1 Equipment

Purpose: To provide a safe means of eliminating all contamination on equipment used in Zone 1 of this project. The equipment list includes:

1. Rock crusher
2. Dump truck
3. W-20 front-end loader
4. John Deere front-end loader
5. Case dozer
6. Case track hoe
7. Flanner
8. Feed System
   a. Weigh hopper
   b. Shredder
   c. Conveyor
   d. Auger
   e. Feed hopper
9. Miscellaneous small equipment and hand tools.

Decontamination Procedures

All equipment with the exception of the rock crusher will be moved into the constructed enclosed decontamination pad area. Here a partial dismantling will occur to allow access to all external surfaces of contaminated equipment. These surfaces will then be washed with high pressure water and/or steam to dislodge any and all contamination. When completely cleaned the equipment will be inspected and moved to a staging area to be sampled via the wipe test procedure and await sample results. When sample results show that the equipment is free of contamination or within the approved tolerance level, it will be released from the site.

If this procedure proves to be ineffective, minor modifications to the decontamination pad will be made to allow for the use of negative pressure apparatus and sand-blasting equipment.

Personnel protective equipment for this operation will consist of Level C protection, PAPR respirators, face shields, liquid resistant outer clothing, Tyvek coveralls, gloves, and boots.

All materials generated by the decontamination activities, liquid and solid, will be disposed of by incineration.

Rock Crusher

Due to the size, location, and difficulty associated with the movement of the rock crusher, it is believed that the safest means of cleaning this equipment is to partially dismantle some of its components, transfer the smaller parts to the decontamination pad, and clean the major portion where it is located.

The rock crusher is the first equipment scheduled to be decontaminated. It has the largest rusted surfaced area and will be a prime example of the effectiveness of pressure steam cleaning. Results of this decontamination will provide answers to implementation of the sand-blasting program.

When sample results show that the rock crusher is clean, it will be moved to a staging area to await removal from site.

Description of ENSCO Procedure for Sampling and Decontamination of POTW Tanks

Purpose: In order that we may ensure a safe performance of demobilization and prevent the release of a possible contaminated holding tank, the following procedures will be followed:

Sampling

All liquids held in and transferred through the three tanks of the POTW system have been sampled, analyzed, and found to be free of contamination. This water is then discharged. When completely empty, the interior surface of the tanks can be wipe sampled using the currently established sampling technique.

Access to the two holding tanks can be made through the 6-inch blind flange on the bottom of the tank or by disconnecting the discharge pipe flange. Either access would permit the entry of the sampler to facilitate the sample. The carbon and sand filter tank requires removal of the solid contents prior to sampling. This will be accomplished by visual inspection to ensure all liquids have evacuated the tank. (This inspection would be performed when the last liquid is transferred to the holding tank.) The top manway hatch will be removed and the tank contents transferred to other containers (drums) for transport to the kiln feed system. When all solids have been removed, the vessel will be rinsed and the rinse water collected for incineration as well. This tank is now ready for wipe sampling.

Decontamination

1. The tanks will be laid over on their sides to allow safe and easy access to the top manway.

2. Perform standard confined space entry procedures.

3. Personnel will enter the vessel with high-pressure and/or steam-cleaning equipment to wash the entire interior of the tanks. All wash water will be collected and transferred for incineration.

4. When the cleaning process is completed, wipe samples will be taken again.

When sample analysis comes in clean, the tanks will be removed from site.

ATTACHMENT B-3

MISSISSIPPI POTW PERMIT

MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES
Bureau of Pollution Control
P. O. Box 10385
Jackson, Mississippi 39209
(601) 961-5171

August 19, 1988

Mr. Jeffrey J. Short
Environmental Research Engineer
Department of the Air Force
Headquarters of the Air Force
Engineering and Services Center
Tyndall Air Force Base, Florida 32403

Dear Mr. Short:

Re: Pretreatment Permit No. PT90249
Draft Permit Modification

Enclosed please find a copy of the proposed modified permit page 2 for the above referenced facility. This draft contains the following change(s):

The monitoring frequency has been changed for 2, 3, 7, 8-tetrachlorodibenzo-p-dioxin from three times per week to each batch discharge for Outfall 001.

We intend to incorporate these conditions as part of the final permit. Also, please note the effluent limitations, schedule of compliance, and monitoring requirements. Additionally, the POTW Authority is being given an opportunity to comment on the enclosed draft permit modification.

If you have any questions concerning the information transmitted herewith, please notify this office in writing by September 12, 1988.

Respectfully,

Jerry C. Beasley
Industrial Wastewater Control Section

JCB:lr
Enclosure

DRAFT

PART I

A. PRETREATMENT LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning October 31, 1986 and lasting until October 30, 1991 the permittee is authorized to discharge from outfall(s) serial number(s) 001 (Treated Scrubber Effluent from Pretreatment System).

Such discharges shall be limited and monitored by the permittee as specified below:

PARAMETER	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	kg/day (lbs/day)		Other Units (Specify)		Measurement Frequency	Sample Type
	Daily Avg.	Daily Max.	Daily Avg.	Daily Max.		
Flow-M^3/day (MGD)	--	--	--	(.0072)	Each Batch Discharge	Grab
2,3,7,8 Tetrachlorodibenzo-p-dioxin (TCDD)	--	--	--	Not Detectable	Each Batch Discharge	Grab
2,4,5 Trichlorophenoxyacetic Acid	--	--	--	Not Detectable	Each Batch Discharge	Grab
2,4 - Dichlorophenoxyacetic Acid	--	--	--	Not Detectable	Each Batch Discharge	Grab

2. The pH shall not be less than 5.5 standard units nor greater than 9.5 standard units and shall be monitored twice per week with a grab sample of the effluent.

3. Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): in the treated effluent holding tank after neutralization and carbon filtration but prior to release to the POTW collection system.

4. Each treated batch of wastewater must be sampled and analyzed to ensure permit compliance prior to release to the POTW.

This permit may be modified after the submittal of the analytical laboratory results of the scrubber effluent from the test burns.

B. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations specified for discharge in accordance with the following schedule:

   The permittee shall achieve compliance with the specified limitations upon start-up of discharge to the POTW.

2. No later than 10 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

ATTACHMENT B-4

EG&G IDAHO EQUIPMENT DECONTAMINATION CRITERIA

Idaho National Engineering Laboratory

September 28, 1988

DISTRIBUTION

NCBC DECONTAMINATION CRITERIA - CEF-50-88

This letter is to establish the decontamination criteria and policy for the decontamination and demobilization phase of the project.

The upper limit is established at 40 nanograms 2378 TCDD per square meter. (i.e., Any equipment wipe sample result greater than 40 nanograms per square meter will require cleaning of the areas or item sampled.) A minimum area swipe will be 0.25 square meters which will have a 10 nanogram 2378 TCDD upper limit before cleaning is required.

The rational for the above criteria is as follows:

- Original criteria from the "Equipment Decontamination" phase of this project was 40 nanograms total TCDD per square meter.

- Decontamination criteria used by IT Corporation on the "Small Scale Demonstration" phase of this project was 100 nanograms 2378 TCDD per square meter. The lower number of 40 nanograms 2378 is conservative.

- Use of the 2378 TCDD rather than Total TCDD is also a logical since the 2378 TCDD isomer is the predominant isomer in the herbicide orange and is also considered the most toxic of the isomers. The use of the 2378 isomer is also consistent with previous decontamination samples taken on various equipment since the full scale demonstration started.

- A 40 nanogram per square meter will allow a 0.25 square meter wipe to have an action level of 10 nanograms which is well above the highest detection level anticipated of 2.0 nanograms.

The following policy shall also be employed:

Any equipment showing a positive 2378 TCDD as indicated via swipe sample results after the first decontamination effort shall be cleaned again in the appropriate areas even though the indication is below the above stated criteria.

The general procedure to be employed for swipe samples shall be to soak a gauze pad with 8 ml of laboratory pure hexane and to swipe a nominal 0.25 square meter of area in two directions perpendicular to one another. A sample can include as many as four swipes of 0.25 square meters each or as few as one. QA samples will be equal to at least 10% of the actual number of swipe samples, and will include duplicate samples (swipe samples taken at the same time on the same surfaces), and glove blanks.

A form has been generated to facilitate the decontamination planning and sampling of each piece of equipment. The form has been attached for your information.

C. E. Friedrich, Manager
Site Demonstration Project

Attachment:
As stated

Distribution

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ATTACHMENT B-5

WIPE SAMPLING PROCEDURE FOR 2,3,7,8-TCDD

Background

This procedure describes how wipe samples are to be obtained during decontamination of equipment at the completion of the RD&D project at NCBC. Specifically, after all soil decontamination activities are completed, the RD&D permit requires that all potentially dioxin-contaminated equipment be cleaned and wipe sampled to verify cleaning.

Sampling Equipment

The following equipment is required as a minimum to obtain wipe samples:

1. Sterile 4 x 4-inch gauze pads
2. Laboratory pure hexane
3. Clean glass container and dispenser to measure 8 mL hexane
4. Clean surgical gloves
5. 16 oz I-Chem sample jars and labels
6. Chain-of-custody forms
7. NCBC equipment decontamination sample form (see Figure B-5-1)
8. Rule to measure a distance of 20 inches.

Sampling Procedure

Prior to sampling, consult the Quality Assurance Program Plan (QAPP) for NCBC RD&D completion. The QAPP establishes guidance for determining the locations and number of samples to be obtained for each piece of equipment to be decontaminated. After each sample location is identified, the following procedure should be used to obtain samples.

Using a rule, roughly define a surface area of 0.25 m^2 (approximately 20 x 20 inches). Use care not to touch the surface while defining the sampling area to minimize the possibility of cross contamination.

PAGE____OF____

NCBC AIR FORCE INCINERATION PROJECT

EQUIPMENT DECONTAMINATION

MAKE AND MODEL OF EQUIPMENT________________________________

SERIAL NUMBER________________________________

PARTS OF EQUIPMENT TO BE CLEANED:________________________________

____

____

____

****

SAMPLE NUMBER________________ DATE TAKEN________________

TAKEN BY________________ RESULTS________________

(Must be less than 40 ng 2,3,7,8-TCDD/m^2)

	PARTS OF EQUIPMENT TO BE SAMPLED	APPROX. AREA SAMPLED ($meter^2$)
1.		
2.		
3.		
4.		

TOTAL AREA (must be 0.25 to 1.0 $meter^2$)________________

DATE SAMPLE(S) SENT________________ DATE RESULTS REC'D________________

EQUIPMENT DISPOSITION: CLEAN TO BE RESAMPLED

________________________________ ________________

EG&G Idaho On-Site Representative Date

Figure B-5-1. NCBC Equipment Decontamination Sample Form.

Two people should perform sampling, one to actually do wipe sampling and an assistant to record data and mitigate the possibility of cross contamination. Because these samples will be analyzed at very low detection limits, even low amounts of cross contamination could negatively bias results.

After defining the area to be sampled, the sampler should don surgical gloves. The assistant should tear open a gauze package and expose the gauze without touching it so the sampler can remove it from the package. The sampler then holds the gauze while the assistant dispenses 8 mL of hexane on the gauze. The assistant should evenly dispense the hexane to soak the entire gauze pad.

The sampler then wipes the surface with the gauze pad, first covering the entire surface by wiping in even, sequential vertical strokes, then repeating the same operation by wiping in horizontal strokes (i.e., the entire sample area is actually wiped twice during sampling). If visible particulate is observed, care should be taken to obtain the particulate as part of the wipe sample.

When wipe sampling is complete, the assistant should open an I-Chem sample jar so the sampler can insert the gauze pad in the jar. The jar should then be closed immediately. Care should be taken to minimize the time the jar is open to minimize the possibility of cross contamination. The sampler should then discard the surgical gloves. If an entire square meter (i.e., at four different locations) is to be sampled for one piece of equipment, the same pair of gloves can be used. Otherwise, the same gloves should never be used to obtain more than one sample.

Verify the sample number on the sample jar (the sample jars should be labeled prior to initiation of sampling activities) and record it on the chain-of-custody form and the EG&G Idaho Equipment Decontamination form. Fill in the required information on each of the forms. In addition to these forms, the sampler should maintain a field notebook to record (at a minimum) the following information:

1. Date and time sample obtained
2. Sample number
3. Description of sample location and equipment being sampled
4. Names of sampling personnel
5. Any unusual problems or conditions encountered.

After each sampling episode is completed (at least daily), the samples should be staged in a clean sample recovery area. Custody seals should be attached either to each sample jar lid or on the container in which the samples are to be shipped in. No special sample preservation is required. Samples should be packaged and shipped according to applicable Department of Transportation regulations (i.e., flammable solid).

Sample Blanks

Because cross contamination is of concern, glove blanks will be obtained to detect any potential sampling problems. Glove blanks are obtained in the same manner as normal samples; however, no equipment is sampled. A glove blank should be obtained once for each 20 samples taken or at least one glove blank per day if fewer than 20 samples are taken.

Special Procedure for Sampling Rusted Areas

Rusted areas are to be sampled in a similar manner as described earlier; however, a sharp, flat instrument such as a wood chisel should be used to remove rust particles from the surface to be included in the wipe sample. The following describes the deviation from normal wipe sampling for sampling rusted areas:

- Clean sample instrument (wood chisel) with hexane rinse
- Surface area to sample should be 4 x 4 inches
- Scrape surface evenly being careful to collect rust by wiping end of sample instrument with gauge pad after each pass

- After scraping surface both horizontally and vertically, wipe area using a second gauge pad also soaked with 8 mL hexane

- Perform typical sample recovery.

APPENDIX C

STANDARD OPERATING PROCEDURE FOR OBTAINING AMBIENT AIR SAMPLES AT NCBC DURING OPERATION OF ENSCO'S MWP-2000 INCINERATOR

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APPENDIX C

STANDARD OPERATING PROCEDURE FOR OBTAINING AMBIENT AIR SAMPLES AT NCBC DURING OPERATION OF ENSCO'S MWP-2000 INCINERATOR

NOTE: This report, issued 21 October 1987, was prepared for EG&G Idaho, Inc., by Versar, Inc., of Springfield, Virginia. Several figures in the original report are not included because they were not reproducible.

SECTION 1. DAILY REPORTS

After each day's air sampling, a report is due to EG&G Idaho the same day as the sampling is completed. The report includes a copy of the Ambient Air Monitoring Datasheet (AAMD), the site chart with plotted wind directions, chain-of-custody form, and the applicable pages from the field logbook.

There are two sets of the daily report made: One set goes to the EG&G Idaho representative onsite at NCBC, and the other copy is filed by month in Versar's field files. The set to EG&G Idaho contains a photo copy of the AAMD, the site chart, the chain-of-custody form, and the field logbook. The set to the Versar field files contains the original AAMD form, the original site chart, the fourth carbon copy of the chain-of-custody form, and photo copies of the field logbook. The third carbon copy of the chain-of-custody form (pink copy) goes to the data clerk for the project (Crystal Desommes). The AAMD is completed using the AAMD workbook (slender blue logbook) which is discussed in Section 2 of this guide. The chain-of-custody form is filled out using the sample numbers and air volumes sampled from the AAMD. Remember to put the Federal Express airbill number on the chain-of-custody form.

SECTION 2. OTHER DAILY PAPERWORK

There is other paperwork for each day's sampling such as the AAMD workbook, the sample logbook, and the Federal Express shipping document.

The total volume of air sampled per unit is determined by multiplying the number of minutes by the flow rate of air per minute of a particular unit. The number of minutes a unit has run is based on the start and stop time of the sampling less any time the unit was off for checking the oil, etc., unless the unit was off for several hours due to technical difficulties, then use the minutes off of the minute or hour counter of the instrument.

The flow rate for a PUF sample unit is determined by averaging the initial and final magnehelic readings, using this number as the ordinate value (X-axis) on the calibration curve and finding the Y-intercept for the flow rate in cubic feet per minute. The result from this calculation is converted from cubic feet to cubic meters by dividing with 35.3451. The remarks section is for narrating any anomalies during sampling and the number of wind shifts.

SECTION 3. SAMPLE SHIPMENT

The PUF samples are analyzed by Envirodyne Engineers in St. Louis, Missouri, and are shipped daily upon completion of a day's sampling. The PUF sample from Station C (Sample PC) is the EPA compliance sampler and is marked for analysis on the chain-of-custody form. All of the remaining samples are marked as archive samples. Every tenth Quality Assurance (QA) sample (Sample PE) is marked for analysis (10% QA rate). The remaining samples are archived for 90 days unless Sample PC or PE, when applicable, are positive on their analysis for 2,3,7,8-TCDD.

The samples are packed in 8-oz, wide-mouth stubby jars. The particulate filter is folded into quarters and placed in the bottom of the jar, and the three PUF filters are placed in the jar on top of the filter in the same sequence they were in the cartridge. The jar lids are sealed with a custody seal and placed in a zip-lock bag with as little air in the bag as possible. The jars in plastic bags are then packed in 1-gallon paint cans with vermiculite. Three jars will fit in one can and the remaining two in another can. The cans are sealed with two custody seals. The cans are then packed in coolers with vermiculite also. The cooler is lined with a large trash bag and 2-3 inches of vermiculite is placed in the bag before putting the cans in and covering them with vermiculite. The bag is then twist tied.

The top two copies of the chain-of-custody form are placed in a 1-gallon zip-lock bag and taped to the inside of the cooler lid; do not forget to write the Federal Express airbill number on the chain-of-custody form. The lid is secured down with packing or duct tape around both ends of the lid. Four ORM-E hazardous material labels are applied to the cooler--one to each side. Four "This End Up" labels are also applied to the cooler and four chain-of-custody seals. The Federal Express label is filled out and applied using a peel-off plastic window; do not seal the label window. Federal Express picks up samples after 2:30 p.m. from Margaret's office. Make a copy of the completed Federal Express form and place it in the Federal Express copy file.

SECTION 4. OTHER PAPERWORK

A. High-Volume

The total suspended particulates are determined from the mass of particulates on the high-volume filters and the volume of air sampled. The initial and final desiccated weights for a high-volume filter are kept in the gray sample logbook. The formula for determining this result is as follows:

TSP = (gms particulate/volume air) x 1000 mg/gm

The results for these analyses are considered within acceptable limits if the downwind high-volume does not have three times the suspended solids loading of the upwind high-volume. The following pages are examples of a high-volume memorandum to EG&G Idaho on the results of the weighings. Copies of the memo are given to the data clerk, Connie Nash, EG&G Idaho's representative onsite, and one to the Versar field files.

B. Weather Data

Once every few days, the weather chart for the applicable sampling days is removed from the weather instrument. The data must be correctly marked and two copies of the strip chart made. One copy of the chart goes to EG&G Idaho's representative onsite and one goes into the field files. The original strip chart also goes into our field files. The data is also filed by month like the daily reports.

SECTION 5. MISCELLANEOUS

A. Generators

The generators are to have their oil changed at least once per week. Along with changing the oil, the spark plugs should also be removed and cleaned or changed, if necessary. During sampling, the oil was checked twice each sampling day to monitor the oil levels in the generators. Add oil as needed. If a generator is using excessive amounts of oil, check the oil more often. If there is an available spare generator, it may be better to change the poorly functioning generator with the spare. Any actions regarding the maintenance of the generators needs to be logged and initialed. It is paramount that the generators not run out of oil and burn up. The excavations should not be halted due to a failure of the air-monitoring equipment.

B. Other Paperwork

In the afternoons, EG&G Idaho issues an "Operational Plan for the Day" for the following day of operation. This document explains the plots that will be excavated for the next day, and it is to be used to determine where the center of excavation operations are to be for plotting the positioning of the air monitors according to the wind direction. This document is filed upon completion of its use in the field files. The monitoring checklist and troubleshooting guide are posted in Versar's trailer, and additional copies are available in the field files.

APPENDIX D

CALIBRATION PROCEDURES FOR POLYURETHANE FOAM (PUF)
AND HIGH-VOLUME MONITORS

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APPENDIX D

CALIBRATION PROCEDURES FOR POLYURETHANE FOAM (PUF) AND HIGH-VOLUME MONITORS

Calibration of Polyurethane Foam (PUF) Monitors

1. The PUF monitors are calibrated without either the PUF cartridges or the borosilicate particulate filters in the PUF module. The empty glass filter holder is kept in the unit to ensure a proper seal through the module.

2. Remove the filter-retaining ring from the top of the module by loosening the thumbnuts, flipping the screws down, and lifting the ring off the module. Install the calibration orifice meter (GMW-40 Orifice Calibrator) on the top of the PUF module and tighten the thumbnuts back down on the meter.

3. Connect the tubing from the U-tube manometer to the brass nipple on the calibrator. Hang the manometer from the side of the sampler so it hangs straight down. Ensure that the liquid level in the two arms of the manometer are equal before proceeding. If they are unlevel, shake the manometer to see if the liquid will level out. If this fails, check to see if the plastic nipple screws are tightened all the way down. These fittings should be backed off about one to one-and-a-half turns from completely tight.

4. Find the ball valve inside the unit and open the valve completely.

5. Turn the sample on the manual switch and let the unit warm up for 5 minutes.

6. Loosen the locking nut on the voltage regulator located on the time counter of the sampler. Using a screwdriver, adjust the voltage regulator until the magnehelic gauge reads 90 inches of water. Record

this magnehelic reading and the difference in true inches of water between the two legs of the U-tube manometer.

7. Using the ball valve, adjust the ball valve and adjust the flow on the sampler unit until the magnehelic gauge reads 80. Record both the magnehelic reading and the differences in inches of water on the manometer.

8. Repeat step 7 for magnehelic readings of 70, 60, and 50 inches of water and record the data.

9. After completing the data readings from Step 8, reopen the ball valve again until the magnehelic gauge reads 80 inches of water. This reading roughly corresponds to 10.5 cubic feet per minute (cfm) that is the desired flow rate for the PUF sampling at NCBC.

10. Using the calibration data supplied by the manufacturer for the orifice meter and the true inches of water from the U-tube, read the flow rate in cubic feet per minute from the abscissa of the curve. Record this measurement with the magnehelic readings of each instrument on a calibration sheet.

11. Plot the magnehelic reading against the flow in cfm on the calibration data sheet. Plot a straight line which fits best through the data points, and this is the calibration curve for that instrument and PUF module.

12. When operating the PUFs, be sure that the proper PUF module is fitted to each sampler as the combination of the two are what has been calibrated.

13. Calibration of these monitors should be performed on a monthly basis and the calibration curves and data maintained in a separate calibration logbook.

Calibration of High-Volume Monitors

1. Install a borosilicate filter in the high-volume monitor and insert the calibrated orifice meter (Sierra Model 330 Calibrator) over the filter and tighten the thumbscrews.

2. Hang the U-tube manometer from the side of the sampler and ensure that the liquid in both legs of the manometer is level.

3. Connect one leg of the manometer to the brass nipple of the orifice meter and turn on the monitor. Allow the instrument to warm up for about 5 minutes.

4. The two older high-volume samplers do not have voltage regulators and must be flow rated at the beginning and ending of a sampling period. After the instrument has warmed up, read the difference in inches of water on the manometer and record it. Read the flow rate off of the calibration curve for the Model 330 meter. The average of the flow rates from the beginning and ending of a sampling period is the flow used to calculate the volume of air sampled during that time.

5. The new high-volume monitors do have voltage regulators, and these units are to be set at a flow rate of 40 cfm. There is an anemometer on the sampler that is used to maintain a constant flow rate after a flow rate is established. After the sampler has warmed up, adjust the voltage regulator until there is a liquid level differential of 5.3 inches on the U-tube manometer. This reading corresponds to a flow rate of 40 cfm on the calibration curve. Record the inches of water on the straight tube manometer on the sampler. This pressure differential should be maintained during sampling to ensure a flow rate of 40 cfm.

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