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VOL IV

FULL-SCALE INCINERATION SYSTEM DEMONSTRATION AT THE NAVAL BATTALION CONSTRUCTION CENTER, GULFPORT, MISSISSIPPI - VOL IV: INCINERATOR OPERATIONS

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This technical report is divided into eight volumes. This portion of the report comprises Volume IV, Incinerator Operations. This 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 99.999T), and (3) determination of the cost and reliability of using the incinerator on a long-term basis. This volume provides a general background section; a brief description of the process equipment, operations planning and implementation, field operations, analytical procedures and results; and a conclusion and recommendation section.

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EXECUTIVE SUMMARY

The Naval Construction Battalion Center Demonstration Project was conducted as part of the research test and evaluation phase of the U.S. Air Force Environmental Restoration Program sponsored by the Air Force Engineering and Services Center. The overall goal of the project was to determine the cost and effectiveness of a 100 ton/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 ton/day incinerator to destroy soil contaminated with constituents of Herbicide Orange, in particular 2,3,7,8-tetrachlorinated dibenzo dioxin (TCDD).

The second phase demonstrated the ability of the incinerator to meet the requirements of the Resource Conservation and Recovery Act, 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.

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 volatize 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 SCC. The treated soil (ash) was removed from the quench tank and stored in rolloff boxes awaiting laboratory analysis. Upon receipt of satisfactory analytical results, the treated soil was removed from the rolloff boxes and placed back in the field. None of the treated soil required reprocessing.

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

This report is the fourth of eight volumes. It includes a general background section, a brief description of the process equipment, an operations planning and implementation section, a field operations section that includes a detailed description of the process equipment, an analytical procedure and results section that describes the methods and protocols as well as the ash sample analysis and publicly owned treatment works water analysis, and finally a conclusion and recommendations section.

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 Public 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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TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AFESC	Air Force Engineering and Services Center
DAS	Data Acquisition System
DOD	Department of Defense
DOE	Department of Energy
DRE	Destruction and Removal Efficiency
DRMO	Defense Reutilization and Marketing Office
EML	Environmental Monitoring Laboratory
ENT	Effluent Neutralization Tank
EPA	Environmental Protection Agency
GC/MS	Gas Chromatograph/Mass Spectrography
HO	Herbicide Orange
HRGC	High Resolution Gas Chromatograph
HSWA	Hazardous and Solid Waste Amendments
INEL	Idaho National Engineering Laboratory
ITAS	International Technologies Analytical Services
JI	Johnston Island
LRMS	Low Resolution Mass Spectrometry
MPC	Maximum Possible Concentration
NCBC	Naval Construction Battalion Center
ND	Nondetectable
POTW	Publicly Owned Treatment Works
PPB	Part Per Billion
PPM	Part Per Million
PPT	Part Per Trillion
PQL	Practical Quantification Limit
RCRA	Resource Conservation and Recovery Act
RD&D	Research, Development, and Demonstration
SCC	Secondary Combustion Chamber
USAF/OEHL	United States Air Force Occupational and Environmental Health Laboratory

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 ENSCO Environmental Services of Little Rock, Arkansas was selected for this Air Force Full-Scale Demonstration. The former HO storage site at the 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 hexachlorodibenzo-p-dioxin and respective isomers of polychlorodibenzofuran to less than one part per billion (ppb). The overall soil treatment goal was to reduce the contaminants to criteria approved by Environmental Protection Agency (EPA) Headquarters, 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 (HSWA) 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 primarily composed 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. The 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 the Interior jointly announced the suspension of certain uses of 2,4,5-T. This suspension resulted from published studies indicating that 2,4,5-T was a teratogen. Subsequent studies revealed that the teratogenic effects resulted from a toxic contaminant in the 2,4,5-T identified as 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 U.S. 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:

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

2. 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.

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

4. 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 (OEHL), 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 Air Force used the technical capabilities of the Department of Energy's (DOE) Idaho National Engineering Laboratory (INEL) and, in particular, EG&G Idaho, a DOE contractor.

In 1985, the Air Force and EG&G Idaho coordinated a site characterization study (Reference 1). The Air Force 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 Air Force still had little data to predict the cost and feasibility of remediating large quantities of contaminated soil. The Air Force, in coordination with EG&G Idaho, proceeded with 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 Environmental Services Company, Pyrotech Division, now known as 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. International Technologies Analytical Services (ITAS), 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 Resource Conservation and Recovery Act (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 November 23, 1987. Testing and remediation continued until November 19, 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 the NCBC at Gulfport, Mississippi. 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 6-10-inch hard pan 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 1970-77. 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 towards 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.

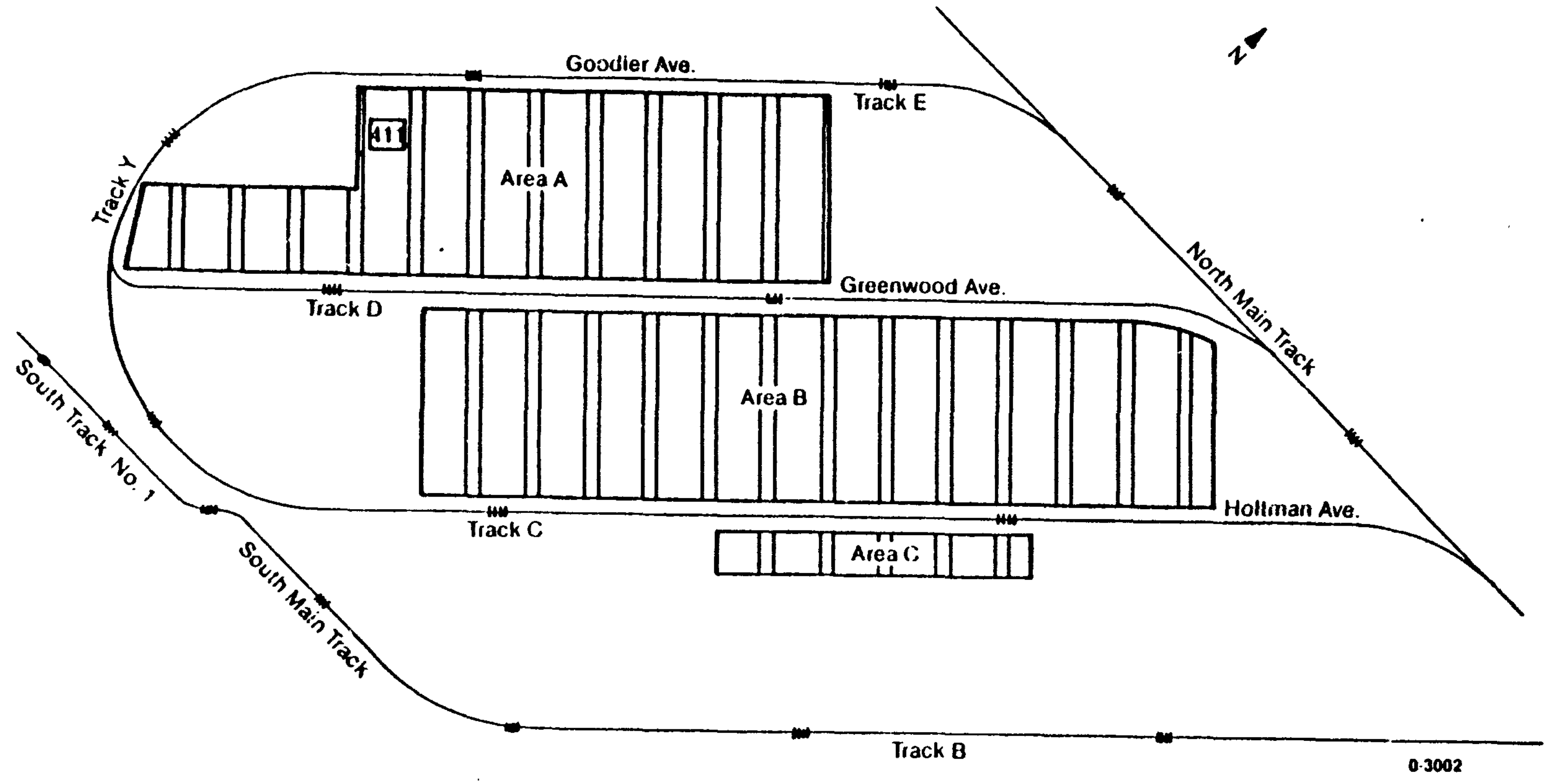

Figure 1. Former Herbicide Orange Storage Site.

In the late 1970s, the Air Force Occupational and Environmental Health Laboratory (OEHL) conducted studies that determined that dioxin was migrating slowly offsite via the drainage ditches. Based upon those studies, the Air Force 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 1977-78 and in 1980-82. Over 1,700 samples and 200 quality assurance 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 to 5 feet. The sampling program for Areas B and C conducted in 1986-87 consisted of 920 surface samples with an additional 87 samples collected for quality assurance purposes.

C. SCOPE/APPROACH

This report will describe the incinerator operations and decontamination/demobilization tasks in support of the remediation task. Planning and implementation, using the technologies and processes, are described, followed by an account of actual field events.

SECTION II

DESCRIPTION OF TECHNOLOGY USED

This section provides a brief description of the MWP-2000 incinerator system components. More detailed descriptions of the incinerator can be found in Section IV of this report and in Reference 2.

A. GENERAL DESCRIPTION

The ENSCO incinerator system (Mobile Waste Processor--MWP-2000) was designed and fabricated by ENSCO at their White Bluff, Tennessee, manufacturing facility. The MWP-2000 incinerator is a modular system designed to destroy and detoxify solid, semi-solid, and/or liquid wastes. Most of the components of the system are installed on flatbed trailers, platforms, or skids to facilitate the movement of the system from location to location in order to perform onsite cleanup of contaminated sites.

Figure 2 shows an overall view of the MWP-2000 incinerator system as it was installed at the NCBC site. Figure 3 is a system flow schematic. Principal components of the unit are:

- Waste feed system
- Rotary kiln with outlet cyclones
- Secondary Combustion Chamber (SCC)
- Air pollution control train consisting of
    - Effluent neutralization unit
    - Packed tower
    - Ejector scrubber, demister, and stack.

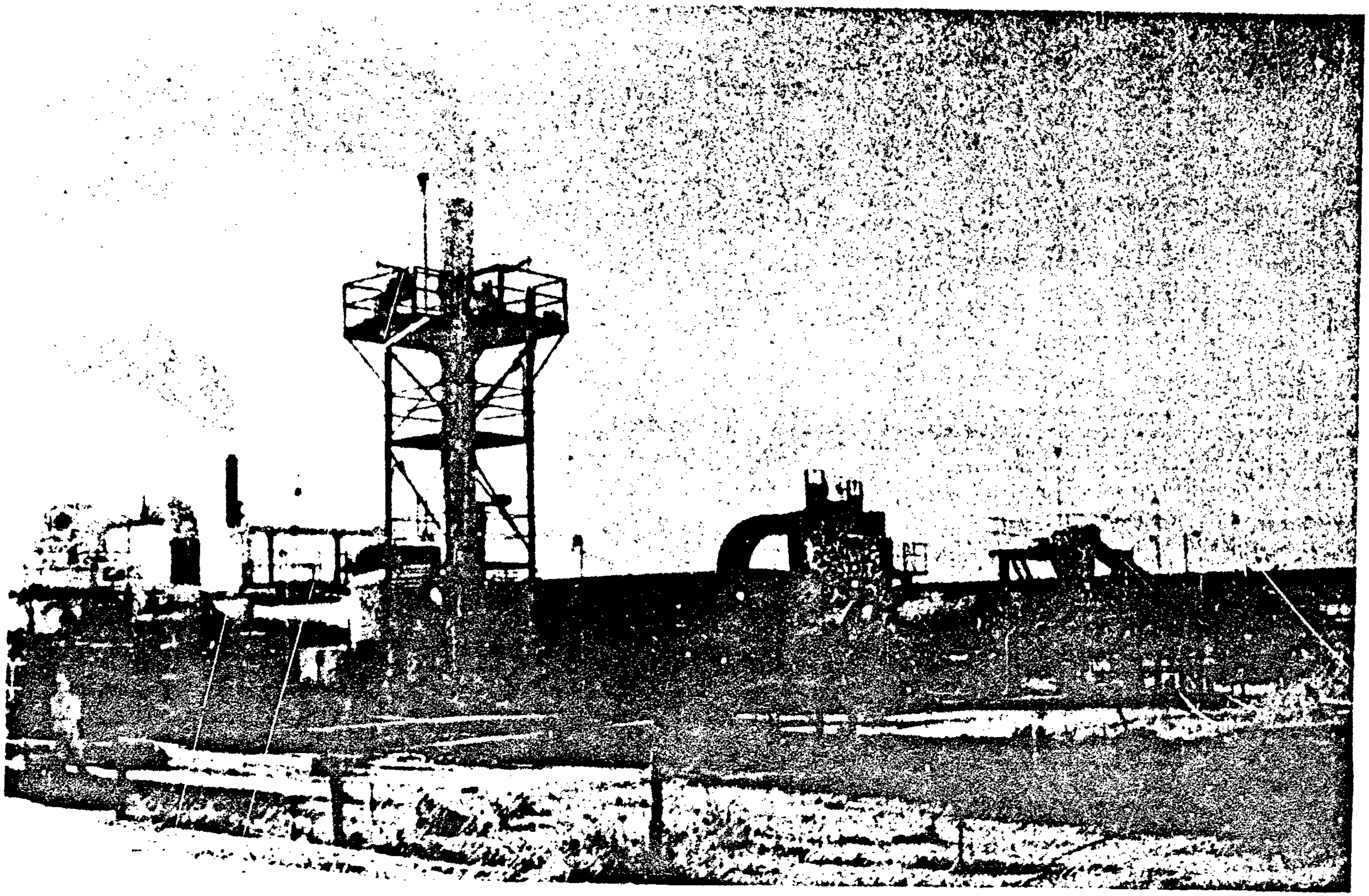

Figure 2. Overall View of MWP-2000 Incinerator System.

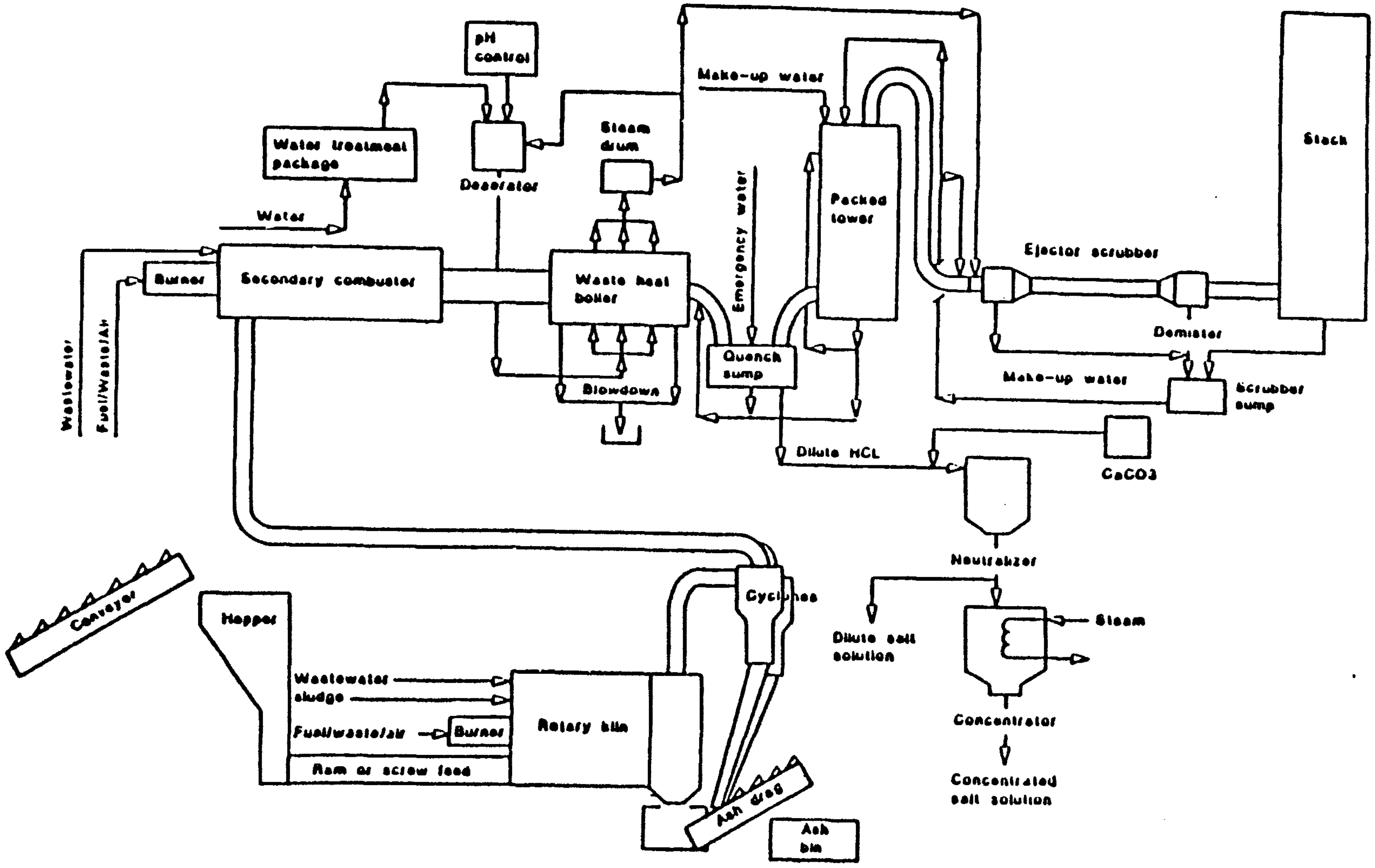

Figure 3. System Flow Schematic.

The auxiliary components of the unit are:

- Waste heat boiler and steam drum
- Boiler water treatment unit
- Ash removal unit
- Effluent settling unit
- Effluent holding tanks.

B. PROCESS DESCRIPTION

1. Waste Feed System

Contaminated soil was transferred from the soil storage area to the weigh hopper using a front-end loader. After recording the weight of the contaminated soil in the weigh hopper, the soil was dropped into a shredder. As the soil passed through the shredder, it dropped onto a covered conveyor belt, which carried the material to the feed hopper/feed auger located on the front of the rotary kiln. The feed auger then pushed the soil into the kiln for processing.

2. Rotary Kiln and Cyclones

The rotary kiln is a carbon steel cylinder, lined with 6 inches of fire brick mounted horizontally on a custom semi-trailer. The kiln has an interior diameter of 5.5 feet and an interior length of 30.0 feet. The kiln is mounted so that it can be declined (front to back) as much as 4 degrees; it is capable of being rotated from 0.5 to 4.0 revolutions per minute (rpm).

3. Secondary Combustion Chamber

The secondary combustion chamber (SCC) is a carbon steel cylinder mounted horizontally on a custom semi-trailer. It is lined with 2.25 inches of insulating brick and 4.50 inches of fire brick. It has an interior diameter of 6.6 feet and an interior length of 40.0 feet. It is designed to further burn the gases discharged from the rotary kiln.

4. Air Pollution Control Train

The air pollution control train consists of a quench system, packed tower, ejector scrubber, stack, and effluent neutralization tank (ENT). This equipment train was designed to cool and remove acid and submicron particulate from the gases that exited the waste heat boiler and to neutralize the effluent generated in this train.

C. PROCESS MONITORING AND CONTROL

The incineration process is remotely monitored and controlled from an operators panel located in a mobile control room trailer. This panel provides the operator with indications of process system parameters and those manual controls necessary to adjust system variables to required operating conditions. The panel includes numerical and status light indicators, switches, video monitors, and computer monitor (many of which are shown in Figure 4).

Central to the control process is monitoring by a personal computer-based data acquisition system (DAS). The DAS collects data from electronic instruments that include a variety of thermocouples, pressure transducers, and level indicators. A complete list of the instruments is provided in Reference 2. In addition, the stack gas emissions are continuously monitored for carbon monoxide, carbon dioxide, and excess oxygen content. The combustion efficiency being achieved by the MWP-2000 incinerator system is continually calculated by the DAS from readings from the carbon monoxide and carbon dioxide monitors.

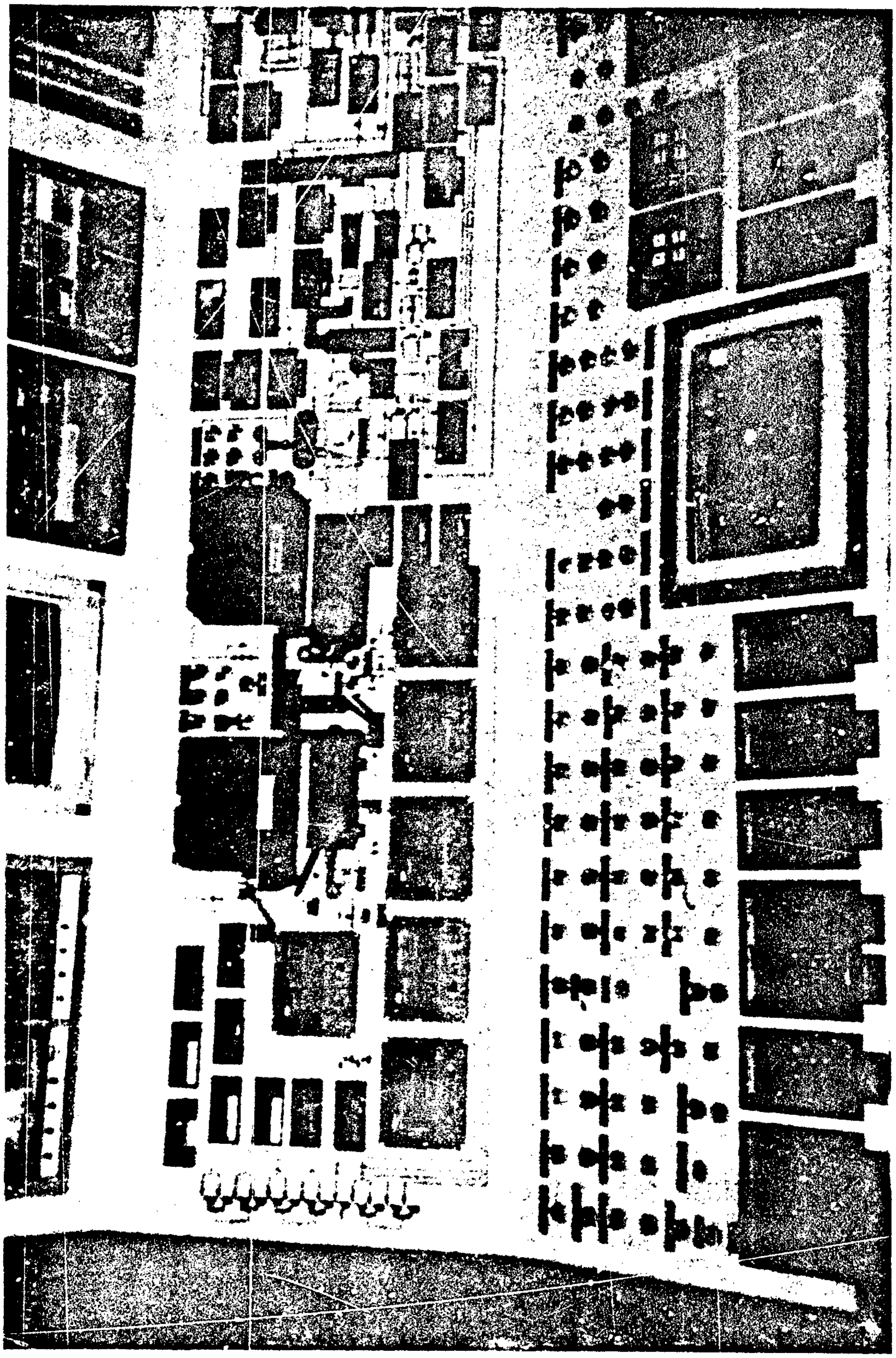

Figure 4. View of Incinerator Operator's Control Panel.

When active, the DAS also is able to automatically stop waste feed if certain operational parameters fall outside of the EPA permit specifications or if the flame to the kiln or SCC fails. Details of the automatic waste feed shutoff (AWFSO) system are provided in Reference 2.

SECTION III
OPERATIONS PLANNING AND IMPLEMENTATION

A. ORGANIZATION

The operational staff consisted of four shifts, each made up of one shift supervisor, two control board operators, and two material handlers. The shift supervisors reported to the Plant Superintendent. Each shift worked approximately fourteen 12-hour shifts each month. A typical monthly shift operations schedule is shown in Table 1.

The duties of the operators consisted of operating the control room process instrumentation and taking hourly readings on various systems outside the control room. One operator manned the control room while the second operator performed the system checks. The material handlers main duties were to transfer soil from the soil storage tents to the weigh hopper, and to transfer processed soil (ash) from the ash conveyor system to the ash storage bins. They performed other duties as required to process soil.

B. HEALTH AND SAFETY

The ENSCO Health and Safety Plan used at the NCBC Demonstration Project was adopted by the other subcontractors as well as by EG&G Idaho. This was done to avoid the confusion of each contractor/subcontractor having their own set of safety rules or having to spend the time and money to ensure all health and safety requirements would be compatible.

The ENSCO Plan provided general guidance for project personnel working under normal operational conditions and specific abnormal operational conditions such as equipment malfunctions, spills of hazardous substances, fires, and adverse weather conditions.

The complete ENSCO Health and Safety Plan is included in Reference 2.

TABLE 1. OPERATIONS SCHEDULE NOVEMBER 1988.

	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Date			1	2	3	4	5
Day			A	A	A	B	B
Night			D	D	D	C	C
Date	6	7	8	9	10	11	12
Day	B	D	D	D	D	C	C
Night	C	C	B	B	B	A	A
Date	13	14	15	16	17	18	19
Day	C	B	B	B	B	A	A
Night	A	A	C	C	C	D	C
Date	20	21	22	23	24	25	26
Day	A	C	C	C	C	D	D
Night	D	D	A	A	A	B	B
Date	27	28	29	30			
Day	D	A	A	A			
Night	B	B	D	D			

A = A shift
B = B shift
C = C shift
D = D shift

C. SPARE PARTS

A formal spare parts list did not exist on the NCBC Demonstration Project. When a part was used, the person who used the part usually went to the purchaser and requested that one or two parts be ordered for spares. As a result, most parts were ordered on a rush basis.

D. SHUTDOWN PLANNING

Scheduled shutdowns were never routinely planned in advance on the NCBC Demonstration Project. The shutdowns depended solely on the quantity of particulate buildup in the SCC. As the particulate buildup attained a certain level, a decision was made to shutdown and clean the system out. After the decision was made to shutdown for cleaning, then other items were discussed for repair and/or replacement, time permitting.

Because of the heavy impact on incinerator operations, the only scheduled shutdown that was planned in advance was for moving the weigh hopper/shredder/conveyor system in August 1988. It was originally anticipated that it would take two weeks to tear the system down, relocate it to a position 90° from its original position, set the system up, and begin operations. Because of the extensive preplanning, the task was completed in 9 days.

E. DAILY OPERATIONS

For ENSCO operations there were two daily log books: one for the shift supervisors and one for the control board operators. The entries in the supervisor log book were usually very brief, one line statements listing the shift's activities. The entries in the operator log book were very definitive, listing individual times of the day that events or activities occurred. For this reason, the operator log book proved to be of significant value in obtaining information on the availability of the incinerator. A copy of the log book pages was kept not only in the daily files, but also in the scheduled/unscheduled maintenance file kept by EG&G Idaho site personnel.

A daily report was issued by the ENSCO Plant Superintendent listing: (1) the operating time in hours, (2) the on-line time for the previous 24 hours expressed as a percentage, (3) the tons of soil processed the previous 24 hours, (4) month to date operating hours, month to date on-line time expressed as a percentage, and (5) the month to date tons of soil processed. There was also space for a brief narrative on the activities of the previous 24 hours to explain unusual events or downtime.

The daily report was combined with copies of the shift supervisor log book entries, operator log book entries, daily operational checklists, and health and safety checklists to make up an operational package that was submitted daily to the EG&G Idaho site personnel.

The daily report was also transmitted to ENSCO offices in Little Rock, Arkansas and Buffalo, New York, and to the USAF, Tyndall Air Force Base, Florida.

The operational run time was based on the feed auger operating hours. The time the feed auger was not operating, expressed in hours and tenths of hours, was subtracted from 24 hours resulting in the incinerator (auger) run time for the day. The reasons for the feed auger not operating could be either scheduled/unscheduled maintenance or one of 17 operational interlocks.

SECTION IV
FIELD OPERATIONS

A. OPERATING PARAMETERS

This section describes the activities associated with field operations during the NCBC Demonstration Project. First, the RD&D permit operating parameters are listed, followed by a description of the process, procedures for ash and water sampling, decontamination/demobilization activities, a description of the ENSCO subcontract, and the costs to perform the field operations.

As specified by the RD&D permit, waste was fed to the incinerator only when the following conditions were met:

• Kiln Outlet Temperature	1450°F minimum
• SCC Outlet Temperature	2150°F minimum
• SCC gas residence time	1.65 s minimum
• Stack carbon monoxide	100 part per million (PPM) maximum
• Kiln pressure	negative
• Soil Feed Rate	5.3 ton/h maximum

A computerized process control system would automatically shut down the waste feed system if those conditions were not met.

B. SAMPLING PROCEDURES

The sampling procedures covered in this report are for ash and water. Soil sampling and air sampling are covered in the Soil Excavation Report (Reference 3). Ash and water samples were taken using the sampling techniques and procedures described in the Operational Sampling Plan for the

NCBC Demonstration Project.* A brief description of the ash and water sampling procedures follows.

1. Ash Sampling

Each full rolloff box of ash (treated soil) was sampled and held, pending satisfactory analytical results, before the ash could be removed from the ash storage rolloff box and returned to the excavated area for backfilling. A composite sample was obtained from each ash storage rolloff box from the previous day's soil processing, (i.e., a sample from each rolloff box was combined to make up a daily composite). The daily composite, as well as the individual rolloff box composites (individual composite samples were made up by taking several scoops of ash from various locations inside the rolloff box and mixing them) were all sent to the laboratory. The daily composite was analyzed first. If the results showed the concentration of 2,3,7,8-TCDD, total dioxins and total furans to be less than 1.0 ppb, the individual rolloff box samples were not analyzed. If the daily composite had a concentration of 1.0 ppb or greater 2,3,7,8-TCDD, total dioxins, or total furans, then the individual rolloff box composite samples would have been analyzed to determine would have been the contaminated ash was stored. However, all ash samples from this project were found to be well below the 1.0 ppb limits.

2. Water Sampling

Before waste water was allowed to go to the Publicly Owned Treatment Works (POTW) it was stored in the two 10,000 gallon POTW holding tanks. The waste water came from either the Effluent Neutralization Tank (ENT) or settling tank. Whenever one of the 10,000 gallon tanks was at least three-fourths full, the water was sampled and analyzed for pH, 2,3,7,8-TCDD, 2,4-D, and 2,4,5-T content per the State of Mississippi Water Pollution Control Permit (Appendix A). The sample had to be between 5.5 and

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* A copy of the Operational Sampling Plan for the NCBC Demonstration Project can be obtained from EG&G Idaho.

9.5 pH with nondetectable levels 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.

Because of analytical interference from suspended solids in the water sample, it was very difficult to obtain the required discharge parameters (nondetectable levels for 2,3,7,8-TCDD, 2,4-D, and 2.4.5-T). This required the laboratory to spend considerable time filtering the samples, making dilutions, and rerunning the analysis to verify the results.

To minimize the particulate carryover from the ENT and/or settling tank, a swimming pool sand filter was installed in the line leading from the unit to the POTW holding tanks. The sand filter was not effective in performing the desired task for several reasons: (1) it was an "off the shelf" item and not designed to remove the quantity of particulate transported from the ENT to the POTW holding tanks, (2) the holding tanks contained a large quantity of particulate from water transfer operations before the sand filter was installed, and (3) the quantity of particulate from the ENT and the holding tanks overloaded the sand in the filter. To completely remove the particulate during sampling would have required several changes of sand in the filter every time the system was used, and this was not practical.

C. SOIL PROCESSING

1. Feed

As the soil was excavated, it was placed in one of three soil storage tents located near the incinerator. A soil storage tent is shown in Figure 5. Soil excavation is discussed in detail in the Soil Excavation Report (Reference 3).

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. Figure 6 shows the front end loader loading the weigh hopper, while Figure 7

Figure 5. Soil Storage Tent.

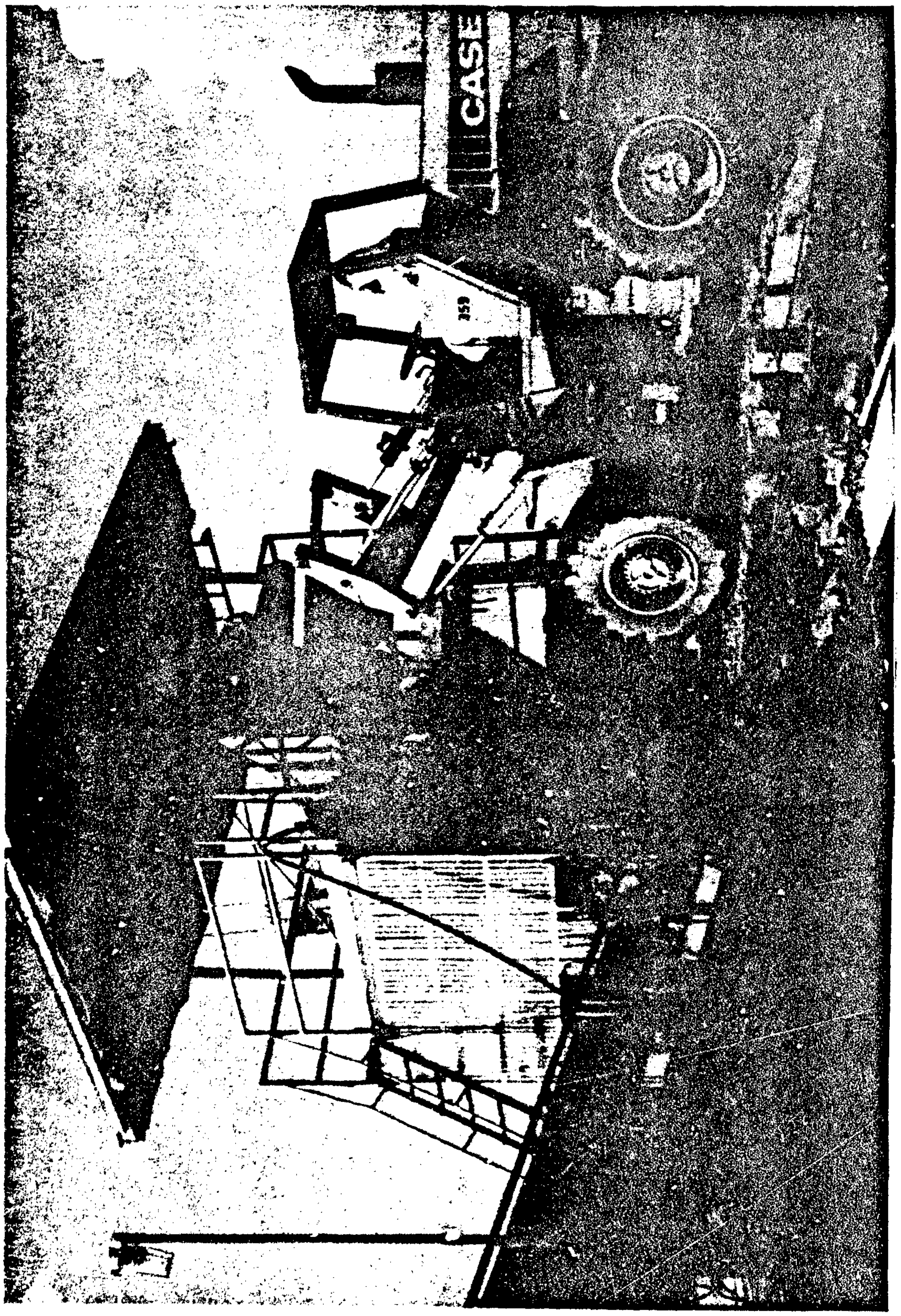

Figure 6. Front End Loader.

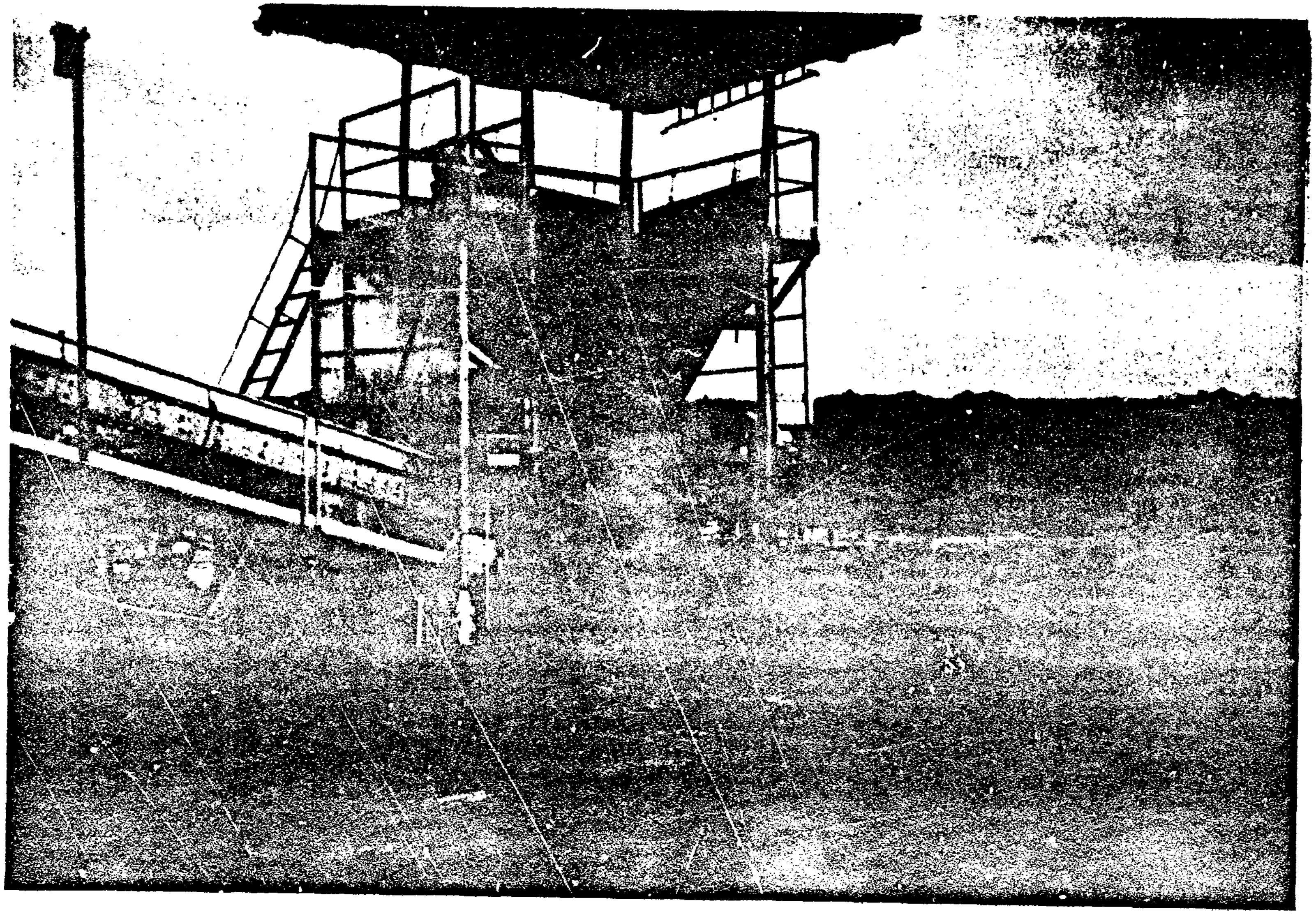

Figure 7. View of Weigh Hopper, Shredder, and Covered Convevor.

shows the shredder, which is located below the weigh hopper and the covered conveyor belt.

The covered conveyor belt carried the soil to the feed hopper where the auger fed the soil into the rotary kiln incinerator. The auger, located inside the feed hopper, is shown in Figure 8.

2. Primary Incineration

The rotary kiln is primarily designed to burn or detoxify hazardous waste. Detoxification occurs by thermal desorption of organics from the solid waste. Because of the high temperatures, however, the kiln will compost and destroy some of those desorped organics. Additionally wastewater and other liquid materials can be processed by injection through nozzles located near the burner.

The soil in the rotary kiln was subjected to a minimum temperature of 1450°F for 20 to 40 minutes to volatilize the organics. The amount of time the soil was kept at 1450°F depended on the auger feed rate, kiln rotational speed, and the angle of kiln declination. For this project, the maximum permissible feed rate was 5.3 ton/h. At this feed rate, the kiln rotational speed was maintained at 1.5 rpm, and the kiln was declined approximately 2 degrees. The rotary kiln is shown in Figure 9.

3. Ash Collection

At the gas outlet of the kiln, the solids fall into an ash quench while the gases rise up and flow into the cyclone particle separators. The ash quench is a rectangular water tank into which the processed soil falls. The ash quench and cyclones are shown in Figure 10.

At the bottom of the ash quench is an ash drag conveyor that removes the process ash and places it into an ash bin (Figure 11). During the verification test burns, a rolloff box, shown in Figure 11, was used. The ash quench also serves as a seal between the process gases and the outside environment.

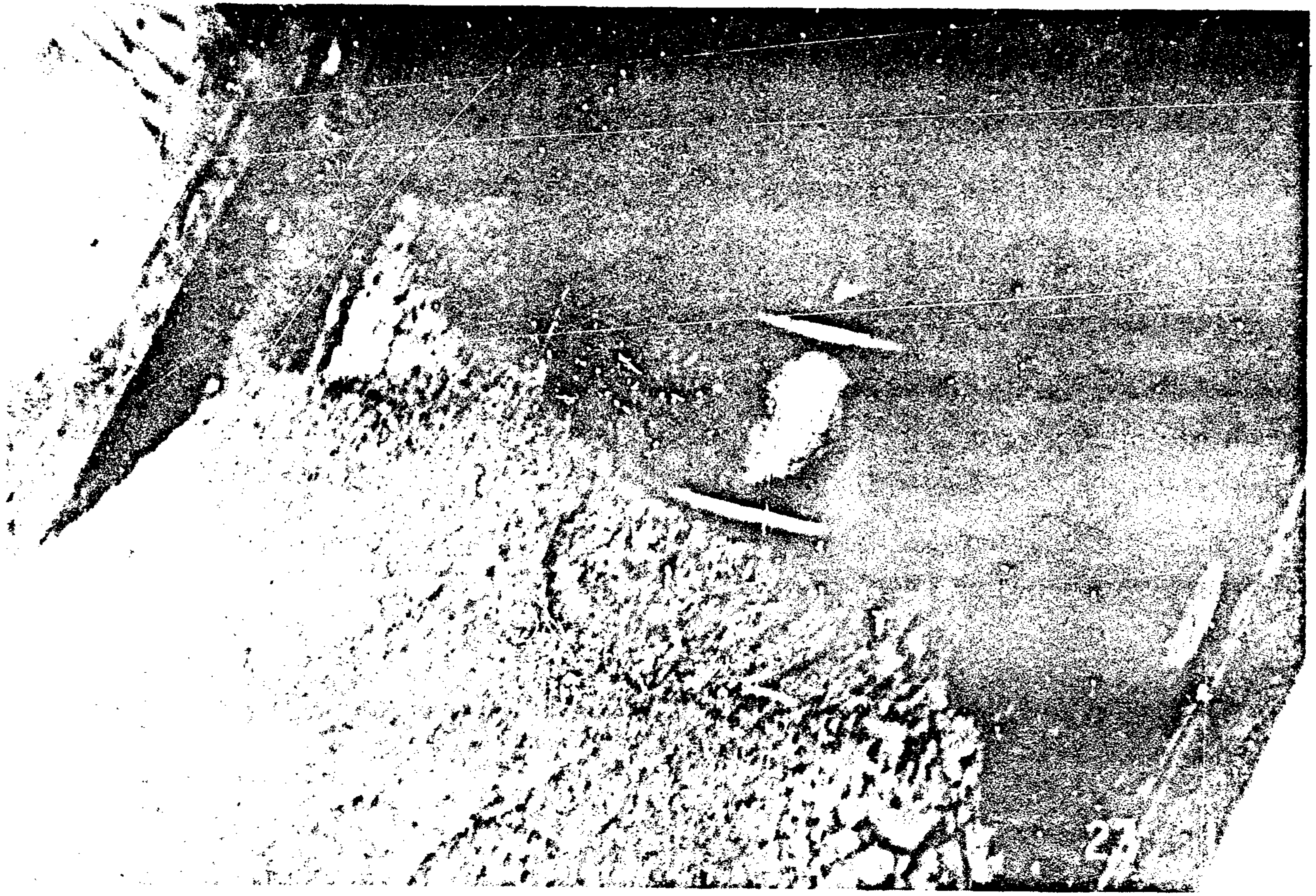

Figure 8. View of Rotary Auger Inside Feed Hopper.

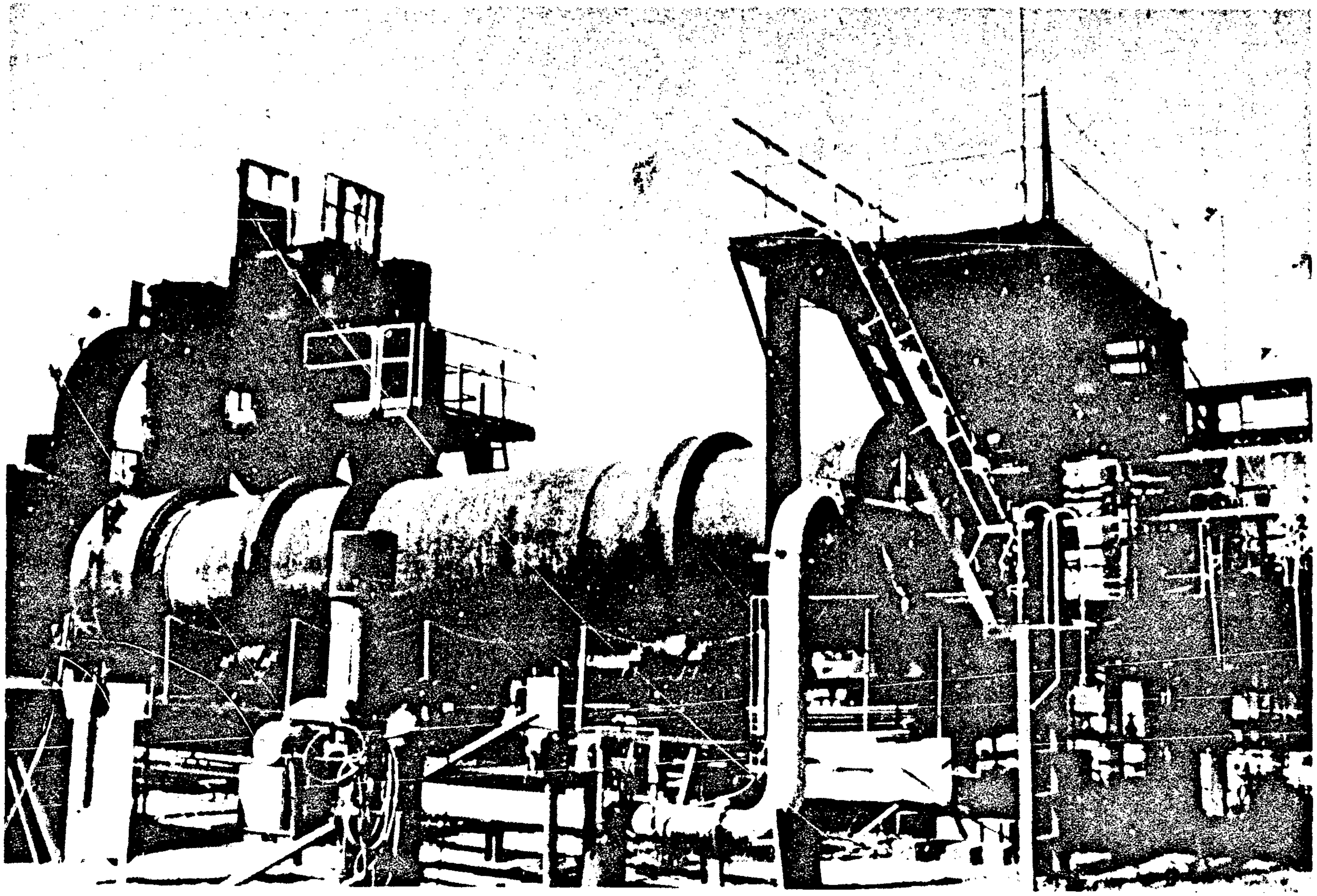

Figure 9. View of Trailer-Mounted Rotary Kiln.

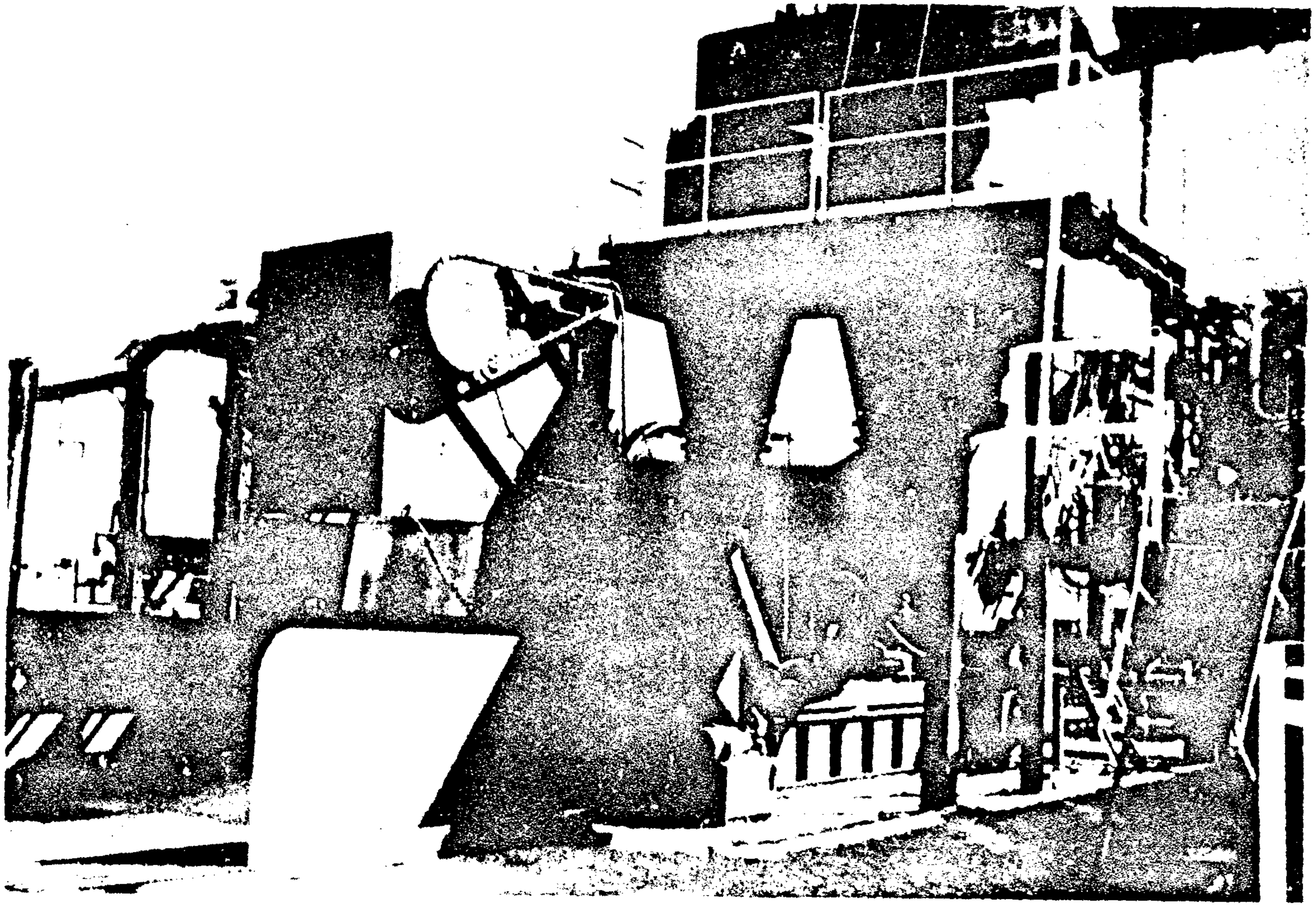

Figure 10. View of Cyclones and Ash Quench.

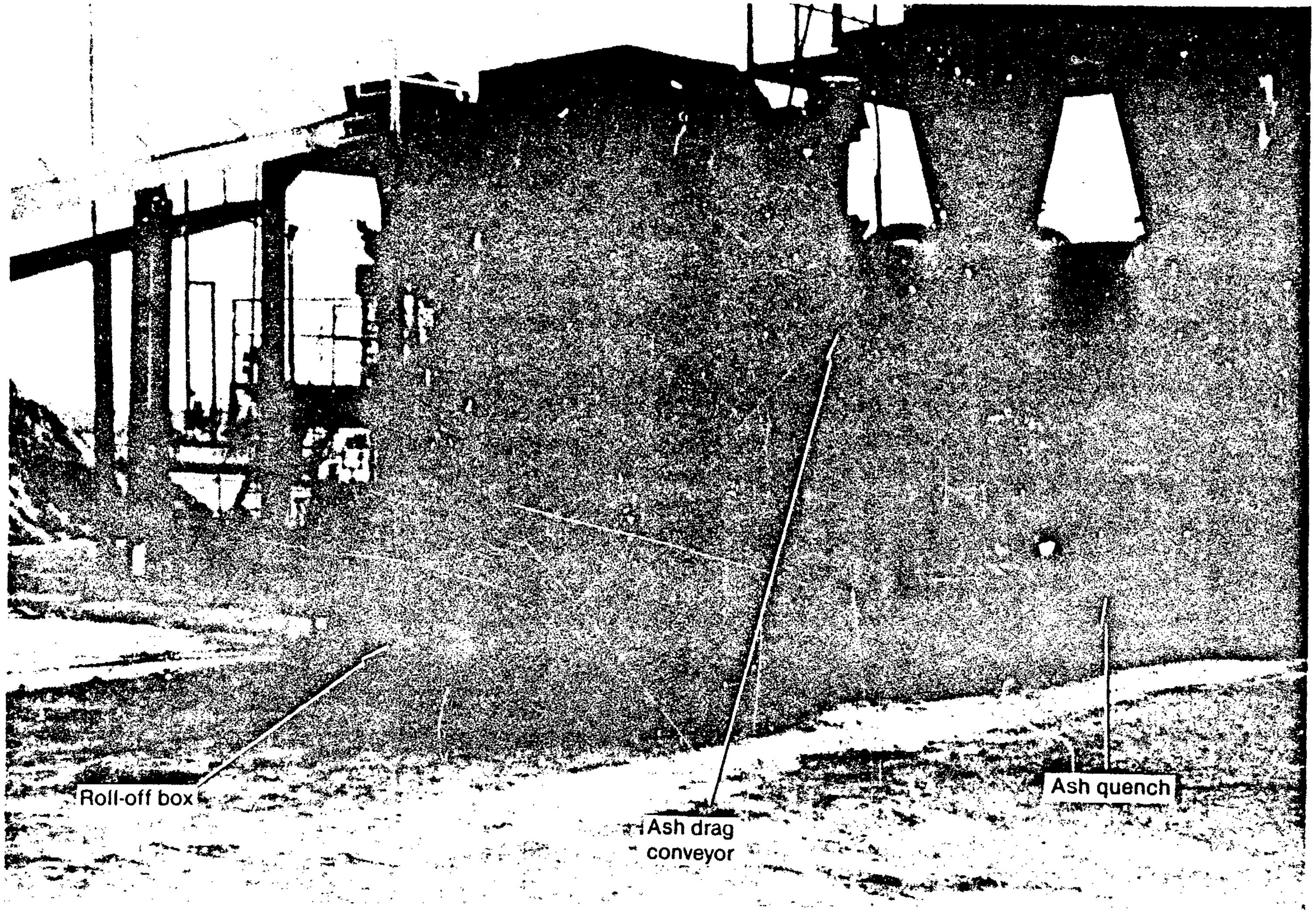

Figure 11. View of Ash Drag and Rolloff Box for Ash Collection.

4. Gas Stream Particulate Separation

The hot process gases flow from the kiln upward to the cyclone separators that remove the heavy particulate from the gas stream. The removed particulate falls down into the ash quench. Although the incinerator has two cyclones in parallel flow paths, only one cyclone was used for this project.

5. Secondary Combustion

The process gases leave the cyclone and flow into the Secondary Combustion Chamber (SCC), which raises the temperature of the process gas to 2,150°F. This high temperature combusts any remaining organics in the off-gas that were not combusted in the kiln. The SCC is approximately 40 feet long and sits on a flatbed tractor trailer (Figure 12).

The SCC is equipped with a vortex burner that is capable of producing approximately 24 million Btu/h by burning natural gas. The burner is capable of using fuel oil or propane in addition to natural gas; however, those fuels were not used during the NCBC Demonstration Project. Similar to the kiln, the SCC can burn liquid organics or contaminated water by direct injection of the liquid into the burner flame.

6. Gas and Liquid Effluent Waste Stream Control

Once the gases leave the SCC, they flow through a fire tube boiler that is designed to produce 250 psig steam by recovering heat from the off-gases. The waste heat boiler and its steam drum are shown in Figure 13. The steam produced in the boiler is used primarily for the ejector scrubber, which is discussed below.

In order to prevent molten and vaporous silica from the processed soil from glassifying onto the inside of the boiler tubes, water spray nozzles were installed between the SCC and the waste heat boiler. The

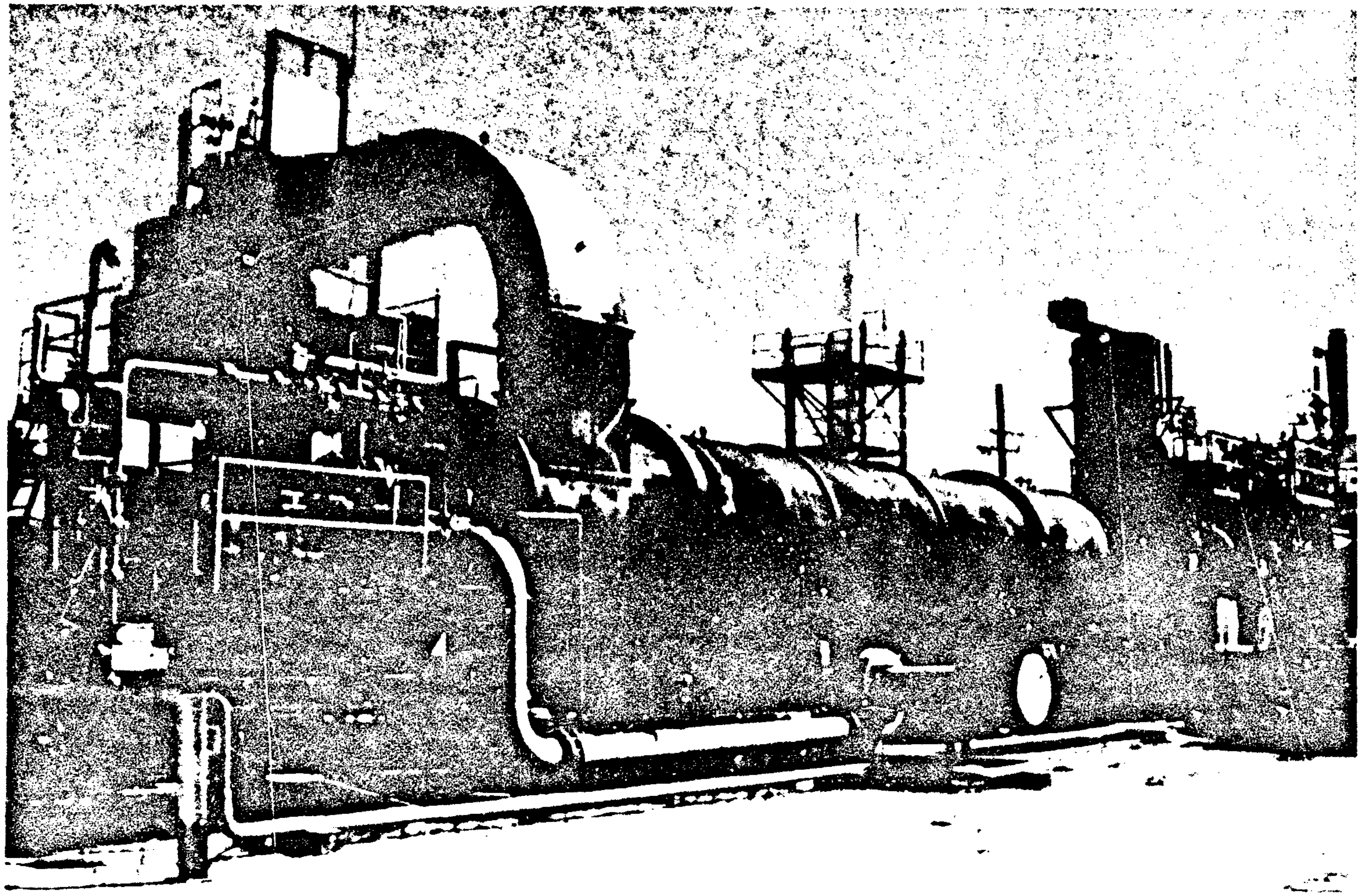

Figure 12. View of Trailer-Mounted Secondary Combustion Chamber.

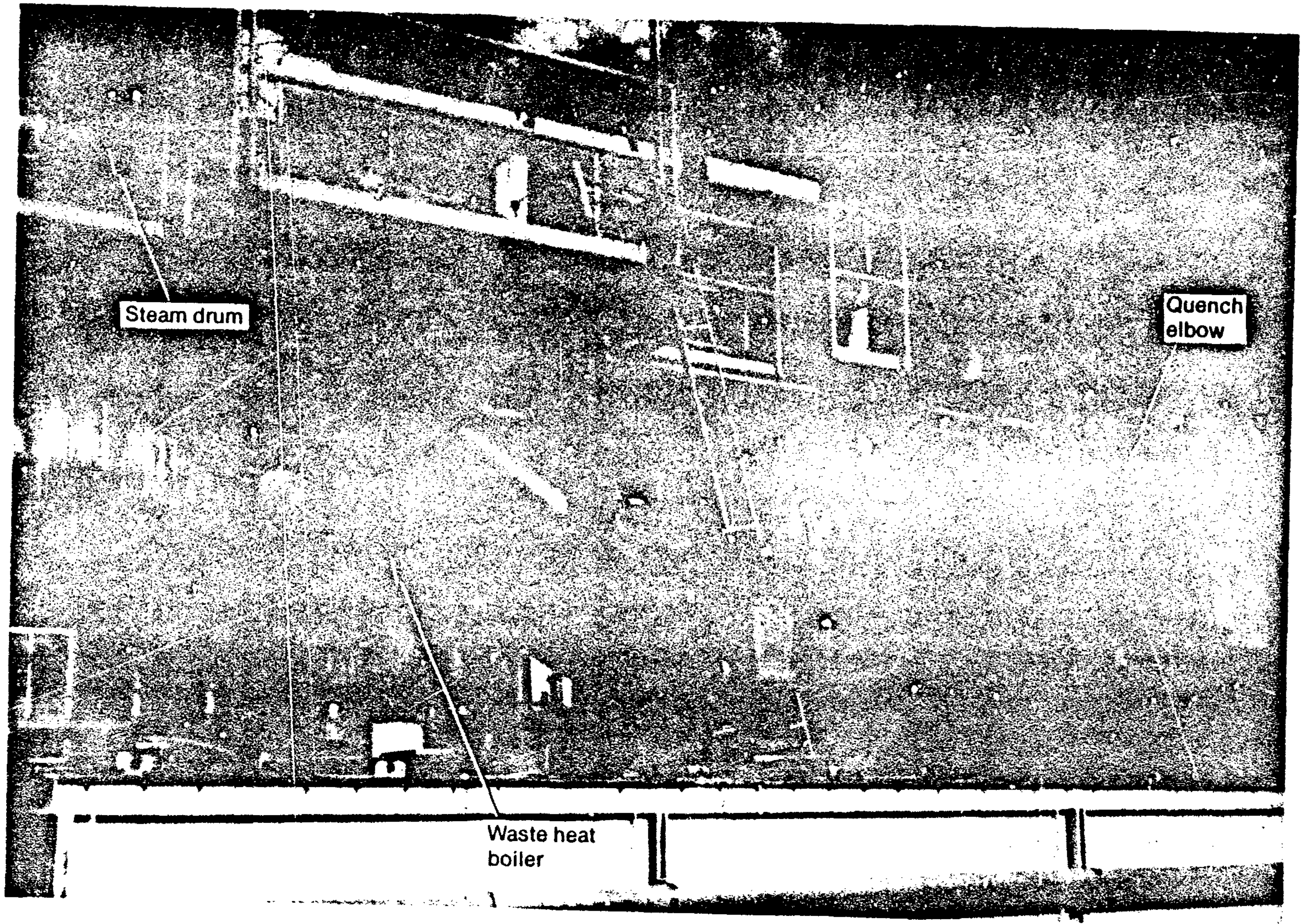

Figure 13. View of Waste Heat Boiler and Steam Drum.

injected water condenses the molten and vaporous silica so that the silica behaves as a particulate rather than as a gas and thus does not plate out onto the boiler tubes.

After the gases leave the boiler, they enter the quench elbow, which is the first device among a series of devices that control effluent gas emissions. The quench elbow, shown to the right of the waste heat boiler in Figure 13, is designed to cool the off-gas by direct water injection. The injected water cools the gases to approximately 170°F, thus allowing the use of fiberglass reinforced plastic for all downstream gas duct work. Additionally, the quench elbow removes some of the acid gases.

The excess water from the quench elbow is collected in the Effluent Neutralization Tank (ENT), which is in front of the quench elbow and packed tower shown in Figure 14. The ENT serves as the central collection point for all of the scrubber water used. The water collected in the ENT is used in a variety of scrubber applications. Caustic (e.g., NaOH) is occasionally added to increase the acid gas scrubbing efficiencies of the scrubbing water.

After the gases are cooled, they flow upward through the packed tower, which is a counter-current flow contact absorber, to remove acid gases (HCl) that may exit the quench zone. (Figure 15). Water is sprayed in the tower at the top and flows downward over plastic packing material, which maximizes its contact with the upward moving gases.

Upon leaving the packed tower, the gases flow into the ejector scrubber. The ejector scrubber, shown in Figure 16, serves two primary purposes: (1) to remove the fine particulate from the off-gases, and (2) to provide the motive force to draw the gases through the entire incinerator system. The ejector scrubber operates by injecting high pressure steam into the annular region of the ejector scrubber. The steam acts as the motive fluid in an ejector pump and also agglomerates the fine particles in the venturi section of the jet pump.

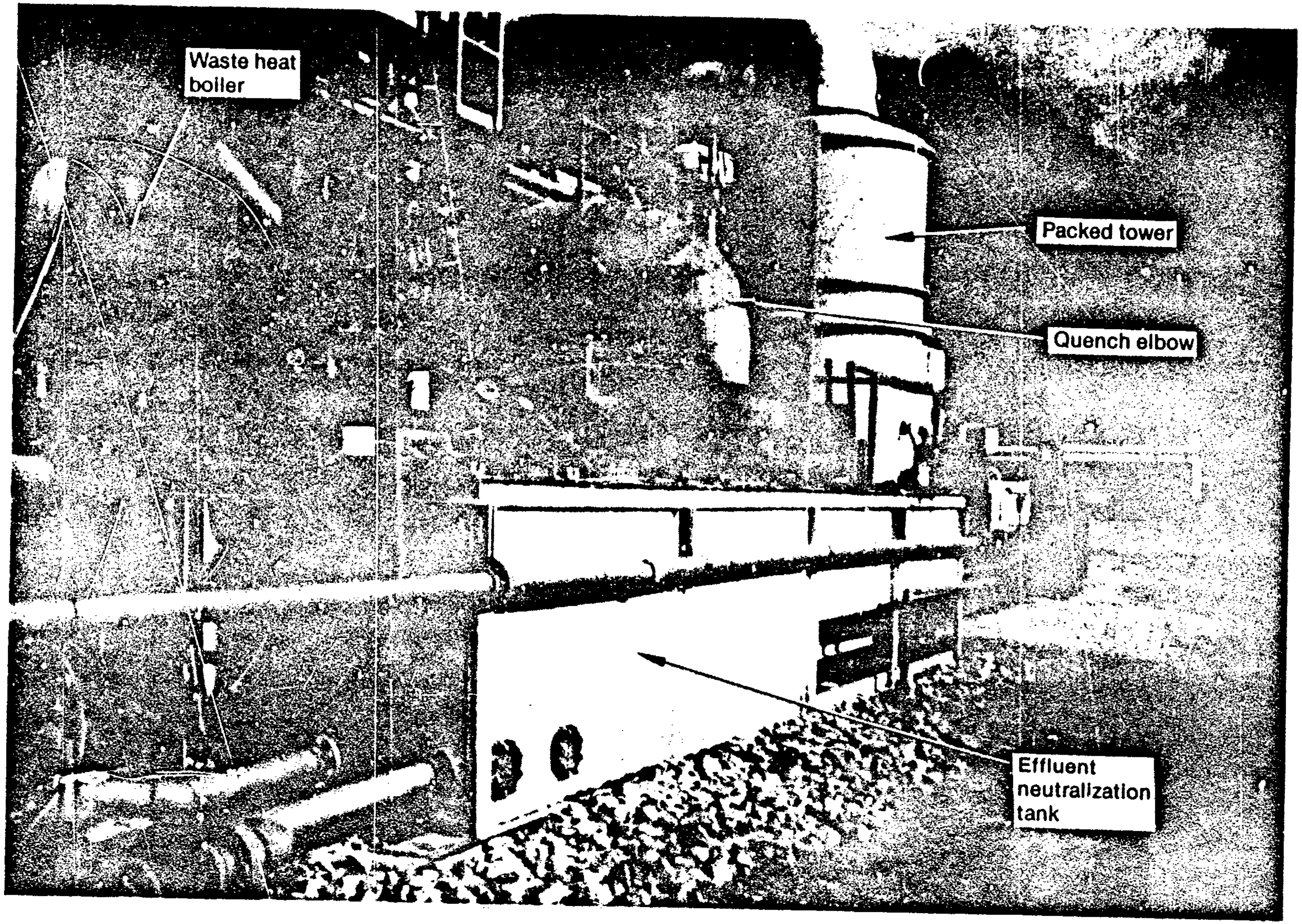

Figure 14. View of Effluent Neutralization Tank with Quench Elbow and Packed Tower.

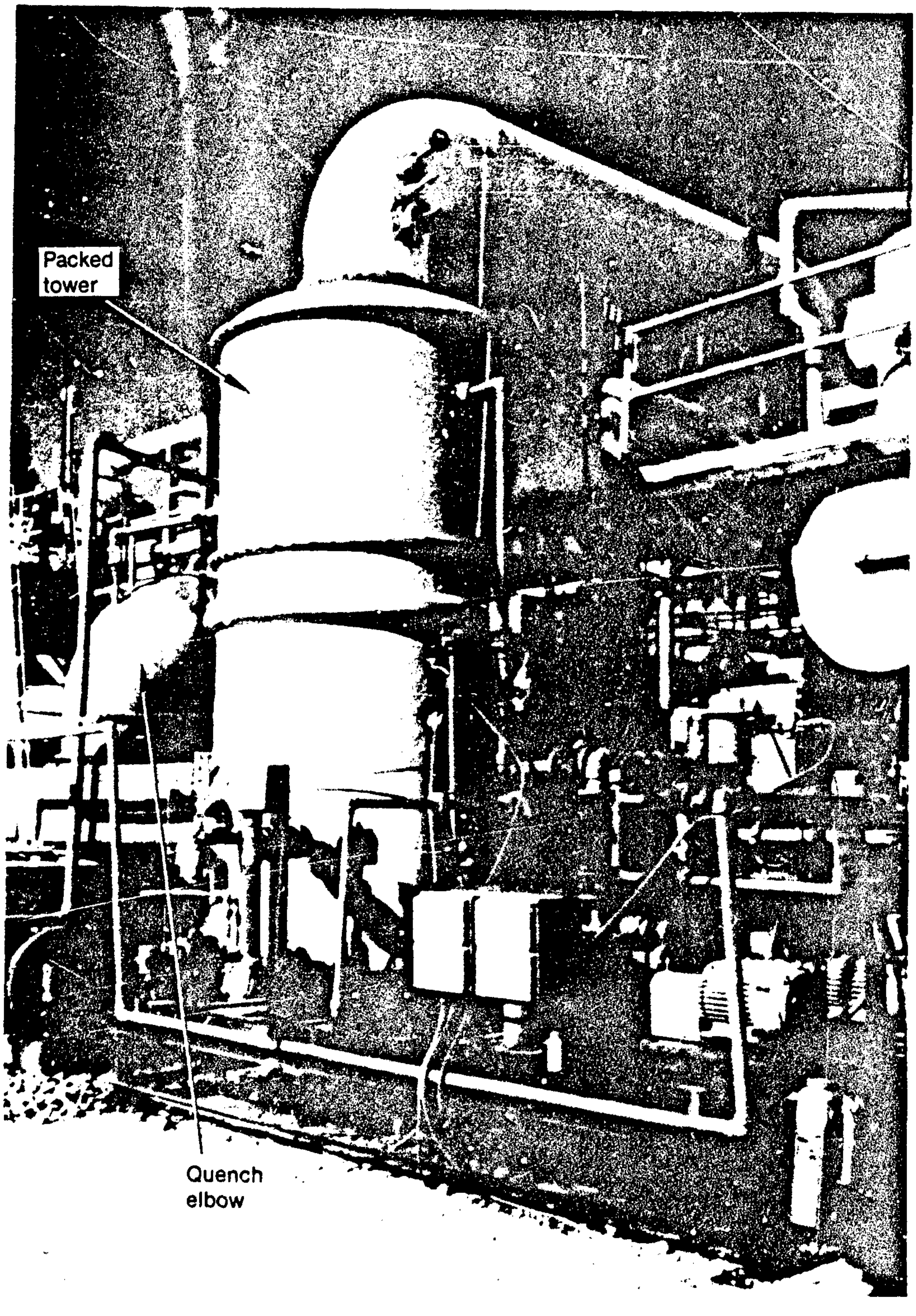

Figure 15. View of Skid-Mounted Packed Tower.

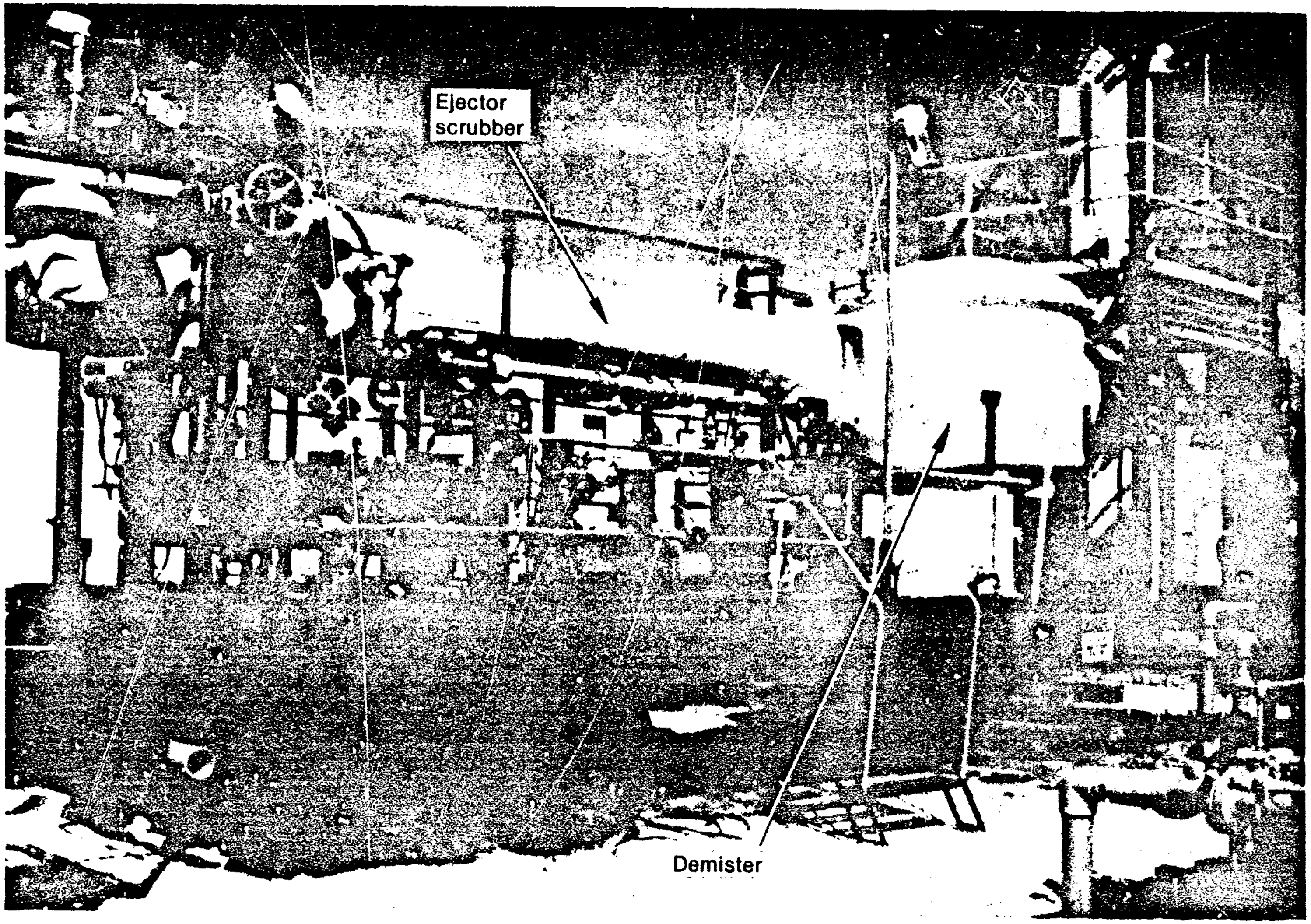

Figure 16. View of Trailer-Mounted Ejector Scrubber and Demister.

After leaving the ejector scrubber, the gases flow through a demister, also shown in Figure 16. The demister removes the condensate from the jet scrubber along with the agglomerated fine particulate captured in the condensate. The condensate water and particulate are pumped back to the ENT for recycling. The combustion gases and steam from the jet pump are then exhausted through the 40 foot tall stack, as shown in Figure 17 (see also Figure 2). The ejector scrubber, demister, and stack are mounted on a flatbed tractor trailer; however, the stack is installed at the field site.

D. DECONTAMINATION

The objective of the decontamination task was to decontaminate assorted vehicles, equipment, and miscellaneous material that were used in the NCBC Demonstration Project. Because the site was contaminated with HO, including trace levels of 2,3,7,8-TCDD, the equipment may have also been contaminated with 2,3,7,8-TCDD and therefore required cleaning before it was removed from the site.

The upper contamination limit was established at 40 ng 2,3,7,8-TCDD per square meter based on previous decontamination efforts by IT Corporation during the small scale demonstration (i.e., any equipment swipe sample result greater than 40 ng per square meter would require cleaning of the areas or item sampled). A minimum area swipe sample covered 0.25 square meters and had a 10 ng 2,3,7,8-TCDD upper limit before equipment cleaning was required. The 2,3,7,8-TCDD isomer was used rather than total TCDD since the 2,3,7,8-TCDD isomer is the predominent isomer in HO and is also considered the most toxic of the isomers.

During the decontamination task, any equipment that showed a positive 2,3,7,8-TCDD concentration (versus a non-detectable result), as indicated by the swipe sample results after the first decontamination effort, would be cleaned again in the appropriate areas even though the indication was below the above stated criteria.

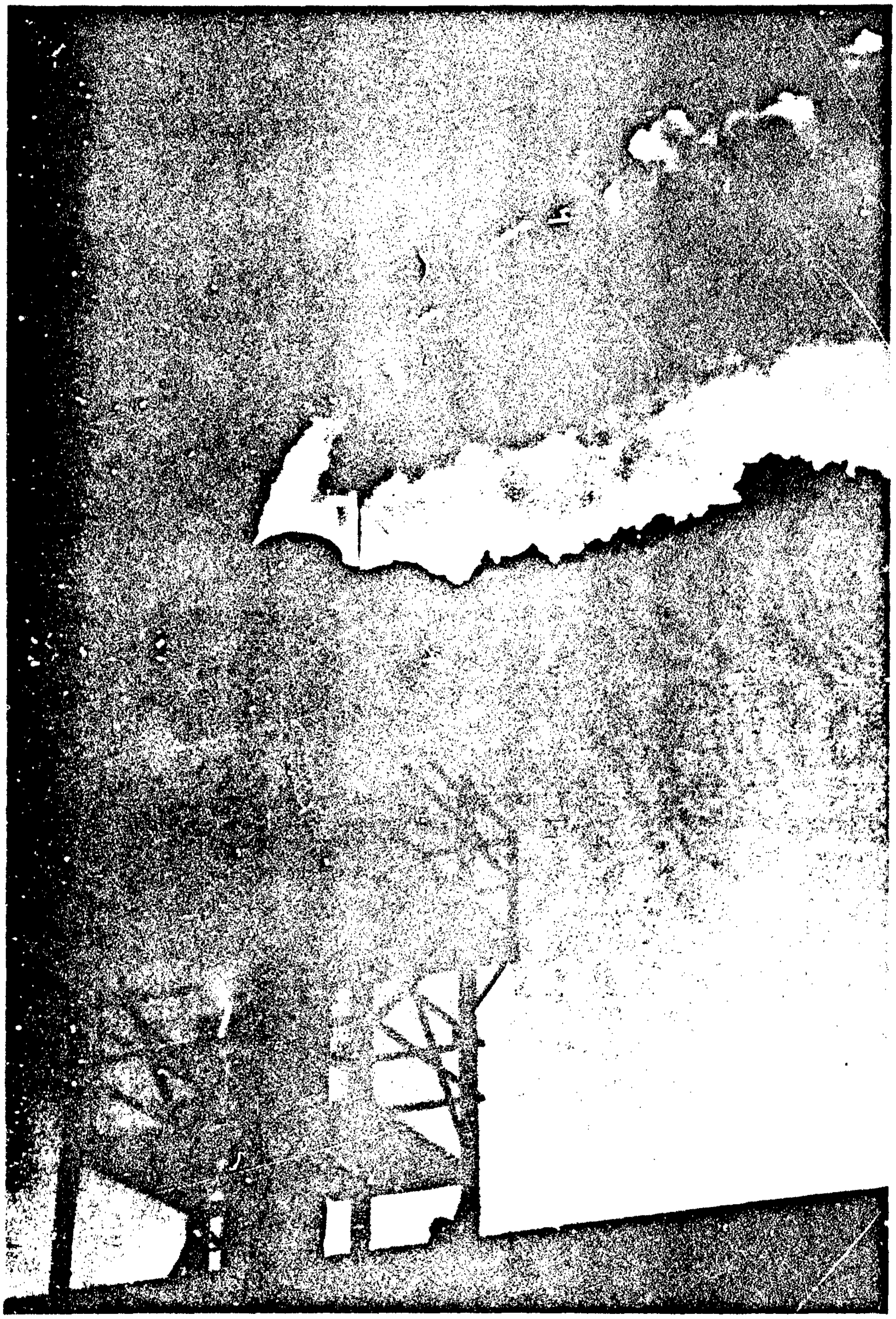

Figure 17. View of Incinerator Stack.

The general procedure to be employed for swipe samples was 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 could include as many as four swipes of 0.25 square meters each or as few as one. QA samples were to be equal to at least 10 percent of the actual numbers of swipe samples, and were to include duplicate samples (swipe samples taken at the same time on the same surfaces), and glove blanks (swipe samples taken on a new pair of gloves).

A form, Figure 18, was generated to facilitate the decontamination planning and sampling of each piece of equipment.

In some cases, special attention was required to remove oil, grease, or tar from the equipment before steam cleaning. This was especially true of the rolloff boxes because they had been sealed with tar to prevent water leakage. The bulk of the tar was removed by heating a modified metal shovel that was used as a scraper. The remaining tar was removed by burning with an acetylene torch.

The rock crusher was another special case. Because it was too large for the decontamination pad, special provisions were required for its cleaning. The rock crusher is a Universal Engineering Corp. Model 1016 RBSL Jaw Crusher with a 48 in. x 18 in. bar x 9 in. pitch wobbler feeder. A temporary decontamination area was constructed using a plastic cover. The plastic cover was spread out on the ground over wooden berms to contain the water resulting from steam cleaning. The ground was contoured so that the water would flow to a common area to allow collection and transportation to the water holding bin before incineration. After the rock crusher was cleaned, the plastic cover and support materials were incinerated.

The following decontamination procedure was used for the project (The first two steps and the last two steps were accomplished in order. However, steps 3 through 6 were done in parallel with the workers being divided into teams and the teams assigned to different tasks):

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 40ng 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 m^2) ______________________

DATE SAMPLE(S) SENT ______________ DATE RESULTS REC'D ______________

EQUIPMENT DISPOSTION: CLEAN TO BE RESAMPLED
(Circle One)

______________________________ ______________________________

EG&G On-Site Representative Date

Figure 18. Swipe Sample Form.

1. All wood, tents, and miscellaneous contaminated debris were incinerated.

2. All soil excavation and soil feeding equipment was decontaminated and sampled.

3. All ash storage rolloff boxes were decontaminated.

4. Any water in POTW tanks was discharged to the POTW and:

   a. Charcoal bed tank and sand filter were cleaned out and sampled.

   b. Charcoal and sand were processed in the incinerator.

   c. The tanks were washed out and the wash water was processed in the incinerator.

   d. If the POTW tanks did not come clean upon washing, they were sandblasted, and the sand was processed in the incinerator.

   e. When the swipe samples from the POTW tanks met the established analytical criteria, the tanks were shipped offsite.

5. The ash drag water was incinerated and the ash drag receiver was flushed several times with clean water. Each tank of ash drag water was incinerated.

6. The ENT water was incinerated and the ENT was flushed several times with clean water. The ENT water was then sampled and analyzed for pH, 2,3,7,8-TCDD, 2,4-D, and 2,4,5-T.

The analysis showed a positive 2,4-D result. After re-extracting the sample and trying other sample cleaning techniques at the laboratory, the 2,4-D result was determined by EG&G Idaho Chemical Services and Envirodyne Laboratory personnel to be a false positive. The positive indication came from interferences in the sample.

After discussions with State of Mississippi Water Pollution Control personnel, the water was declared clean and was discharged through the sand filters to the POTW system.

7. The incinerator was cleaned out using a vacuum truck, and all solids were analyzed for 2,3,7,8-TCDD.

a. All sumps, tanks, incineration chambers, cyclones, ducts, and the sand filter were cleaned out.

b. After it was determined that the solids met the analytical requirement of less than 1.0 ppb 2,3,7,8-TCDD, the solids were placed back on the site per the EPA Permit guidelines (Reference 2).

c. The kiln refractory was removed from the kiln and shipped to a landfill.

8. The incinerator and all support equipment were shipped offsite.

All swipe samples were sent to Envirodyne Laboratory in St. Louis, Missouri for analysis. Samples sent to the laboratory were requested to be analyzed within 3 days. EG&G Idaho maintained a data base of all sample results on a computer at the site. Included in this data base was the date the sample was taken, when it was shipped to the laboratory, and when the results were received via telefax at the site office at the NCBC.

After all cleaning was completed, the water remaining in the collection bin was incinerated in the MWP-2000.

E. DEMOBILIZATION

The objective of the demobilization task was to clean up the site, repair the rail tracks, dismantle the incinerator and support systems, and remove all equipment used in the project from the NCBC.

The dismantling subtask was performed by ENSCO personnel. The ENSCO employees were divided into small working units assigned to dismantle a certain section of the incinerator. To expedite this subtask several extra pieces of equipment, such as acetylene torches, a boom truck, and an Omega crane were rented so that the work units could work independently.

As part of the demobilization task it was necessary to dispose of materials used in the trial burns and the refractory brick from the kiln. The trial burn sand and the refractory brick from the kiln were disposed of at a hazardous waste landfill, operated by CECOS International, in Hammond, Louisiana. The unused chemicals, used to spike the sand during the trial burns, were shipped to chemical firms for restocking.

Other miscellaneous items performed during the demobilization task were fence repair, rail track repair, disposition of excess equipment, and removal of rented trailers that were used as office space during the project. Local firms repaired the fence and the rail track. The Defense Reutilization and Marketing Office (DRMO) took the excess equipment, and the office trailers were returned to the subcontract vendors. One trailer was left onsite to house the ash and clean bottom of hole samples until site delisting and closure are completed.

F. SUBCONTRACT DESCRIPTION

The subcontract for the NCBC Demonstration Project was considered to be a standard cost-plus fixed-fee (CPFF) subcontract. In a CPFF contract, the subcontractor submits a cost estimate prior to signing of the contract.

Based upon this cost estimate, the contracting officer and the subcontractor negotiate a fixed-fee or profit. If the actual costs for the project exceed the original estimate, the contracting officer will pay the excess legitimate costs; however, the fee remains fixed throughout the project for the given work scope. If the work scope expands by request of the contracting officer, an additional fee may be negotiated. This type of contract is generally used for research and development projects that include numerous uncertainties in the scope of work.

To increase the tons of soil being processed per month, it was determined that an incentive fee over and above the 8 percent fixed-fee would improve production. The incentive fee provided an additional profit to the subcontractor for processing soil at a rate above a specified rate of 2,000 ton/month. This revision to the ENSCO subcontract was implemented in March 1988.

G. COST

During the months of soil processing from December 1987 through November 1988, the incinerator operations costs ranged from a low of approximately $213K/month to a high of approximately $314K/month. There are several factors accounting for this wide range of monthly costs, but the main reasons were the cost of materials, natural gas usage, and labor. Material costs in February 1988 were $95K, while those in November 1988 were $20K. The same months showed natural gas usage at $76K in February, and $57K in November.

The operations labor variance depended on the incinerator downtime for the month coupled with the number of days of soil excavation. If the incinerator was down for maintenance, all personnel worked to restart the incinerator and, therefore, the labor charged to operations was greater.

As can be noted in Table 2, the monthly lease rate on the incinerator was originally greater than $87K/month and in January dropped to approximately $60K/month. This reduction in the lease rate was caused by a change in the depreciation rate by ENSCO. Not shown in Table 2, the incinerator lease rate also included monthly leases for other ENSCO owned equipment, such as the soil conveyor system, weigh scales, drying oven, shredder (until September), emergency generator, personnel decontamination trailer, support trailer (parts and maintenance), and seven rolloff boxes.

The ABC Rental cost was for miscellaneous equipment such as weed eaters, chainsaws, and special small tools. Heavy equipment rented from Hertz Rental included front end loaders, cranes, and trucks.

The monthly expenditures for materials may not reflect when these materials were purchased or used. For example, the material costs for February 1988 were approximately $95K (See Table 2). This expenditure may have been for materials purchased months earlier. This discrepancy was partially caused by the lag in vendors billing for materials purchased.

Expenditures for the decontamination/demobilization task were very sporadic until September 1988 when some cleaning and swipe sampling began. Expenditures jumped dramatically in October 1988 because of a $44K cost to dispose of the trial burn sand at a hazardous landfill in Hammond, Louisiana.

As can be seen by the labor charges in Table 3, major decontamination efforts began in late November 1988 and continued on into the first of January 1989 when the demobilization subtask took over and continued on until the first week of February 1989. The careful reviewer will notice that this spreadsheet (Table 3) does not contain certain time periods. In this case, costs were not incurred and therefore are not reported in the spread sheet.

The expenditure of $42.4K for ACE Transportation in February 1989 was for transporting the incinerator and all support equipment from the NCBC in Gulfport, Mississippi to ENSCO facilities in White Bluff, Tennessee.

Supporting cost curves for both the incinerator operations and decontamination/demobilization tasks are shown in Figure 19 and 20.

TABLE 2. INCINERATOR OPERATIONS COST.

NCBC INCINERATION PROJECT
INCINERATOR OPERATIONS
MAY 1987 THROUGH FEBRUARY 1989

MONTHLY MONETARY TOTALS		MAY 87 $191,169.31	JUNE 87 $102,017.69	JULY 87 $106,564.48	AUG 87 $87,299.00
ITEM EXPENDITURES	: UNIT TOTALS :				
INCINERATOR LEASE	:$1,501,632.50 :	87,299.00	87,299.00	87,299.00	87,299.00
ABC RENTAL	: $7,268.86 :	1,442.00	46.00		
HERTZ RENTAL	: $37,153.54 :	6,163.00			
LABOR	:$1,018,804.00 :	62,111.00			
NATURAL GAS	: $974,144.52 :	18,780.84	12,978.90	18,946.24	
WATER	: $14,749.02 :	1,959.85	1,375.13		
SEWAGE	: $3,392.93 :				
ELECTRICITY	: $87,447.49 :	306.12	318.66	319.24	
FRONT END LOADER	: $83,936.62 :				
FORKLIFT	: $26,673.94 :				
MATERIALS	: $612,205.86 :	13,107.50			

TABLE 2. INCINERATOR OPERATIONS COST (CONTINUED).

NCBC INCINERATION PROJECT
INCINERATOR OPERATIONS
MAY 1987 THROUGH FEBRUARY 1989

MONTHLY MONETARY TOTALS		SEPT 87 $149,524.98	OCT 87 $164,294.68	NOV 87 $176,943.55	DEC 87 $272,582.63
ITEM EXPENDITURES	UNIT TOTALS				
INCINERATOR LEASE	$1,501,632.50	87,299.00	87,299.00	87,299.00	87,299.00
ABC RENTAL	$7,268.86		187.62		612.00
HERTZ RENTAL	$37,153.54		1,496.00	2,793.10	6,005.00
LABOR	$1,018,804.00	46,645.00	52,093.00	71,529.00	65,879.00
NATURAL GAS	$974,144.52		3,322.50		84,825.64
WATER	$14,749.02		33.25	2.85	813.20
SEWAGE	$3,392.93		19.95	1.42	487.82
ELECTRICITY	$87,447.49		269.09	289.65	2,794.22
FRONT END LOADER	$83,936.62	945.00	2,597.00		4,717.00
FORKLIFT	$26,673.94	1,500.00	581.94	2,120.00	2,720.00
MATERIALS	$612,205.86	13,135.98	16,395.33	12,908.53	16,429.75

TABLE 2. INCINERATOR OPERATIONS COST (CONTINUED).

NCBC INCINERATION PROJECT
INCINERATOR OPERATIONS
MAY 1987 THROUGH FEBRUARY 1989

MONTHLY MONETARY TOTALS		JAN 88 $249,208.53	FEB 88 $313,908.84	MAR 88 $273,385.15	APRIL 88 $224,029.36
ITEM EXPENDITURES	: UNIT TOTALS :				
INCINERATOR LEASE	:$1,501,632.50 :	60,371.00	59,371.00	61,549.00	61,549.00
ABC RENTAL	: $7,268.86 :		107.38	45.58	292.56
HERTZ RENTAL	: $37,153.54 :	2,968.00	7,935.11	2,666.10	5,510.62
LABOR	:$1,018,804.00 :	77,170.00	63,484.00	61,927.00	47,054.00
NATURAL GAS	: $974,144.52 :	67,129.00	75,606.00	83,199.83	61,705.83
WATER	: $14,749.02 :	635.00	766.00	846.93	901.08
SEWAGE	: $3,392.93 :	380.00	459.00	507.78	540.55
ELECTRICITY	: $87,447.49 :	5,282.22	5,946.81	4,852.51	6,037.24
FRONT END LOADER	: $83,936.62 :	2,597.00	2,597.00	2,597.00	5,247.00
FORKLIFT	: $26,673.94 :	2,150.00	2,905.00	2,507.00	1,097.10
MATERIALS	: $612,205.86 :	30,526.31	94,731.54	52,686.42	34,094.38

TABLE 2. INCINERATOR OPERATIONS COST (CONTINUED).

NCBC INCINERATION PROJECT
INCINERATOR OPERATIONS
MAY 1987 THROUGH FEBRUARY 1989

MONTHLY MONETARY TOTALS		MAY 88 $263,942.83	JUNE 88 $228,984.28	JULY 88 $250,497.81	AUG 88 $246,783.09
ITEM EXPENDITURES	UNIT TOTALS				
INCINERATOR LEASE	$1,501,632.50	61,549.00	61,549.00	61,549.00	61,549.00
ABC RENTAL	$7,268.86	199.02			405.88
HERTZ RENTAL	$37,153.54		568.88		
LABOR	$1,018,804.00	78,821.00	51,369.00	70,039.00	62,723.00
NATURAL GAS	$974,144.52	65,959.08	73,595.67	68,267.10	63,663.57
WATER	$14,749.02	1,149.03	1,241.18	1,073.98	795.63
SEWAGE	$3,392.93				
ELECTRICITY	$87,447.49	5,761.73	6,895.37	7,138.87	8,124.63
FRONT END LOADER	$83,936.62	5,247.00	5,247.00	5,247.00	5,247.00
FORKLIFT	$26,673.94	1,097.10	1,219.00	1,097.10	1,097.10
MATERIALS	$612,205.86	44,159.87	27,299.18	36,085.76	43,177.28

TABLE 2. INCINERATOR OPERATIONS COST (CONTINUED).

NCBC INCINERATION PROJECT
INCINERATOR OPERATIONS
MAY 1987 THROUGH FEBRUARY 1989

MONTHLY MONETARY TOTALS		SEPT 88 $285,207.06	OCT 88 $280,458.19	NOV 88 $212,813.27	DEC 88 $182,171.88
ITEM EXPENDITURES	: UNIT TOTALS :				
INCINERATOR LEASE	:$1,501,632.50 :	59,882.00	59,882.00	59,882.00	59,882.00
ABC RENTAL	: $7,268.86 :	906.57	638.63	621.35	1,196.16
HERTZ RENTAL	: $37,153.54 :				
LABOR	:$1,018,804.00 :	59,490.00	75,307.00	57,917.00	15,246.00
NATURAL GAS	: $974,144.52 :	61,589.79	82,441.98	56,925.63	75,206.92
WATER	: $14,749.02 :	702.05	944.30	646.00	722.48
SEWAGE	: $3,392.93 :				
ELECTRICITY	: $87,447.49 :	6,240.81	6,803.02	7,469.37	6,576.40
FRONT END LOADER	: $83,936.62 :	5,247.00	11,937.46	8,586.00	6,586.00
FORKLIFT	: $26,673.94 :	1,097.10	1,097.10	1,097.10	1,097.10
MATERIALS	: $612,205.86 :	90,051.74	41,406.70	19,668.82	13,658.82

TABLE 2. INCINERATOR OPERATIONS COST (CONCLUDED).

NCBC INCINERATION PROJECT
INCINERATOR OPERATIONS
MAY 1987 THROUGH FEBRUARY 1989

MONTHLY MONETARY TOTALS		JAN 89 $79,969.11	FEB 89 $25,653.56
ITEM EXPENDITURES	: UNIT TOTALS :		
INCINERATOR LEASE	:$1,501,632.50 :	59,882.00	14,794.50
ABC RENTAL	: $7,268.86 :	319.06	249.05
HERTZ RENTAL	: $37,153.54 :		1,047.73
LABOR	:$1,018,804.00 :		
NATURAL GAS	: $974,144.52 :		
WATER	: $14,749.02 :	141.08	
SEWAGE	: $3,392.93 :		996.41
ELECTRICITY	: $87,447.49 :	5,244.44	777.09
FRONT END LOADER	: $83,936.62 :	3,339.00	3,956.16
FORKLIFT	: $26,673.94 :	1,097.10	1,097.10
MATERIALS	: $612,205.86 :	9,946.43	2,735.52

TABLE 3. DECONTAMINATION AND DEMOBILIZATION COSTS.

NCBC INCINERATION PROJECT
DECONTAMINATION AND DEMOBILIZATION
MAY 1987 THROUGH FEBRUARY 1989

MONTHLY MONETARY TOTALS		SEPT 87 $0.00	OCT 87 $1,644.00	NOV 87 $1,290.00	DEC 87 $0.00
ITEM EXPENDITURES	: UNIT TOTALS :				
DECON. PAD MATERIAL	$3,393.10				
LABOR TO BUILD PAD	$3,740.00				
LABOR TO CLEAN EQUIPMENT	$15,870.00				
LABOR TO TAKE SWIPE SAMPLES	$2,225.00				
ENVIRODYNE - SWIPES	$83,646.00		1,644.00	1,290.00	
ABC RENTAL	$2,072.08				
HERTZ RENTAL	$2,887.35				
EQUIP RENTAL	$12,069.03				
LABOR TO DISMANTLE	$217,449.05				
MATERIALS	$27,650.43				
TRIAL/BURN SAND DISPOSAL	$44,607.40				
REFRACTORY DISPOSAL	$6,323.75				
ACE TRANSPORTATION	$42,416.45				

TABLE 3. DECONTAMINATION AND DEMOBILIZATION COSTS (CONTINUED).

NCBC INCINERATION PROJECT
DECONTAMINATION AND DEMOBILIZATION
MAY 1987 THROUGH FEBRUARY 1989

		JAN 88	FEB 88	MAR 88	APRIL 88
MONTHLY MONETARY TOTALS		$0.00	$0.00	$1,370.00	$0.00
ITEM EXPENDITURES	UNIT TOTALS				
DECON. PAD MATERIAL	$3,393.10				
LABOR TO BUILD PAD	$3,740.00				
LABOR TO CLEAN EQUIPMENT	$15,870.00				
LABOR TO TAKE SWIPE SAMPLES	$2,225.00				
ENVIRODYNE - SWIPES	$83,646.00			1,370.00	
ABC RENTAL	$2,072.08				
HERTZ RENTAL	$2,887.35				
EQUIP RENTAL	$12,069.03				
LABOR TO DISMANTLE	$217,449.05				
MATERIALS	$27,650.43				
TRIAL/BURN SAND DISPOSAL	$44,607.40				
REFRACTORY DISPOSAL	$6,323.75				
ACE TRANSPORTATION	$42,416.45				

TABLE 3. DECONTAMINATION AND DEMOBILIZATION COSTS (CONTINUED).

NCBC INCINERATION PROJECT
DECONTAMINATION AND DEMOBILIZATION
MAY 1987 THROUGH FEBRUARY 1989

MONTHLY MONETARY TOTALS		MAY 88 $0.00	JUNE 88 $0.00	JULY 88 $25.00	AUG 88 $0.00
ITEM EXPENDITURES	UNIT TOTALS				
DECON. PAD MATERIAL	$3,393.10				
LABOR TO BUILD PAD	$3,740.00				
LABOR TO CLEAN EQUIPMENT	$15,870.00				
LABOR TO TAKE SWIPE SAMPLES	$2,225.00			25.00	
ENVIRODYNE - SWIPES	$83,646.00				
ABC RENTAL	$2,072.08				
HERTZ RENTAL	$2,887.35				
EQUIP RENTAL	$12,069.03				
LABOR TO DISMANTLE	$217,449.05				
MATERIALS	$27,650.43				
TRIAL/BURN SAND DISPOSAL	$44,607.40				
REFRACTORY DISPOSAL	$6,323.75				
ACE TRANSPORTATION	$42,416.45				

TABLE 3. DECONTAMINATION AND DEMOBILIZATION COSTS (CONTINUED).

NCBC INCINERATION PROJECT
DECONTAMINATION AND DEMOBILIZATION
MAY 1987 THROUGH FEBRUARY 1989

MONTHLY MONETARY TOTALS		SEPT 88 $6,556.00	OCT 88 $57,503.60	NOV 88 $27,800.68	DEC 88 $79,128.08
ITEM EXPENDITURES	: UNIT TOTALS :				
DECON. PAD MATERIAL	: $3,393.10 :		3,393.10		
LABOR TO BUILD PAD	: $3,740.00 :	2,000.00		1,740.00	
LABOR TO CLEAN EQUIPMENT	: $15,870.00 :	680.00	700.00	[illegible],750.00	10,380.00
LABOR TO TAKE SWIPE SAMPLES	: $2,225.00 :	40.00	100.00		1,856.00
ENVIRODYNE - SWIPES	: $83,646.00 :	3,836.00	4,110.00	8,768.00	822.00
ABC RENTAL	: $2,072.08 :				
HERTZ RENTAL	: $2,887.35 :				
EQUIP RENTAL	: $12,069.03 :		1,200.00	1,200.00	1,200.00
LABOR TO DISMANTLE	: $217,449.05 :			13,310.88	63,977.05
MATERIALS	: $27,650.43 :		3,393.10	31.80	893.03
TRIAL/BURN SAND DISPOSAL	: $44,607.40 :		44,607.40		
REFRACTORY DISPOSAL	: $6,323.75 :				
ACE TRANSPORTATION	: $42,416.45 :				

TABLE 3. DECONTAMINATION AND DEMOBILIZATION COSTS (CONCLUDED).

NCBC INCINERATION PROJECT
DECONTAMINATION AND DEMOBILIZATION
MAY 1987 THROUGH FEBRUARY 1989

		JAN 39	FEB 89
MONTHLY MONETARY TOTALS		$139,162.78	$149,869.50
ITEM EXPENDITURES	UNIT TOTALS		
DECON. PAD MATERIAL	$3,393.10		
LABOR TO BUILD PAD	$3,740.00		
LABOR TO CLEAN EQUIPMENT	$15,870.00	1,360.00	
LABOR TO TAKE SWIPE SAMPLES	$2,225.00	204.00	
ENVIRODYNE - SWIPES	$83,646.00	31,392.00	30,414.00
ABC RENTAL	$2,072.08		2,072.08
HERTZ RENTAL	$2,887.35		2,887.35
EQUIP RENTAL	$12,069.03	4,486.00	3,983.03
LABOR TO DISMANTLE	$217,449.05	95,491.87	44,669.25
MATERIALS	$27,650.43	6,228.91	17,103.59
TRIAL/BURN SAND DISPOSAL	$44,607.40		
REFRACTORY DISPOSAL	$6,323.75		6,323.75
ACE TRANSPORTATION	$42,416.45		42,416.45

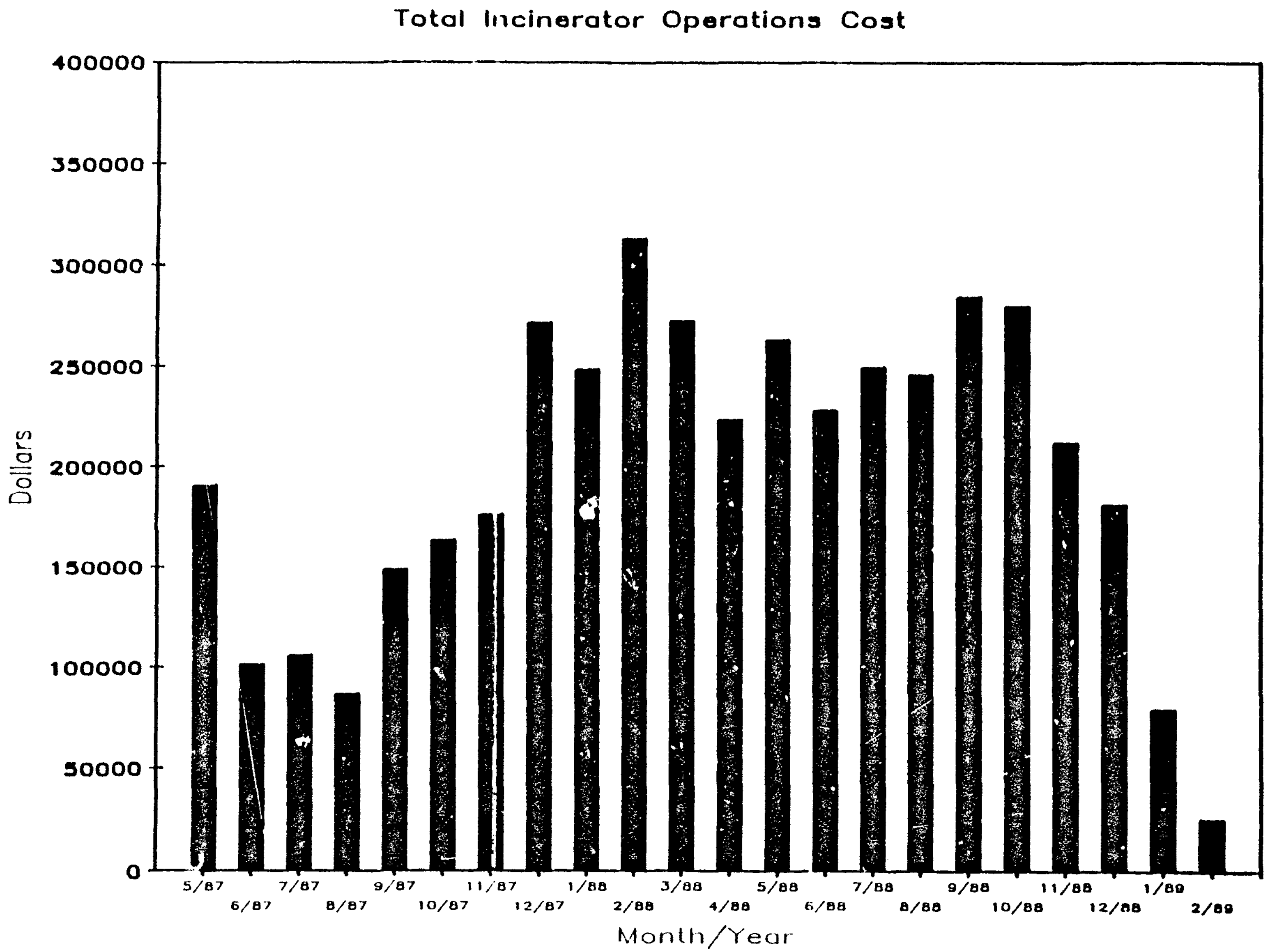

Figure 19. Incinerator Operations Graph.

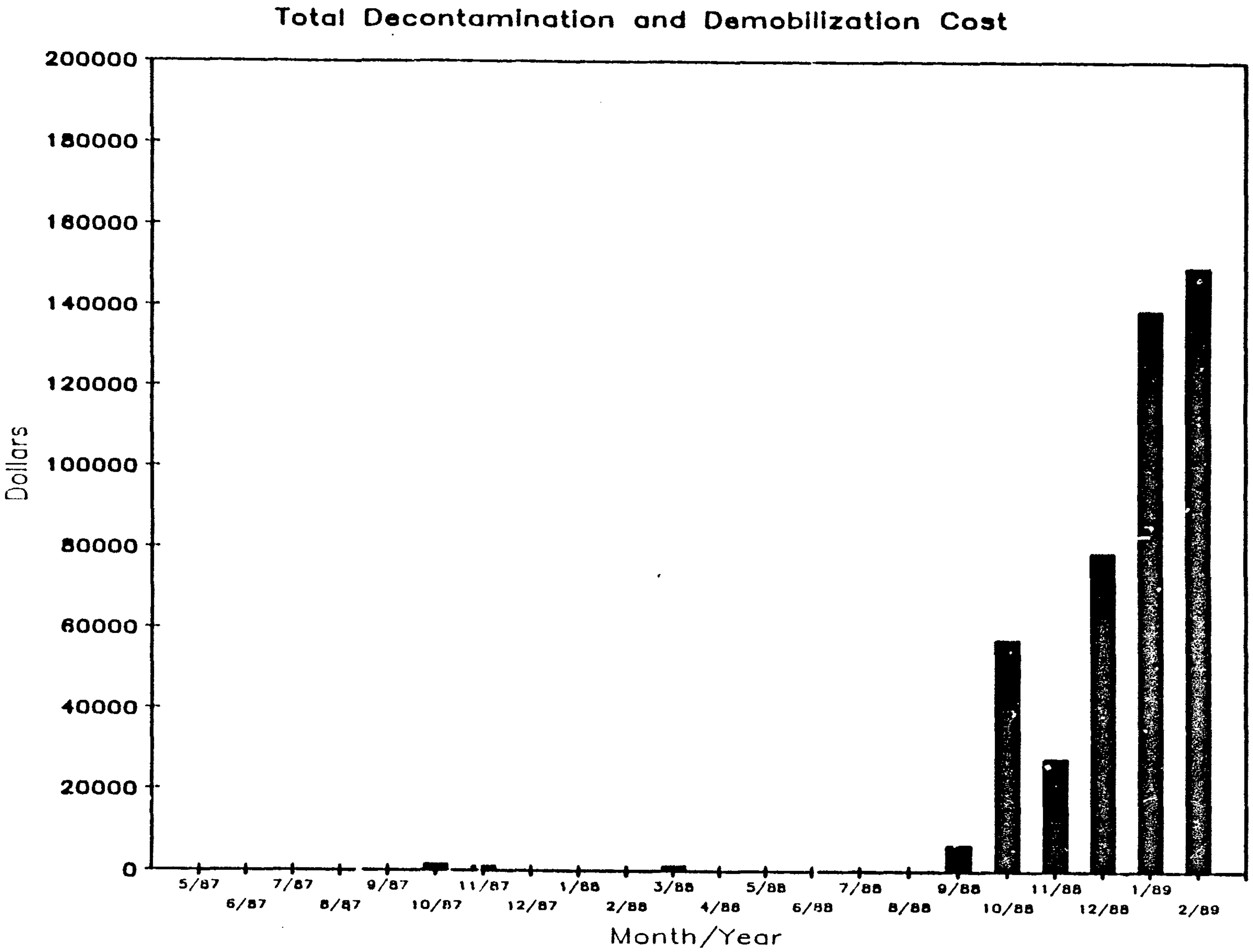

Figure 20. Decontamination/Demobilization Graph.

SECTION V

ANALYTICAL PROCEDURES AND RESULTS

This section describes the procedures and detection limits used in the analysis of the POTW water samples, the treated soil (ash) samples, and samples obtained during the incinerator stack tests performed on May 5, 6, and 7, 1988. Results from each of these samples are discussed in the latter portion of the section.

A. METHODS AND PROTOCOLS

1. Processed Water Discharged to the POTW

a. The ENSCO MWP-2000 incinerator system operated at the NCBC used water for cooling and scrubbing the incineration gases. As the incinerator operated, the Effluent Neutralization Tank (ENT) became clogged with dust that carried over from the combustion chambers. Periodically the water was drained from the ENT system so that the ENT system could be cleaned out and refilled with fresh water.

There was a possibility that the water drained from the ENT contained some amount of contaminants that could not be discharged to the POTW. The contaminants of concern were 2,4-D, 2,4,5-T, and 2,3,7,8-TCDD. The ENT water was therefore analyzed to determine that these contaminants were not present before it could be discharged to the POTW system. As the water was drained from the ENT system, it was collected in one of two large holding tanks. When one tank became full, its contents were recirculated through a treatment system consisting of a sand filter and an activated carbon bed. Following this treatment, water samples were collected and analyzed to determine if they contained any of the contaminants.

The water samples were analyzed with Gas Chromatography/Mass Spectroscopy (GC/MS) techniques, which allowed resolution and quantification of individual organic constituents. Water samples were analyzed for 2,4-D, 2,4,5-T, and 2,3,7,8-TCDD. The procedures used for these analyses are outlined in US EPA SW-846, Test Methods for the Evaluation of Solid Waste. Method 8150 is the procedure for 2,4-D and 2,4,5-T analysis, and Method 8280 is the procedure for 2,3,7,8-TCDD.

Method 8150 uses Low Resolution GC analysis, while Method 8280 uses High Resolution GC/Low Resolution MS (HRGC/LRMS) to allow for identification of individual isomers of chlorodibenzodioxin/chlorodibenzofuran. The calculated detection limits had to be within an order of magnitude of the EPA accepted groundwater Practical Quantification Limit (PQL) value. The groundwater PQL for 2,4-D is 12.0 ppb, for 2,4,5-T it is 2.0 ppb, and for 2,3,7,8-TCDD it is 0.0044 ppb.

The State of Mississippi Water Pollution Control Permit issued to the Air Force Engineering and Services Center (AFESC) for discharge of wastewater into the Harrison County Wastewater Management District can be found in Appendix A.

If the dioxin and herbicides in the water samples were determined to be nondetectable by GC/MS analysis following the procedures defined by Methods 8150 and 8280, and they met the EPA accepted PQL values, the ENT water would fulfill requirements of the State of Mississippi POTW discharge permit, and could be discharged to the POTW system.

2. Treated Soil (Ash) Sampling

Two types of treated soil (ash) samples were collected in accordance with the RD&D permit: (1) daily treated soil samples and (2) monthly comprehensive samples.

The daily treated soil samples were collected to determine if they met the criteria for declaring the ash clean, i.e., less than 1.0 ppb criteria on 2,3,7,8-TCDD, total TCDD, and total TCDF. The daily samples were collected and analyzed from each rolloff box by taking four scoops of treated soil from each side of the box. The sample was sieved through an eight-mesh screen and collected in an aluminum pan. The sieved soil was then placed into a clean sample jar and sent to the analytical laboratory. Equal portions of each rolloff box sample were composited with up to five other rolloff box samples and submitted to the laboratory for analysis. If the daily composite sample did not meet the treated soil criteria, then the individual rolloff box samples would have been analyzed to determine which rolloff box was contaminated. All samples met the required soil criteria.

To support a petition to the EPA that the treated soil could be considered nonhazardous, samples were also collected on a monthly basis for analysis for a comprehensive list of hazardous constituents. This sampling effort also supported one of the RD&D permit conditions.

The samples were originally collected from the storage rolloff boxes but beginning in April 1988 the samples were collected directly from the ash drag to prevent cross contamination. Once a month, an 8-ounce sample was taken every hour for a 24 hour period. At the end of the 24 hour sampling period, the samples were transferred into a disposable glove bag, where a composite was made up from the 24 hourly samples. The disposable glove bag was used to prevent cross contamination from other samples located in the sample storage trailer.

The samples were analyzed for a variety of constituents that included metals, polycyclic aromatic hydrocarbons, and five isomer classes of dioxins and furans. The constituents and the methodologies used are listed in Tables 4 and 5.

Daily samples were analyzed for dioxins and furans using the low resolution methodologies which had a detection limit of 1.0 ppb. The high resolution analysis was used only for the monthly composite samples and had a detection limit of 2.0 ppt and therefore a higher analysis cost than the low resolution analysis.

TABLE 4. DIOXIN/FURANS BY LOW RESOLUTION GC/MS.

Constituent	Analytical Method	Detection Limit µg/kg (ppb)
Antimony	CLP	600
Arsenic	CLP	200
Barium	CLP	400
Benzidine([1,1′-biphenyl]-4,4′ diamine)	SW 846/CLP	2,600
Benzo[a]anthracene (1,2 benzanthracene)	8310	2.0
Benzo[b]fluoranthene (2,3-benzofluoranthene)	8310	2.0
Benzo[a]pyrene (3,4-benzopyrene)	8310	2.0
Beryllium	CLP	200
Bis (2-chloroethoxy)methane (ethane, [methylenebis (oxy)]bis[2-chloro-])	CLP	1,000
Bis(2-chloroisopropyl)ether (propane,2,2′-oxybis[2-chloro-])	CLP	330
Cadmium	CLP	1,000
Chlorinated benzenes, N.O.S.		
1,2,4,5-Tetrachlorobenzene	SW 846/CLP	330
1,2,3,5-Tetrachlorobenzene		
Chlorinated pheno., N.O.S.		
2,4-Dichlorophenol	CLP	330
2,6-Dichlorophenol	SW 846/CLP	330
2,5-Dichlorophenol	SW 846/CLP	330
3,4-Dichlorophenol	SW 846/CLP	330
2,3,4-Trichlorophenol	SW 846/CLP	330
2,4,5-Trichlorophenol........	SW 846/CLP	1,600
2,4,6-Trichlorophenol	CLP	330
2,3,4,5-Tetrachlorophenol	SW 846/CLP	330
2,3,4,6-Tetrachlorophenol		
Chronium (Total)	CLP	2,000
Chronium (Hexavalent)	SW 846	400
Chrysene (1,2-benzphenanthrene)	8310	1.0
Copper	CLP	2,000
Coal tars	Analyzed as methyl phenols	
and		
Creosote (creosote, wood)	PAHs (CLP/8310)	
Cresols (cresylic acid) (phenol, methyl-)	CLP	330
Dibenz[a,h]anthracene (1,2,5,6 dibenzanthracene)	8310	1.0
3,3′-Dichlorobenzidine ([1,1′-biphenyl]-4,4′-diamine,3,3′ dichloro)	CLP	660
2,4-Dichlorophenoxyacetic acid (2,4-D), salts and esters (acetic acid, 2,4-dichlorophenoxy-,saltes and esters)	8150	20.0
4,6-Dinitro-o-cresol and salts phenol, 2,4-dinitro-6-methy-, and salts)	CLP	1,600
2,4-Dinitrophenol (phenol, 2,4-dinitro)	CLP	1,600
2,4-Dinitrotoluene (benzene, 1-methyl-2-4-dinitro-)	CLP	330

TABLE 4. DIOXINS/FURANS BY LOW RESOLUTION GC/MS (CONCLUDED).

Constituent	Analytical Method	Detection Limit µg/kg (ppb)
2,6-Dinitrotoluene (benzene, 1-methyl-1, 6-dinitro-)	CLP	330
Fluoranthene (benzo[j,k]fluorene)	8310	2.0
Hexachlorodibeno-p-dioxins	8280	0.1-0.3
Hexachlorodibenzofurans	8280	0.1-0.3
Hydroxydimethylarsine oxide (cacodylic acid)	(As Arsenic)	
Indeno(1,2,3-cd)pyrene(1,10-1,2-phenylene) pyrene	8310	3.0
Lead	CLP	200
Mercury	CLP	20
Nickel	CLP	4,000
4-Nitrophenol (phenol, 4-nitro-)	CLP	1,600
N-Nitrosodiemthylamine (dimethylnitrosamine)	SW 846/CLP	330
Pentachlorodibenzo-p-dioxins	8280	0.1-0.3
Pentachlorodibenzofurans	8280	0.1-0.3
Pentachlorophenol	CLP	1,600
Phenol (benzene, hydroxy)	CLP	330
Polychlorinated biphenyl, N.O.S.	CLP	100-210
Selenium	CLP	200
Silver	CLP	1,000
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) Dibenzo-p-dioxin,2,3,7,8-tetrachloro-furan)	8280	0.1-0.3
Tetrachlorodibenzo-p-dioxins	8280	0.1-0.3
Tetrachlorodibenzofurans	8280	0.1-0.3
Thallium	CLP	200
Toxaphene (camphene,octachloro-)	CLP	210
2,4,5-Trichlorophenoxyacetic acid (2,4,5-T) (Acetic acid,2,4,5-trichlorophenoxy-)	8150	2.0
Vanadium	CLP	2,000
Zinc	CLP	1,000
pH	9040	Standard Units
Cyanide	9010	500
Sulfide	9030	200
EP Toxicity Extraction	1310	-
Corrosives (as pHO	9040	Standard Units
Total Cyanides	9010	10
Heptachlorodibenzo-p-dioxins	8280	0.1-0.3
Heptachlorodibenzofuans	8280	0.1-0.3
Octachlorodibenzo-p-dioxins	8280	0.1-0.3
Octachlorodibenzofurans	8280	0.1-0.3

TABLE 5. DIOXIN/FURANS BY HIGH RESOLUTION GC/MS.

Constituent	Analytical Method	Detection Limit µg/kg (ppb)
Antimony	CLP	600
Arsenic	CLP	200
Barium	CLP	400
Benzidine([1,1′-biphenyl]-4,4′ diamine)	SW 846/CLP	2,600
Benzo[a]anthracene (1,2 benzanthracene)	8310	2.0
Benzo[b]fluoranthene (2,3-benzofluoranthene)	8310	2.0
Benzo[a]pyrene (3,4-benzopyrene)	8310	2.0
Beryllium	CLP	200
Bis (2-chloroethoxy)methane (ethane, [methylenebis (oxy)]bis[2-chloro-])	CLP	1.000
Bis(2-chloroisopropyl)ether (propane,2,2′-oxybis[2-chloro-])	CLP	330
Cadmium	CLP	1,000
Chlorinated benzenes, N.O.S.		
1,2,4,5-Tetrachlorobenzene	SW 846/CLP	330
1,2,3,5-Tetrachlorobenzene		
Chlorinated pheno,, N.O.S.		
2,4-Dichlorophenol	CLP	330
2,6-Dichlorophenol	SW 846/CLP	330
2,5-Dichlorophenol	SW 846/CLP	330
3,4-Dichlorophenol	SW 846/CLP	330
2,3,4-Trichlorophenol	SW 846/CLP	330
2,4,5-Trichlorophenol........	SW 846/CLP	1,600
2,4,6-Trichlorophenol	CLP	330
2,3,4,5-Tetrachlorophenol	SW 846/CLP	330
2,3,4,6-Tetrachlorophenol		
Chronium (Total)	CLP	2,000
Chronium (Hexavalent)	SW 846	400
Chrysene (1,2-benzphenanthrene)	8310	1.0
Copper	CLP	2,000
Coal tars and creosote (creosote, wood)	Analyzed as methyl phenols and PAHs (CLP/8310)	
Cresols (cresylic acid) (phenol, methyl-)	CLP	330
Dibenz[a,h]anthracene (1,2,5,6 dibenzanthracene)	8310	1.0
3,3′-Dichlorobenzidine ([1,1′-biphenyl]-4,4′-diamine,3,3′ dichloro)	CLP	660
2,4-Dichlorophenoxyacetic acid (2,4-D), salts and esters (acetic acid, 2,4-dichlorophenoxy-,saltes and esters)	8150	20.0
4,6-Dinitro-o-cresol and salts phenol, 2,4-dinitro-6-methy-, and salts)	CLP	1,600
2,4-Dinitrophenol (phenol, 2,4-dinitro)	CLP	1,600
2,4-Dinitrotoluene (benzene, 1-methyl-2-4-dinitro-)	CLP	330

TABLE 5. DIOXINS/FURANS BY HIGH RESOLUTION GC/MS (CONCLUDED).

Constituent	Analytical Method	Detection Limit µg/kg (ppb)
2,6-Dinitrotoluene (benzene, 1-methyl-1, 6-dinitro-)	CLP	330
Fluoranthene (benzo[j,k]fluorene)	8310	2.0
Hexachlorodibeno-p-dioxins	8280	5-30 ppt
Hexachlorodibenzofurans	8280	5-30 ppt
Hydroxydimethylarsine oxide (cacodylic acid)	(As Arsenic)	
Indeno(1,2,3-cd)pyrene(1,10-1,2-phenylene) pyrene	8310	3.0
Lead	CLP	200
Mercury	CLP	20
Nickel	CLP	4,000
4-Nitrophenol (phenol, 4-nitro-)	CLP	1,600
N-Nitrosodiemthylamine (dimethylnitrosamine)	SW 846/CLP	330
Pentachlorodibenzo-p-dioxins	8280	5-30 ppt
Pentachlorodibenzofurans	8280	5-30 ppt
Pentachlorophenol	CLP	1,600
Phenol (benzene, hydroxy)	CLP	330
Polychlorinated biphenyl, N.O.S.	CLP	100-210
Selenium	CLP	200
Silver	CLP	1,000
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) Dibenzo-p-dioxin,2,3,7,8-tetrachloro-furan)	8280	5-20 ppt
Tetrachlorodibenzo-p-dioxins	8280	5-20 ppt
Tetrachlorodibenzofurans	8280	5-30 ppt
Thallium	CLP	200
Toxaphene (camphene,octachloro-)	CLP	210
2,4,5-Trichlorophenoxyacetic acid (2,4,5-T) (Acetic acid,2,4,5-trichlorophenoxy-)	8150	2.0
Vanadium	CLP	2,000
Zinc	CLP	1,000
pH	9040	Standard Units
Cyanide	9010	500
Sulfide	9030	200
EP Toxicity Extraction	1310	-
Corrosives (as pHO	9040	Standard Units
Total Cyanides	9010	10
Heptachlorodibenzo-p-dioxins	8280	0.1-0.3
Heptachlorodibenzofuans	8280	0.1-0.3
Octachlorodibenzo-p-dioxins	8280	0.1-0.3
Octachlorodibenzofurans	8280	0.1-0.3

3. Particulate Stack Test to Support Steam Lance Cleaning

The SCC periodically (about every 30 days) filled to some degree with particulate carryover from the cyclones. If allowed to continue, the incinerator had to be shut down for the SCC to be cleaned out. The shutdown, cleanout, and restart usually took from 4 to 5 days. To minimize these scheduled outages, it was determined by ENSCO operations personnel that by using a high-pressure steam lance in front of the SCC, they could reduce the quantity of particulate. However, by using the high-pressure steam in the SCC, it forced the particulate to move downstream. A stack test was performed during the steam lance testing to see if the particulate was being forced through the quench and scrubber systems and thus out the stack. The EPA Method 5 particulate stack tests were performed by Environmental Monitoring Laboratories, Inc., (EML) of Jackson, Mississippi, on May 5 to 7, 1985.

The incineration process was shut down on April 29, 1988, for cleaning of the SCC and downstream equipment. The incinerator was restarted May 4, 1988, and operated for approximately 24 hours before the tests began. Each subsequent test was conducted after at least the required minimum 18 hours of operating time. Since operations personnel expected to perform steam lancing procedures twice a day once the procedure was approved, this 18 hour delay between tests was assumed to be a worst case analysis of the effects of the steam lance procedure.

The operational conditions requested for conducting the particulate tests were basically the normal operating conditions defined by the operating permit. The average values of the important parameters for each test as well as their required operating ranges are shown in Table 6. These parameters were largely held within the desired ranges with a few exceptions noted below; however, these slight deviations did not materially affect the results obtained. Steam Lance Particulate Test 1 was conducted on May 5, 1988 from 12:51 to 13:53; Test 2 was on May 6, commencing at 08:45 and ending at 09:59; and Test 3 was run on May 7 between 06:52 and 07:52.

TABLE 6. IMPORTANT SYSTEM PARAMETERS, DESIRED OPERATING RANGES, AND AVERAGE VALUES FOR THE STEAM LANCE PARTICULATE TESTS.

Operating Parameter	Desired Range	Test 1	Test 2	Test 3
Kiln Temp. (°F)	>1450	1573	1612	1487
Kiln Draft (in H_2O)	>0.25	0.31	0.30	0.25
SCC Temp. (°F)	2150-2210	2177	2174	2184
SCC Residence Time (sec)	>1.65	1.86	1.94	1.88
Quench Recirculation (gpm)	100-130	132	129	130
Pack Tower Recirculation (gpm)	170-180	193	192	162
Jet Scrubber Recirculation (gpm)	37-47	42.5	40.4	40.0
Stack O_2 (%)	3.5-5.0	4.66	4.24	4.18
Stack CO (ppm)	5-15	6.13	5.89	4.96
Mass Feed Rate (ton/h)	≤5.3	4.89	3.96	5.09

The test plan indicated that the soil feed to the incinerator was to be maintained at the maximum allowed rate of 5.3 ton/h. This necessitated the removal of the automatic waste feed shut-off interlock, which stopped the feed as soon as the rate exceeded 5.3 ton/h. EPA Region IV denied a request to temporarily remove the feed shutoff interlock to conduct the particulate tests. It was therefore not possible to maintain the feed rate at 5.3 ton/h. Instead, the feed rates for each test were maintained as high as possible without causing a feed shutoff interlock. The rates obtained are thus about 5 ton/h, which is indicative of normal operating feed rates. The exception was Test 2, in which the average feed rate was 3.96 ton/h. The lower feed rate was caused by the Data Acquisition System (DAS), which resulted in a feed shutoff interlock. The condition cleared shortly, and the process was brought back on line.

The average Packed Tower flow rate for each test was slightly outside the required operating range. Since the first two tests had slightly higher rates and the last test had a slightly lower rate, the results of the tests enveloped the possible normal operating conditions. The DAS computer was reprogrammed for the tests to collect process parameter data every 5 minutes and record it on a floppy disk.

The draft Steam Lance procedure included in the test plan was closely followed during these tests. The only changes to the final procedure were the lowering of the necessary SCC outlet draft from 3.5 in. water column (w.c.) to 2.5 in. w.c., and the inclusion of a check of the Steam Lance equipment function.

4. Particulate Stack Test Results and Conclusions

The data report from the Environmental Monitoring Lab (EML) provides a detailed description of the particulate measurements, procedures, and calibrations used for the particulate stack tests.*

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* A copy of the Particulate Stack Test data report can be obtained from EG&G Idaho.

TABLE 7. RESULTS FROM STACK PARTICULATE TESTS.

Test Designation	Test 1	Test 2	Test 3	Average
Particulate Emission (gr/dscf)	0.005	0.003	0.002	0.003

The results of the particulate tests are presented in Table 7. These results show that for each test the particulate emissions were well below the allowable standard of 0.079 grams/dry standard cubic foot (gr/dscf) or 180 milligrams/dry standard cubic foot (mg/dscm). The highest value of 0.005 gr/dscf was recorded during Test 1, and this value is nearly 16 times below the limit. In comparison, the particulate test on April 5, 1988 yielded an average value of 0.008 gr/dscf.

The results from these Steam Lance Stack Particulate Tests indicated that the Steam Lancing procedure for cleaning of the SCC did not affect the particulate effluent from the incineration process. The highest valve of the three tests was 0.005 gr/dscf, which is nearly 16 times below the prescribed limit of 0.079 gr/dscf (180 mg/dscm).

B. ASH SAMPLE ANALYTICAL RESULTS

Treated soil (ash) samples collected daily were analyzed for 2,3,7,8-TCDD, total TCDD, and total TCDF using EPA Method 8280 (from SW-846) for low resolution GC/MS. Those analyses had a detection limit of 1.0 µg/kg (1.0 ppb). The analyses were performed by Envirodyne Laboratory and U.S. Testing Company.

The monthly comprehensive samples were analyzed using a variety of techniques depending on the analyte. Two different laboratories were used for the monthly comprehensive analysis. International Technology (IT) Analytical Services of Knoxville, Tennessee was used for most of the samples obtained from December 1987 to April 1988. Twin Cities Testing of St. Paul, Minnesota was used for most of the samples taken after April 1988 until project completion. The change in laboratories was primarily a cost reduction effort.

1. Daily Ash Sample Results

As part of the RD&D permit, the incinerator residue was sampled and analyzed for 2,3,7,8-TCDD, total TCDD, and total TCDF using EPA Method 8280 (from SW-846). The RD&D permit specified that the residue must contain less than 1.0 ppb of each of those constituents to declare the ash clean and acceptable for back filling. During the year of operation, 302 ash samples were analyzed. Every analysis showed the ash to be less than 1.0 ppb for the three constituents of concern.

2. Monthly Comprehensive Analytical Results

This section presents the analytical results obtained from the samples collected during a specified 24 hour operational period. The sampling was performed in the middle of each month of operation. Those analyses served three primary purposes: (1) to satisfy the conditions of the RD&D permit, (2) to provide data for the delisting petition and hence ultimate permanent disposal of the ash, and (3) to satisfy the research needs of the Air Force Installation Restoration Program (commonly called the NCBC Demonstration Project).

The information contained in this subsection is a summary of the detailed data presented in the delisting petition submitted to the EPA Office of Solid Waste on November 9, 1988.

Tables 8 and 9 provide the average concentrations observed for the numerous monthly comprehensive samples collected and analyzed for dioxin and nondioxin constituents. Many of the analyses showed that the 2,3,7,8-TCDD was nondetectable; the average concentration calculation assumes that any nondetectable concentrations were equivalent to a detectable concentration of the same value. Therefore, the averages listed are conservatively high.

TABLE 8. AVERAGE CONCENTRATIONS FOR MONTHLY COMPREHENSIVE NONDIOXIN ASH ANALYSES.

	Number of Samples	Average Concentration μg/g(ppm)	Maximum Concentration or Highest Detection Limit Observed μg/g(ppm)
Polynuclear Aromatic Hydrocarbons			
Fluoranthene	24	0.080	0.29*
Benzo(a)-anthracene	24	0.085	0.29*
Chrysene	24	0.089	0.29*
Benzo(b)-fluoranthene	24	0.078	0.29*
Dibenzo(ah)-anthracene	24	0.078	0.29*
Indeno(123-cd)pyrene	24	0.080	0.29*
Total Metal Analysis			
Antimony	17	3.6	6*
Arsenic	22	5.3	13.8
Barium	22	27.4	48
Beryllium	17	3.2	25
Cadmium	22	0.7	2
Chromium	22	6.1	10
Copper	17	3.8	10
Lead	22	7.3	30
Mercury	22	0.04	0.04
Nickel	22	4.0	6.9
Selenium	22	5.8	12
Silver	22	0.7	1.8
Thallium	17	4.2	6
Vanadium	17	10.8	15
Zinc	17	11.3	34
EP Toxicity Metal Analysis			
Antimony	8	0.03	0.03*
Arsenic	8	0.03	0.03*
Barium	8	0.14	0.17
Beryllium	8	0.003	0.003
Cadium	8	0.005	0.005
Chromium	8	0.01	0.01
Copper	8	0.02	0.03
Lead	8	0.03	0.03*
Magnesium	8	2.5	3.4
Mercury	8	0.001	0.001*
Nickel	8	0.02	0.02*
Selenium	8	0.06	0.06*
Silver	8	0.005	0.005*
Thallium	8	0.03	0.03*
Vanadium	8	0.01	0.01*
Zinc	8	0.042	0.052
Herbicides			
2,4-D	38	0.05	0.46
2,4,5-T	38	0.02	0.5
2,4,5T-P	33	0.011	0.054
Pesticides			
Toxaphene	22	47.4	210

Note * Indicates that the maximum observed was the detection limit and not an observed concentration.

TABLE 9. AVERAGE CONCENTRATIONS FOR MONTHLY COMPREHENSIVE DIOXIN ASH ANALYSES.

	Number of Samples	Average Concentration µg/g(ppm)	Maximum Concentration or Highest Detection Limit Observed µg/g(ppm)
Dioxins and Furans			
2,3,7,8-TCDD	34	0.0046	0.0300*
Tital TCDD	34	0.0031	0.0099
Non 2,3,7,8-TCDD +	34	0.0011	0.0068
2,3,7,8-PeCDD	15	0.0025	0.0056*
Total TeCDD	34	0.0032	0.0110
Non 2,3,7,8-HxCDD	34	0	0.0560
2,3,7,8-HxCDD	18	0.0054	0.0140
Total HxCDD	34	0.0125	0.0560
Non 2,3,7,8-HxCDD	34	0.0036	0.0560
2,3,7,8-TcDD	4	0.0027	0.0059
Total HpCDD	34	0.0127	0.1400
Non 2,3,7,8-HpCDD+		0.0001	0.0019
Total OCDD	34	0.0515	0.6400
2,3,7,8-TCDF	34	0.0038	0.0130
Total TCDF	34	0.0055	0.0130
Non 2,3,7,8-TCDF +	34	0.0037	0.0660
2,3,7,8-PeCDF	15	0.0020	0.0042
Total PeCDF	34	0.0018	0.0042
Non 2,3,7,8-PeCDF+	34	0	0
2,3,7,8-HxCDF	15	0.0035	0.0110
Total HxCDF	34	0.0030	0.0160
Non 2,3,7,9-HxCDF+	34	0	0
2,3,7,8-HpCDF	4	0.0015	0.0032
Total HpCDF	34	0.0057	0.0370
Non 2,3,7,8-HpCDF+	34	0	0
Total OCDF	34	0.0112	0.0710

Note: * Indicates that the maximum observed was the detection limit and not an observed concentration.
+ Indicates the value is a calculated value, not a directly measured value.

The maximum concentration or observed detection limit is also listed in Tables 8 and 9. If the maximum observed value was a detection limit, i.e., not a confirmed positive detection, then the value is delineated by an asterisk (*).

The original dioxin and furan data included numerous data points that were in the low parts per trillion (ppt) range. Because the concentrations of the dioxins and furans are either at or near the detection limits and because the detection limits are extremely low (near the ppt level), it is quite likely that positively detected concentrations are, in reality, false positives. Conversely, false negatives are also possible. The EPA has therefore instituted the concept of practical quantitation limits (PQL) which represent the upper bound of acceptable detection limits and are ten times the minimum detection limit. PQLs are used when analyzing dioxin and furan concentrations because they provide a greater degree of certainty that true values are represented rather than false negatives or false positives. Detection concentrations above the PQL are considered to be a certain positive detection. Detected concentrations below the PQL are considered to be highly unreliable and are therefore considered to be equivalent to a nondetect. The values listed in Table 8, however, assume that all concentrations and detection limits are equivalent to a detectable concentration of the same value.

Examination of Table 9 shows that the average concentration observed for each dioxin and furan isomer is below the PQL for that isomer. Only two of the 34 monthly ash samples collected showed any dioxin or furan isomers above tne PQL; those concentrations were still below the EPA level of concern of 0.499 ppt.*

C. POTW WATER ANALYSIS

Obtaining adequate nondetectable results from the process water before discharge to the POTW proved to be difficult because of the amount of fine

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* The 0.499 ppt level of concern is based upon the EPA delisting criteria, which varies depending upon the volume of waste to be delisted.

particulate passing through the ENT. An activated carbon bed was placed between the ENT and the POTW holding tanks to remove organic contaminants in the water. This carbon bed became plugged with particulate, making it almost impossible to circulate the water through it.

After the initial set of samples was taken in early March 1988 the carbon bed was cleaned out, and new carbon was placed in the filtering tank. To minimize the quantity of particulate reaching the carbon bed, a swimming pool sand filter was placed in the line between the ENT and the carbon bed. Although the sand filter helped, it did not eliminate the particulate and, therefore, the analytical problems persisted.

The analytical results were normally expressed in less than (<) or Maximum Possible Concentration (MPC) values. Because of the particulate interference, the results were usually high MPC values. The fine particulate was actually masking the mass spectrometer results, therefore, the chemist was unable to report low levels of detection.

The laboratory spent considerable time filtering, diluting, and reanalyzing the samples to obtain accurate results.

In addition to the particulate interference, permit conditions required contaminant levels to be nondetectable without specifying a specific detection limit. Interferences in the samples made it virtually impossible to obtain a nondetectable result that had any real meaning.

A calculated detection limit should be within an order of magnitude of the accepted groundwater PQL that takes into account the interferences in a given sample matrix. The groundwater PQL for 2,4-D is 12.0 ppb, for 2,4,5-T it is 2.0 ppb, and for 2,3,7,8-TCDD it is 0.0044 ppb. Because of the analytical problems in obtaining accurate results, the analytical data will not be reported.

SECTION VI
CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The purpose of the NCBC Demonstration Project was to demonstrate the availability and effectiveness of rotary kiln incineration for decontaminating soils containing constituents of Herbicide Orange. The remedial action and data collection efforts achieved the project goals. This report discussed the significant events that occurred during operations and the management planning efforts needed for project implementation.

While remediation had been performed on pilot- and small-scale efforts, it had not been performed on large quantities of soil before this test. This project revealed a number of technical, logistical, and regulatory issues that had not been addressed in the smaller scale testing.

B. RECOMMENDATIONS

1. Strategic Planning

On a strategic planning level the project should be planned chronologically from the end of the project back to the beginning. This enables project planning to focus on the final task goals.

Listed below are some of the significant issues that future remedial action project planners should address.

a. Site Cleanup

Determine the customer requirements for the project site upon completion of the project. Will it be necessary to repair fences, roads, or railroad tracks? If not already done, will it be necessary to remove filter berms and tank berms or backfill deep excavation areas? The project cannot be considered complete until the site appearance meets the customer requirements.

b. Demobilization

This task requires the planning for such items as trip permits (e.g., overweight, length, speed), special escort requirements on state highways, and disposal of the refractory or other materials used during the project.

c. Decontamination

The size and location of the decontamination facility must be planned well in advance. Also the type of equipment to be used, cleaning solutions (if applicable), and the equipment to be decontaminated must be thought about early in the process.

d. Soil Handling

The type and quantity of soil to be excavated will dictate the type of equipment to be used for excavating, transport, and storing the soil. In addition, the depth of soil contamination may also be a factor in the type of equipment to be used.

e. Test Burn

The incinerator must undergo either a Trial Burn or a Verification Burn before starting remedial action. If the incinerator has been EPA certified, only the Verification Burn is required. However, if the incinerator has not been certified, the Trial Burn is required for certification purposes.

f. Mobilization

The mobilization of the incinerator requires detailed planning to obtain trip permits, installation of utilities at the project site, equipment requirements, soil storage requirements, administrative requirements, and support requirements.

2. Advanced Planning

The consequences of the lack of planning will impact three primary areas: delisting, incinerator operations, and project costs (incinerator operations being the largest contributor to project cost). For future site remediation projects, the following guidelines should be followed.

a. Establish a formal inventory list before the start of the project. This inventory list should be based on past operational experience of an incinerator. In addition to the inventory list, a spare parts location and receiving procedure must be established. Use an Economic Order Quantity model (or some variation thereof) to project the repair/replacement parts ordering requirements. The economic model will take into account the projected usage rate and the lead time required for the individual parts.

b. Establish a checklist for shutdown planning. These checklists should be very inclusive and should consider all systems. Extra needed equipment, materials services, and their scheduled availability date should be noted.

c. Review the subcontract requirements with the entire supervisory staff. The supervisory staff must know the reporting requirements, data collection requirements, allowable expenditures, permit violation consequences, etc.

d. Review the permit conditions with all site personnel. All personnel must be aware of the operating parameters to minimize the possibility of violations.

e. Establish a documented preventive maintenance system. A routine inspection and maintenance program will find many of the mechanical problems before failure, which could possibly avoid incinerator shutdown for unscheduled maintenance.

3. Much of the advanced planning should be performed before and while the permit application is written. Numerous site-specific details can be considered during the permit application. For example, the original shredder used was inadequately sized for the cement-stabilized soil. A simple test using clean soil of equal matrix could have demonstrated the need for a larger shredder.

4. Avoid permit conditions that specify nondetectable (ND) analytical levels and establish reasonable upper concentration limits using well established analytical methodologies. Analytical interferences often make low detection limits impractical. If the cleanup criteria simply specifies "nondetect" without a numerical value, then operational personnel have little guidance on the acceptability of the waste stream.

5. Establish the analytical requirements, including the protocols, detection levels, and method of handling outliers. Establish multiple analytical laboratories to identify and use their protocols, which should include the method for extraction of the samples. Establish requirements and methodology for interlaboratory variability studies and Practical Quantification Limits (PQL) for each of the analytical laboratories. These methods should be approved by the regulatory agency.

6. Establish the requirement with the regulatory agency for the storage of the process ash.

7. Determine the broadest range of analysis requirements (protocols, level of detection, extraction method) that will be needed for each phase (trial burn, operations, delisting, and site closure) of the project.

8. Determine the reporting and data tracking requirements for all phases of the project. Establish clear and easy to use procedures for data management; the objective of data management should be ease in retrievability.

9. Planning should also include the number and type of personnel needed to perform the tasks necessary to complete the project. As a minimum the subcontractor personnel should include:

a. Secretary

b. Bookkeeper

c. Purchasing agent

d. Spare parts controller

e. Safety officer

f. Operations manager

g. Soil excavation crew

h. Operations crew, including a supervisor for each shift, at least two control room operators on each shift and two soil handlers on each shift.

The customer (state, county, city, federal government or company) should also be represented at the project site with a minimum of one person. If the incinerator operates continuously (24 hours/day, seven days/week), then two onsite project managers should be employed.

While these examples are not all inclusive, they do point out the need for a significant amount of advance planning.

SECTION VII
REFERENCES

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2. Haley, D. J. and Thomas, R. W., EG&G Idaho, Full-Scale Incinerator System Demonstration at the Naval Construction Battalion Center, Gulfport, MS, Volume II: Verification Burn for the USAF Installation Restoration Program, ESL-TR-89-39, Headquarters, Air Force Engineering and Services Center, Tyndall Air Force Base, Florida, In Press.

3. Deiro, S. W., EG&G Idaho, Full-Scale Incinerator System Demonstration at the Naval Construction Battalion Center, Gulfport, MS Volume VI: Soil Excavation, ESL-TR-89-39, Headquarters, Air Force Engineering and Services Center, Tyndall Air Force Base, Florida, In Press.

APPENDIX A
STATE OF MISSISSIPPI
WATER POLLUTION CONTROL
PERMIT

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State of Mississippi
Water Pollution Control
PERMIT

TO OPERATE A WASTE DISPOSAL SYSTEM IN ACCORDANCE

WITH NATIONAL AND STATE PRETREATMENT STANDARDS

THIS CERTIFIES THAT
UNITED STATES AIR FORCE ENGINEERING SERVICES CENTER
(Naval Construction Battalion Center)
Gulfport, Mississippi
has been granted permission to discharge wastewater into
Harrison County Wastewater Management District

in accordance with effluent limitations, monitoring requirements and other conditions set forth in this permit. This permit is issued in accordance with the provisions of the Mississippi Water Pollution Control Law (Section 49-17-1 et seq., Mississippi Code of 1972), and the regulations and standards adopted and promulgated thereunder, and under authority granted pursuant to Section 402 (b) of the Federal Water Pollution Control Act.

The issuance of this permit does not relieve the permittee from complying with any requirements which the Publicly Owned Treatment Works (POTW) Authority may deem necessary as a prerequisite to the use of the Authority's sewage system and associated treatment works.

MISSISSIPPI NATURAL RESOURCES PERMIT BOARD

DIRECTOR, BUREAU OF POLLUTION CONTROL
MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES

Issued: October 31, 1986

Expires: October 30, 1991

Permit No. PT90249

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)			
	Daily Avg.	Daily Max.	Daily Avg.	Daily Max.	Measurement Frequency	Sampling Type
Flow - M^3/day (MGD)	--	--	--	(.0072)	Each Batch Discharge	Grab
2,3,7,8 Tetrachlorodibenzo-p-dioxin (TCDD)	--	--	--	Not Detectable	Three per Week	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 each batch discharge with a grab sample of the effluent.

3. All 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 pretreatment 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.

C. GENERAL PRETREATMENT PROHIBITIONS

1. In addition to those pollutants limited in Part I.A, the following pollutants shall not be discharged into the POTW:

   (a) Pollutants which create a fire or explosion hazard in the POTW;

   (b) Pollutants which will cause corrosive structural damage to the POTW, but in no case discharges with pH lower than 5.5 unless the works is specifically designed to accommodate such discharges;

   (c) Solid or viscous pollutants in amounts which will cause obstruction to the flow in the POTW resulting in interference;

   (d) Any pollutant, including oxygen demanding pollutants (BOD, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause interference with the POTW; or

   (e) Heat in amounts which will inhibit biological activity in the POTW resulting in interference, but in no case heat in such quantities that the temperature at the POTW treatment plant exceeds 40 C (104° F) unless the approval Authority, upon request of the POTW, approves alternate limits.

D. ORAL NOTIFICATION REQUIREMENTS

The permittee shall notify the Mississippi Pollution Control Permit Board and the POTW orally immediately upon becoming aware of the following:

1. A spill which would result in a discharge to the POTW;
2. Any diversion or bypass of the wastewater treatment system which would result in a discharge to the POTW, or
3. Any system upset which would cause the facility to be in noncompliance with the limitations found in Part I.A or I.C of this permit.

E. OTHER SPECIFIC PRETREATMENT REQUIREMENTS

PART II

A. MANAGEMENT REQUIREMENTS AND RESPONSIBILITIES

1. No Discharge of Wastewater to Surface Water

The discharge of any wastewater from this facility to the waters of the State of Mississippi shall constitute a violation of this permit, except as provided in Section A.4 of this permit, or as authorized under separate permit pursuant to Section 402 of the Federal Water Pollution Control Act.

2. Change in Wastewater Source

Any anticipated facility expansions, production increases, or process modifications which will result in new, different, or increased wastewater flows, must be reported to the Mississippi Pollution Control Permit Board. Following such notice, if the Permit Board determines that such change will violate any condition of this permit, it may require the submittal of a new application, or it may modify this permit accordingly.

3. Facilities Operation

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

4. Bypassing

Any diversion from or bypass of wastewater collection and treatment or control facilities is prohibited, except (i) where unavoidable to prevent loss of life or severe property damage, or (ii) where excessive storm drainage or runoff would damage any facilities necessary for compliance with the effluent limitations and prohibitions of this permit. The permittee shall notify the Mississippi Pollution Control Permit Board in writing of each such diversion or bypass in advance where practicable but in any case, within 72 hours of the diversion or bypass, and shall submit to the Permit Board a plan to prevent recurrence of the diversion or bypass within thirty (30) days of the incident.

5. Removed Substances

Solids, sludges, filter backwash, or other residuals removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent such materials from entering State waters and in a manner consistent with the Mississippi Solid Waste Disposal Act and the Federal Resource Conservation and Recovery Act.

6. Power Failures

In order to maintain compliance with the conditions and prohibitions of this permit, the permittee shall either:

a. Provide an alternative power source to operate the wastewater control facilities;

or, if such alternative power source is not in existence, and no date for its implementation appears in this permit,

b. Halt, reduce, or otherwise control production and/or all wastewater flows upon reduction, loss, or failure of the primary source of power to the wastewater control facilities.

B. MONITORING, REPORTING, AND RECORD KEEPING

1. Routine Reporting

Such test results, reports, or other data as the Mississippi Pollution Control Permit Board may determine to be necessary shall be submitted on a regular basis to the following address:

MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES
BUREAU OF POLLUTION CONTROL
P. O. Box 10385
Jackson, Mississippi 39209

2. Test Procedures

Test procedures for the analysis of pollutants shall conform to regulations published pursuant to Section 304 (h) of the Federal Water Pollution Control Act, as amended.

3. Representative Sampling

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored wastewater.

4. Recording of Results

a. The exact place, date, and time of sampling;

b. The dates the analyses were performed;

c. The person(s) who performed the analyses;

d. The analytical techniques or methods used; and

e. The results of all required analyses.

5. Records Retention

(a) All records and information resulting from the monitoring activities required by this permit (including all records of analyses performed; calibration and maintenance of instrumentation; and recordings from continuous monitoring instrumentation) shall be retained for a minimum of three (3) years, or longer if requested by the Permit Board.

(b) The permittee shall furnish to the Permit Board, upon request, copies of records required to be kept by this permit.

6. Noncompliance Reporting

This permittee shall report any instances of noncompliance orally to the Director, or his representative, within 24 hours of becoming aware of the circumstances. A written report shall also be provided within five (5) days of such time, and shall contain the following information:

(a) A description of the noncompliance and its cause, if known.

(b) The period of noncompliance, including exact dates and times; or if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence.

7. Right of Entry

The permittee shall allow the Mississippi Pollution Control Permit Board and/or its authorized representation of credentials:

(a) To enter upon the permittee's premises where a wastewater source is located or in which records are required to be kept under the terms and conditions of this permit; and

(b) At reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect any monitoring equipment or monitoring method required in this permit; and to sample any wastewater generated at this facility.

8. Transfer of Ownership or Control

This permit is not transferable to any person except after proper notice. In the event of any change in control or ownership of facilities, the permittee shall notify the Mississippi Pollution Control Permit Board at least thirty (30) days in advance of the proposed transfer date. The notice should include a written agreement between the existing and new permittees containing a specific date for the transfer of permit responsibility, coverage, and liability.

9. Availability of Records

Except for data determined to be confidential under the Mississippi Air and Water Pollution Control Law, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Mississippi Bureau of Pollution Control.

10. Permit Modification

(a) The permittee shall furnish to the Permit Board within a reasonable time any relevant information which the Permit Board may request to determine whether cause exists for modifying, revoking and reissuing, or terminating the permit, or to determine compliance with the permit.

(b) Upon sufficient cause this permit may be modified, revoked, reissued, or terminated during its term.

(c) The filing of a request by the permittee for a permit modification, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

11. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State, or local laws or regulations.

12. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject to under Section 311 of the Federal Water Pollution Control Act or the applicable provisions under Mississippi Law pertaining to the transportation, storage, treatment, or spillage of oil or hazardous substances.

13. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstances, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

14. The structural integrity of all levees and dikes shall be maintained in good repair with a minimum freeboard of two feet from the lowest point of the levee to the surface of the water at a level that would produce a discharge of water from the containment.

15. Closure Requirements

Should the permittee decide to permanently close and abandon the premises upon which it operates, it shall so notify the Permit Board no later than 90 days prior to doing so. Accompanying this notification shall be a closure plan which describes how and when all manufactured products, by-products, raw materials, stored chemicals, and solid and liquid wastes will be removed from the premises such that they will present no potential environmental hazard to the area. Abandonment of the site without all aspects of the closure plan, will constitute a violation of this permit and may result in penalties of up to $25,000.