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ENVIRONMENTAL RESTORATION TECHNOLOGY RESEARCH AND TEST EVALUATION
NCBC GULFPORT MS
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EG&G IDAHO, INC.

NCBC Gulfport Administrative Record
Document Index Number

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ADMINISTRATIVE RECORD

HQ AFESC

Environmental Restoration Technology Research and Test Evaluation

Submitted to:
Dioxin Disposal Advisory Group,
Environmental Protection Agency

March 8, 1985

Prepared by:
EG&G Idaho, Inc.

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EXECUTIVE SUMMARY

PURPOSE

The purpose of this document is to provide to the EPA Dioxin Disposal Advisory Group (DDAG), and other interested agencies as applicable, the technical information for the United States Air Force (USAF) Environmental Restoration Program concerning the Research and Test evaluation (RT&E) of selected technologies for decontaminating former Department of Defense (DOD) Herbicide Orange storage sites.

SCOPE

Following suspension of the use of Herbicide Orange and subsequent destruction of the entire USAF stockpile (2.22 million gallons) in the 1970's, the USAF implemented a program in 1980 to restore the Herbicide Orange sites to beneficial use. One of the major activities of this program is to field test and evaluate selected decontamination technologies.

Two technologies and associated contractors have been selected. They are:

1. Thermal pyrolysis of the soil and destruction of the contaminants in a high temperature (2000°F) electric reactor, to be performed by the J.M. Huber Company, at the Naval Construction Battalion Center (NCBC), Gulfport, MS.

2. Thermal desorption followed by ultraviolet light destruction of the contaminants, to be performed by the IT Corporation at NCBC and Johnston Island (JI), Pacific Ocean.

The goal of each technology is to reduce the total isomers of: tetra-, penta-, and hexa-chlorodibenzo-p-dioxin and respective isomers of chlorodibenzo furan to less than 1 ppb.

Additional analysis will be performed to assess the Carcinogen Assessment Groups (CAG), the Priority Pollutant List (PPL), the compounds indigenous to Herbicide Orange, the heavy metals, and the EP Toxicity Test as required.

Following completion of the tests and analysis, the data will be evaluated for:

1. Meeting criteria for soil cleanup,

2. Efficiency of the technology, and

3. Scale-up factors for full site remedial action.

The results of the evaluation and all data will be compiled in the final report to be submitted to the USAF by ESE&G Cleanup, Inc.

The USAF will inform the EPA (DDAG) of the preliminary results (quick-look report) at the conclusion of the testing and will provide to DDAG copies of the final report. All inquiries by the DDAG will be responded to in a timely manner.

OBJECTIVE

The USAF (HQ AFESC) is requesting from the EPA, letters of waiver for permit requirements applicable to the testing of the identified technologies. This is based on the review and approval of the contents of this document by DDAG, followed by subsequent review and approval by the EPA Regional Offices (IV and IX), State of Mississippi authorities, and local Base Commanders.

INTRODUCTION AND BACKGROUND

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-trichlorophenoxyacetic acid (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 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD).[a] Subsequently, the Department of Defense suspended the use of Herbicide Orange (HO), which contained 2,4,5-T. At the time of suspension, the U.S. Forces had an inventory of 1.37 million gallons of Herbicide Orange in South Vietnam and 0.85 million gallons at the Naval Construction Battalion Center (NCBC), Gulfport, MS. In September 1971, the Department of Defense 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 (JI), Pacific Ocean in April 1972. The average concentration of dioxin in the HO was about 2 parts per million with the total amount of TCDD in the entire HO stock estimated at 24.1 pounds.

Herbicide Orange is a reddish-brown to tan liquid, soluble in diesel fuel and organic solvents, but insoluble in water. One gallon of HO theoretically contained 4.27 pounds of the active ingredient 2,4-D and 4.47 pounds of the active ingredient 2,4,5-T. Herbicide Orange was formulated to contain a 50:50 mixture (by weight) of the n-butyl esters of 2,4-D and 2,4,5-T. The percentages of the formulation typically were:

n-butyl ester of 2,4-D	49.49
free acid of 2,4-D	0.13
n-butyl ester of 2,4,5-T	46.75
free acid of 2,4,5-T	1.00
inert ingredients (e.g., butyl alcohol and ester moieties)	0.63

Various disposal techniques for Herbicide Orange were investigated from 1971 to 1974 (Reference 1). Destructive techniques investigated at that time included soil biodegradation, high-temperature incineration, deep-well injection, burial in underground nuclear test cavities, sludge burial, and microbial reduction. Techniques used to recover a useful product included activated charcoal filtration, return to manufacturers, fractionation, and chlorinolysis.

Of these techniques, only high-temperature incineration was sufficiently developed to warrant further investigation. The other methods were temporarily rejected because of several considerations, including long lead times for development, inadequate assurance of success, and the lack of industrial interest.

a = The word "dioxin" in this document refers to 2,3,7,8-TCDD.

During the summer of 1977 the United States Air Force (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 regulation by the U.S. Environmental Protection Agency (EPA) ocean-dumping permits.

The Air Force Plan and the EPA permits for the disposal of the herbicide committed the Air Force to a follow-up storage site reclamation and environmental monitoring program. The major objectives of this program were to:

1. Determine the magnitude of HO contamination (TCDD) in and around the former HO test storage 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 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 (USAF OEHL) initiated site-monitoring studies of chemical residues in soil, silt, water, and biological organisms associated with the former storage sites where the herbicide had been stored at the NCSC and JI. The results of the NCSC and JI monitoring studies have been published.

Secretary of the Air Force/Deputy for Environment and Safety (SAF/MIQ) requested and received from Air Force/Surgeon General (AF/SG) in June 1980 a proposed research protocol to return HO-contaminated sites to full and beneficial use. Based on this research protocol, SAF/MIQ recommended that AFESC/RD Engineering and Services Laboratory (ESL) be designated as lead laboratory for monitoring and reclamation research. Air Force Deputy Chief of Staff for Engineering/Logistics (AF/LEE) agreed that the Environics Division of ESL should handle the complex integration of environmental chemistry and control technology required to address the problem. It was noted, however, that the ESL is dedicated to a research mission and not routine field assistance tasks. This required that site monitoring be consolidated within the dioxin research program, rather than in routine analyses, which is the mission of the OEHL. Before initiation of the overall research program the ESL routed the research requirement through Air Force Deputy Chief of Staff for Research and Development (AF/RD) and Air Force Systems Command/Director of Laboratories (AFSC/DL) in the form of a Statement of Operational Need (SON). The validated USAF SON 2-81 directed that (1) sampling and analysis program be initiated, (2) a program to look at methods to destroy dioxin <u>in-situ</u> be started, but no full-scale effort take place unless further directed by SAF, and (3) pro-

gress on assessing long-term breakdown and movement of dioxin be reviewed yearly at the headquarters Air Force Engineering and Services Center, Engineering and Services Laboratory.

The Environmental Division of ESL has monitored the natural degradation of herbicide Orange at the DOD sites since 1980. In 1984 the Environmental Division contracted with EG&G Idaho, Inc. to map the dioxin concentrations at NCBC and II as well as conducting a hydrogeological study at NCBC. Results of the soil mapping activities will be utilized in defining the research approach for a Research Test and Evaluation (RT&E) program to field evaluate potential cleanup technologies at NCBC and II. The field tests are planned for FY-85.

VOLUME 1

SITE DESCRIPTION AND CHARACTERIZATION

CHAPTER VI: SITE DESCRIPTION/MAPS/PHOTOGRAPHS

A. JOHNSTON ISLAND, PACIFIC OCEAN (JI)

Johnston Island, a coral atoll (Figures 1 through 5), is located 750 nautical miles southwest of Honolulu in the central Pacific Ocean. The island is 1/2 mile wide and 2 miles long (600 acres) with a mean elevation of 7 feet above sea level. The original coral atoll was less than 250 acres, but extensive dredging and filling extended all the original shoreline and increased the size to its present 600 acres.

The island is controlled by Field Command of the Defense Nuclear Agency (FC/DNA). The Army and Coast Guard have tenant units assigned to the island totalling 80 personnel. Base support is provided by a civilian contractor which maintains approximately 300 employees onsite. Future activities will increase the island population by 400 people.

Ten acres of Johnston Island served for storage and support operations for 1.27 million gallons of Herbicide Orange returned from South Vietnam. The operational areas included de-drumming, drum crusher and decontamination facilities. The former storage site is at maximum point downwind on the island and is composed entirely of coral material.

There is no fresh water lens at JI; all potable water is prepared by desalinization. The sea water intake for the desalinization plant is located 10,000 ft up-current from the former Herbicide Orange site.

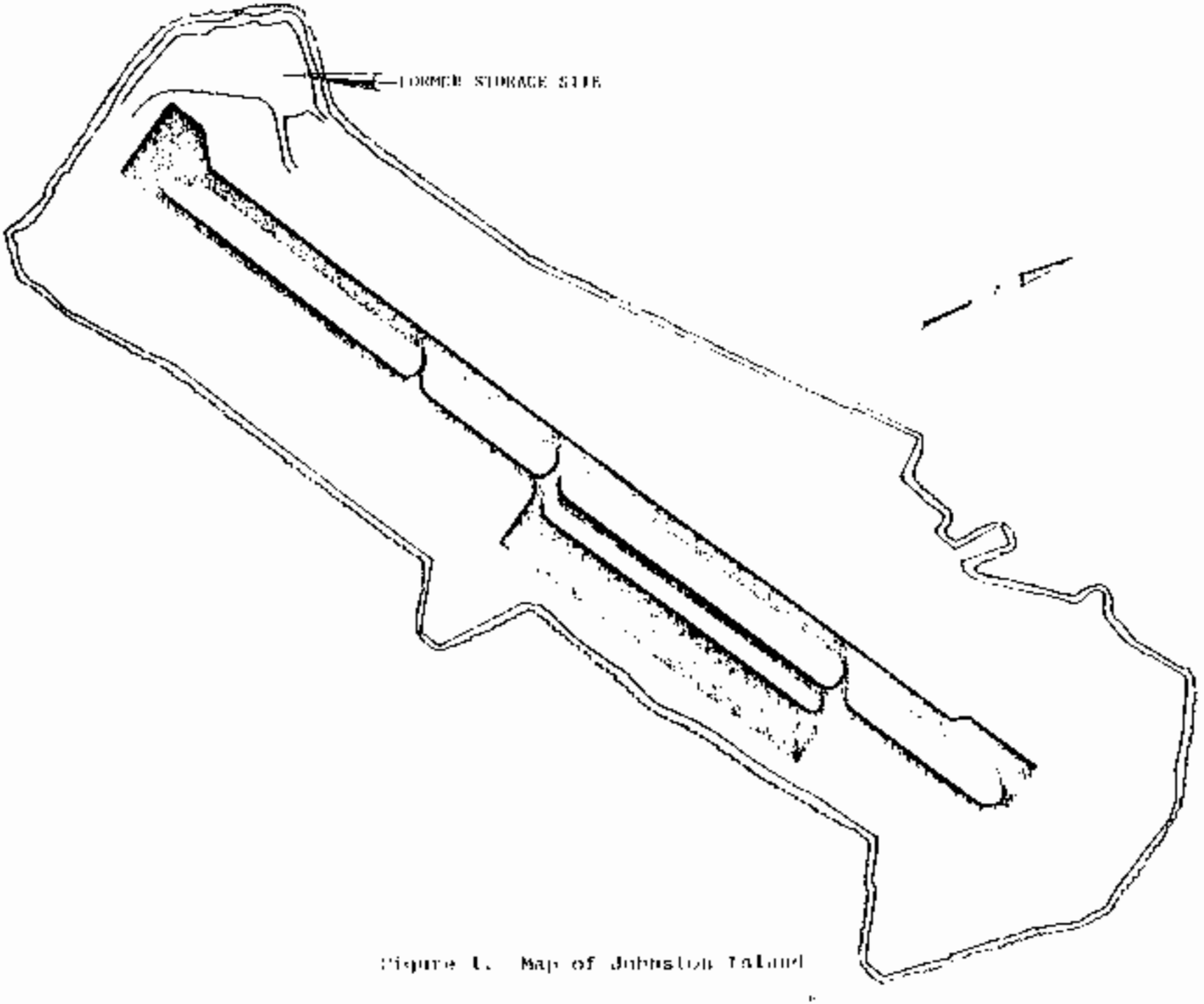


Figure 1. Map of Johnston Island

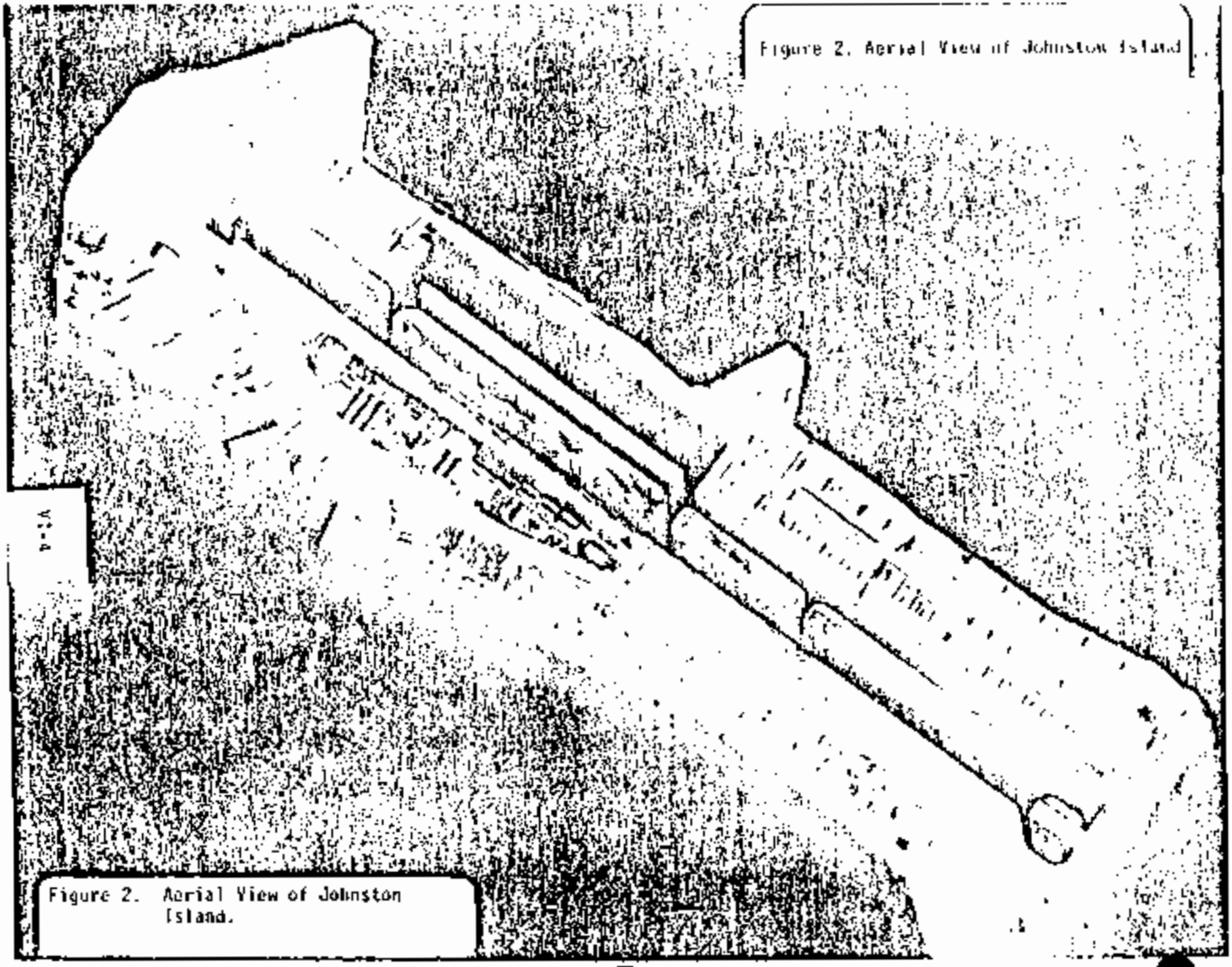


Figure 2. Aerial View of Johnston Island

Figure 2. Aerial View of Johnston Island.

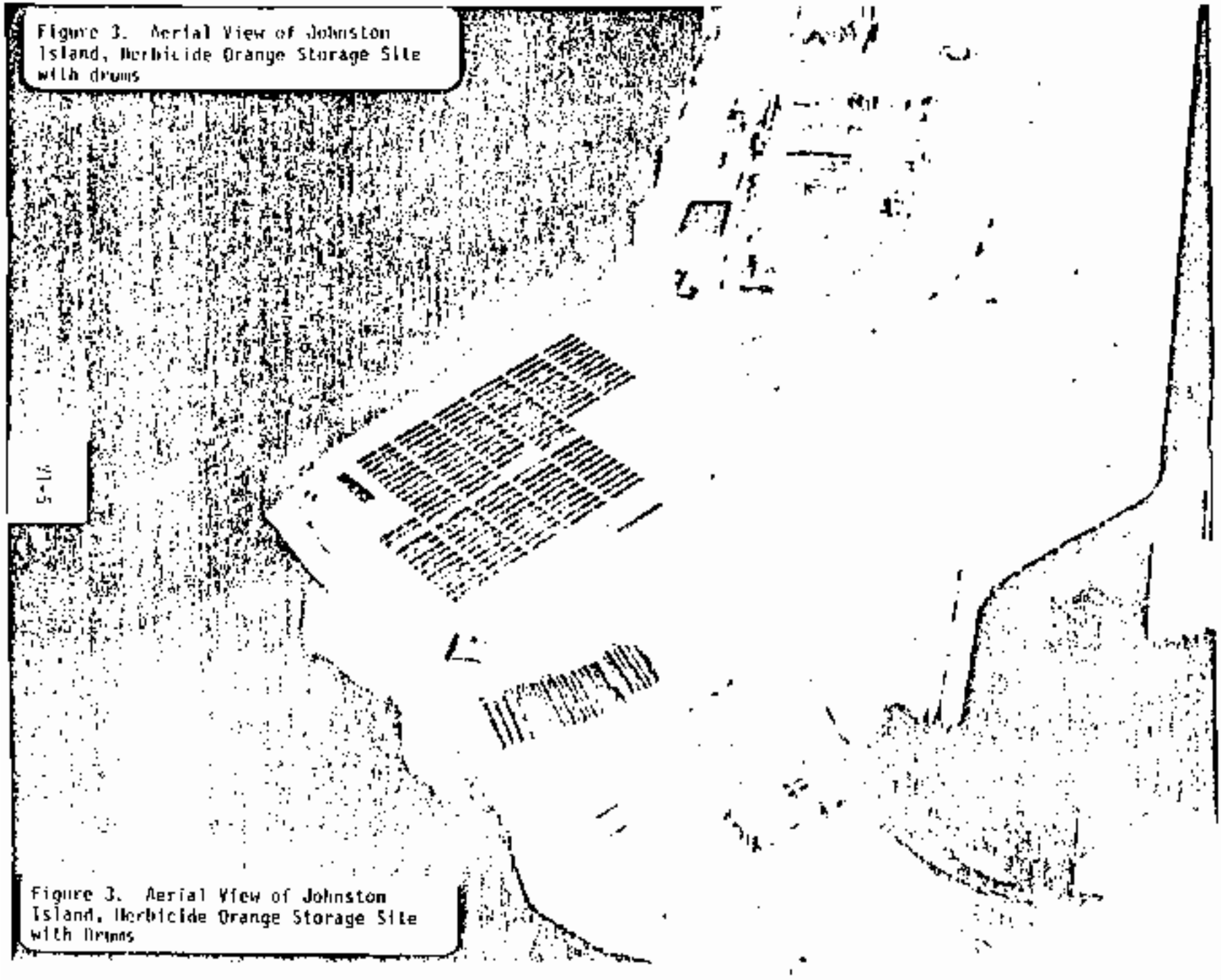


Figure 3. Aerial View of Johnston Island, Herbicide Orange Storage Site with drums

Figure 3. Aerial View of Johnston Island, Herbicide Orange Storage Site with Drums

Figure 4. Ground view of the Johnston Island Herbicide Orange Site.

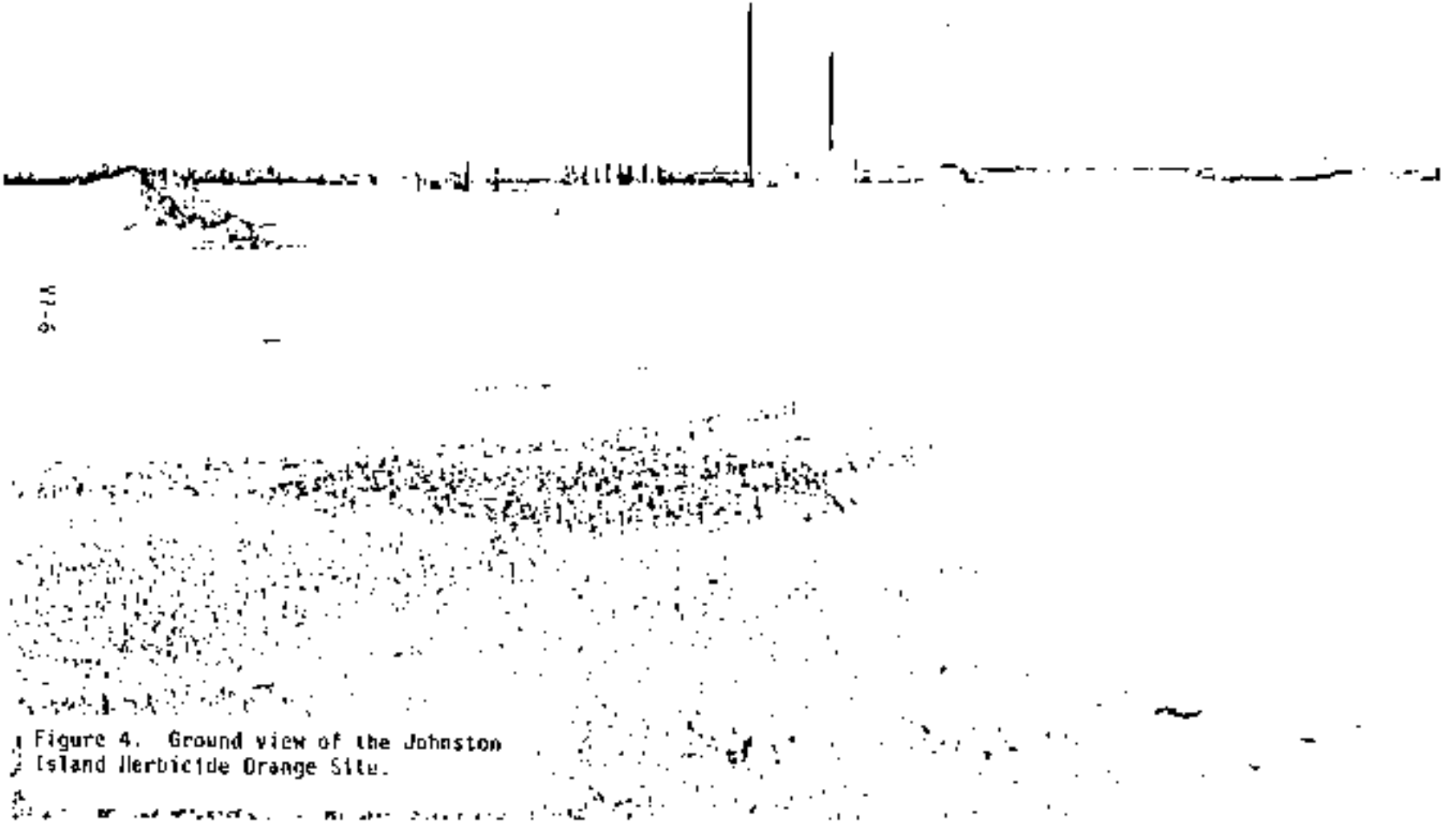


Figure 4. Ground view of the Johnston Island Herbicide Orange Site.

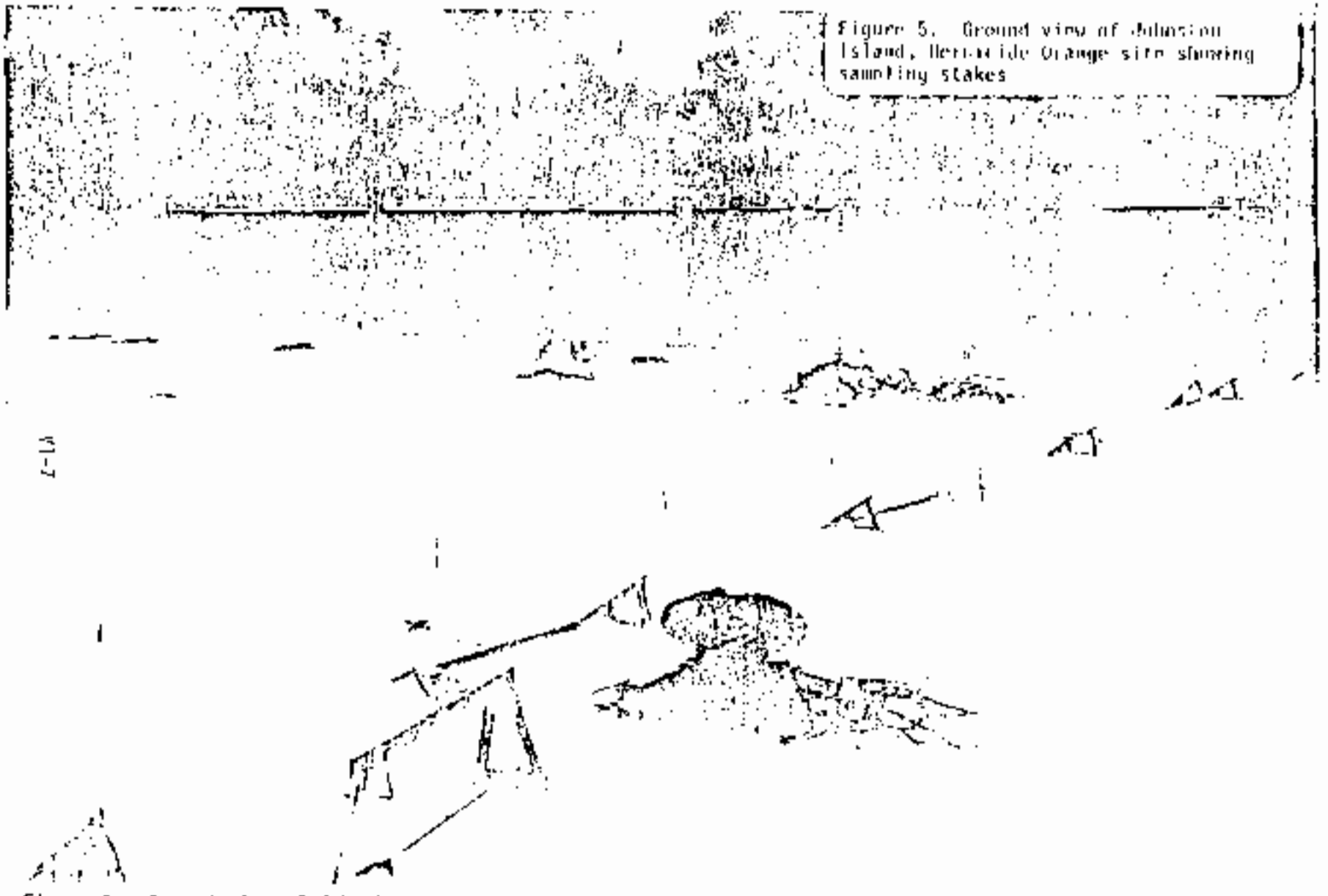


Figure 5. Ground view of Johnston Island, Herbicide Orange site showing sampling stakes

Figure 5. Ground view of Johnston Island, Herbicide Orange site showing sampling stakes

Figure 4. Ground view of the Johnston Island Herbicide Orange Site

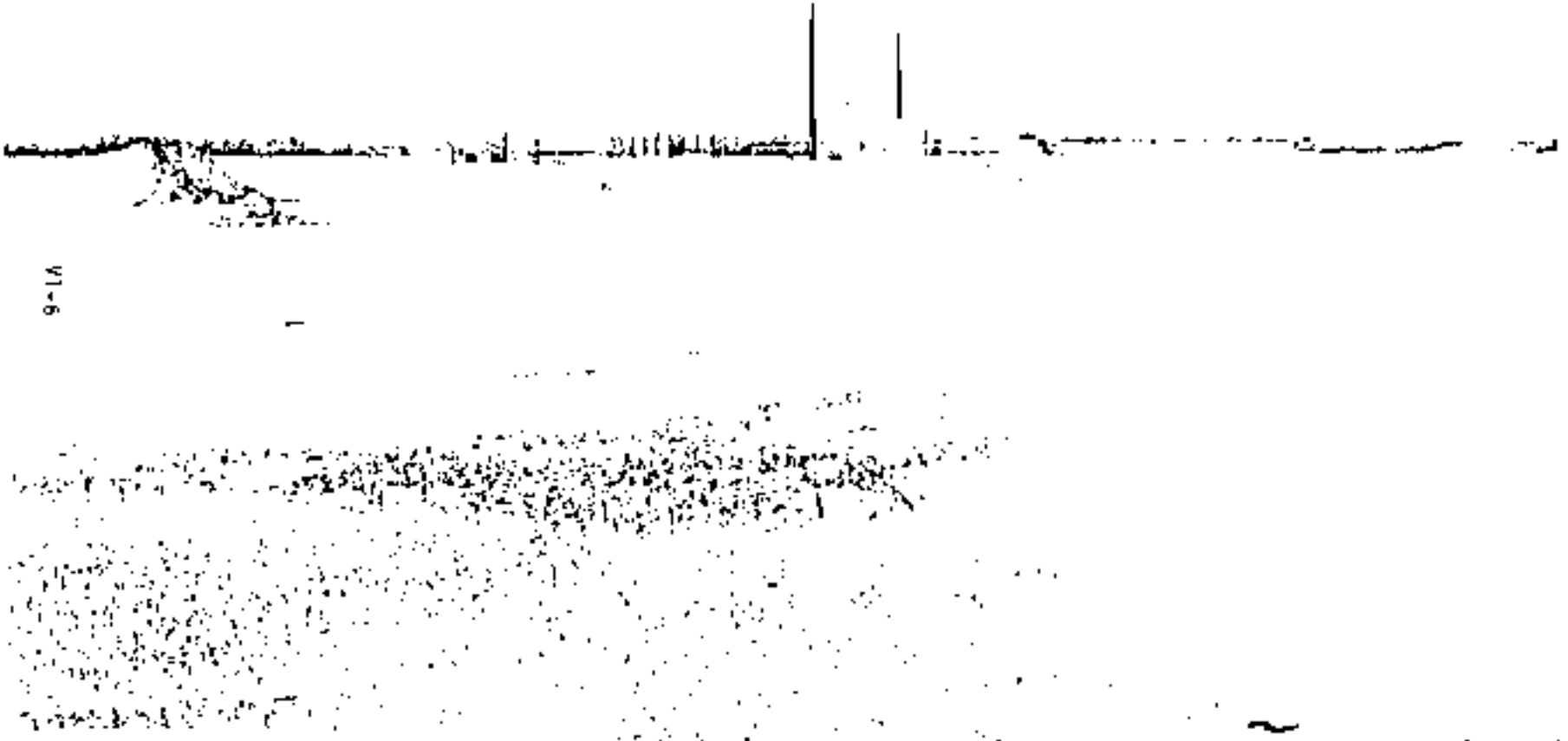


Figure 4. Ground view of the Johnston Island Herbicide Orange Site.

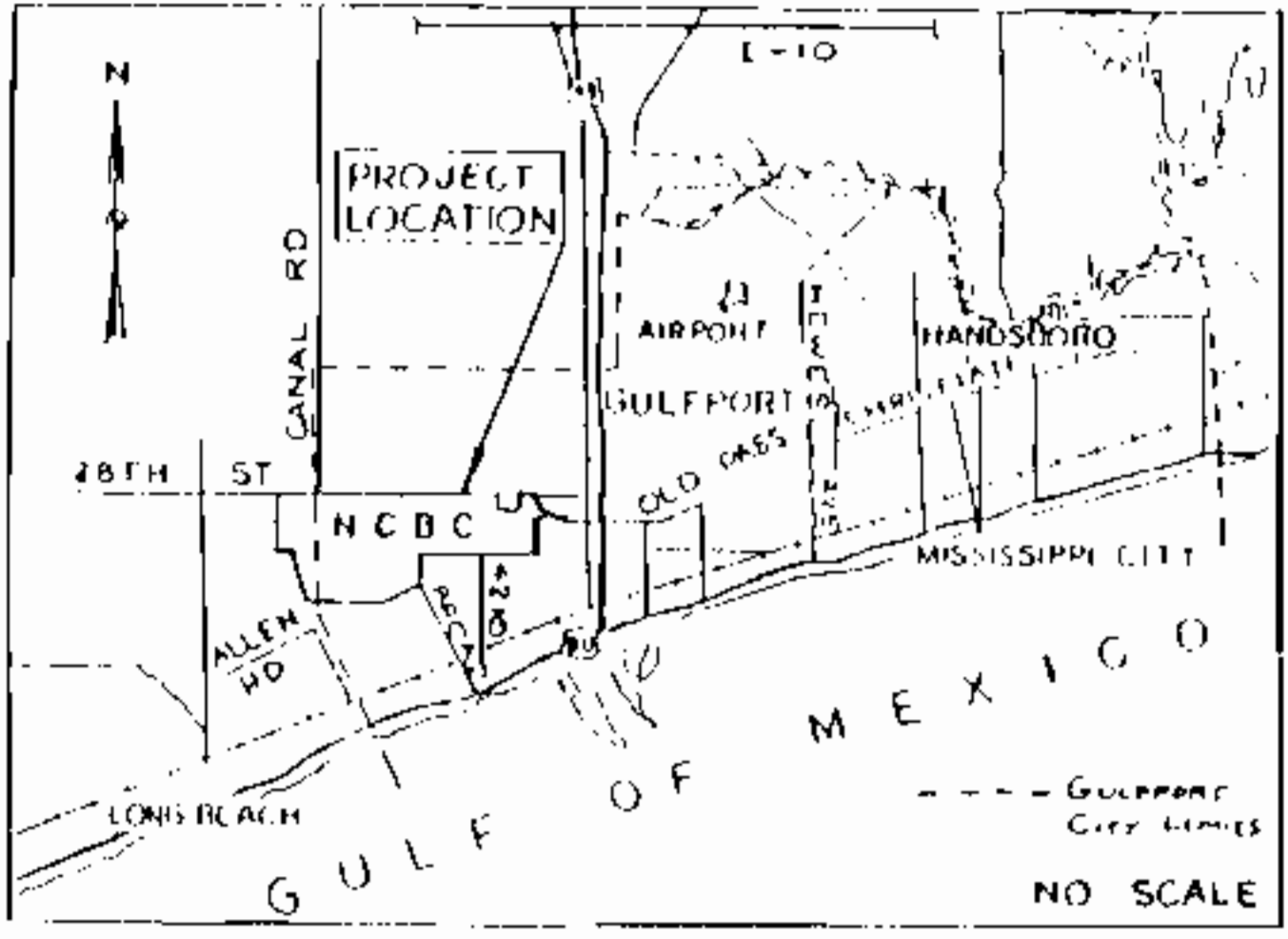


Figure 1. Naval Construction Battalion Center Vicinity Map

3. NAVAL CONSTRUCTION BATTALION CENTER, GULFPORT, MS (NCBC)

The NCBC is located in Gulfport, MS (Figures 1 through 5). The NCBC is located approximately 2 miles from the Gulf of Mexico and occupies a land area of several square miles. The NCBC is approximately 20 feet above sea level. The soil is sand to sandy loam, intermixed with some clay.

Approximately 12 acres at the NCBC served as a storage site for 0.85 million gallons of herbicide Orange. The "old" storage site was stabilized with Portland cement approximately 30 years ago. The stabilized soil provided a hardened storage area for heavy supplies and equipment. Over the years, additional fill materials (shell, rock, soil, asphalt and tar) were added to the storage area, providing a cover of several inches over the cement-stabilized soil.

Approximately 12-18 acres are considered contaminated with Herbicide Orange and its associated dioxin. During 1980, retention basins were constructed on the storage site to prevent the migration of dioxin-contaminated soils off site. Currently the "old" Herbicide Orange storage site is a restricted area and is not used.

Figure 3. Overview of the NCBC
Herbicide Orange Site

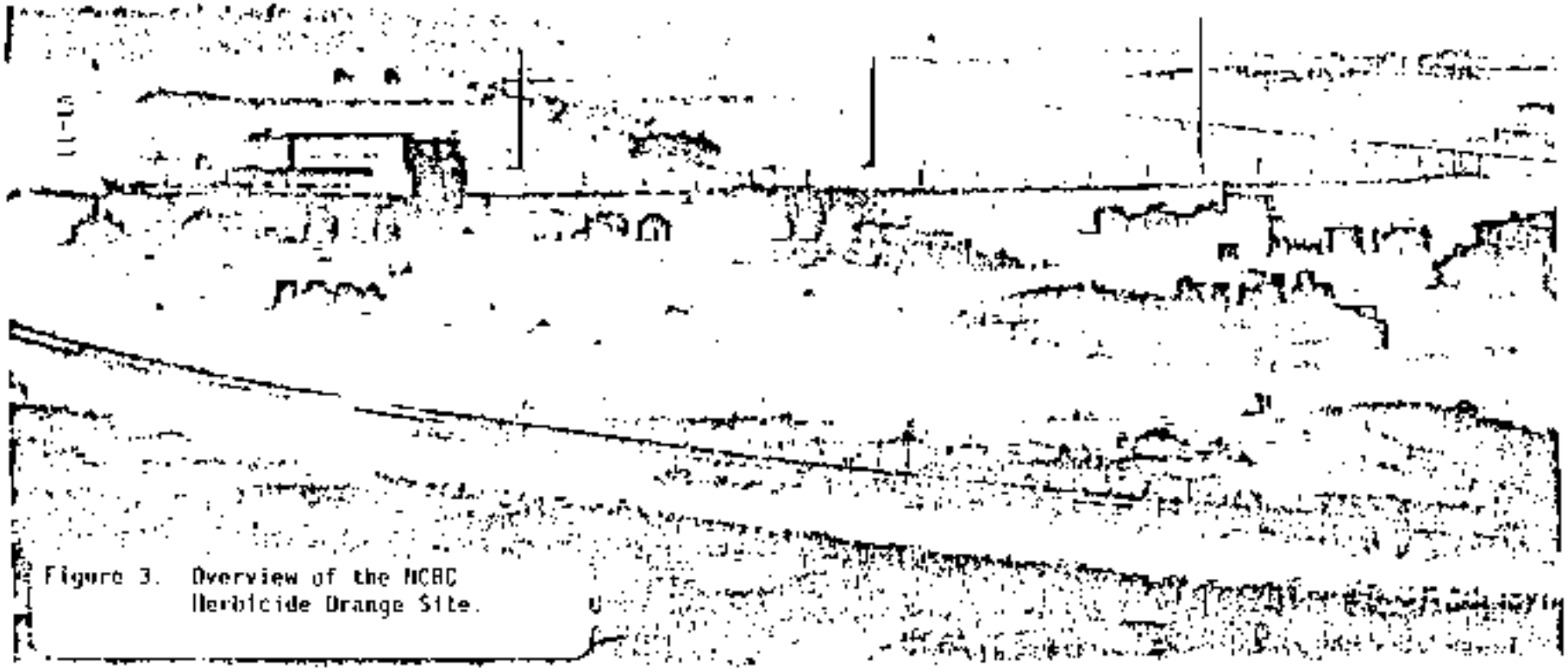


Figure 3. Overview of the NCBC
Herbicide Orange Site.

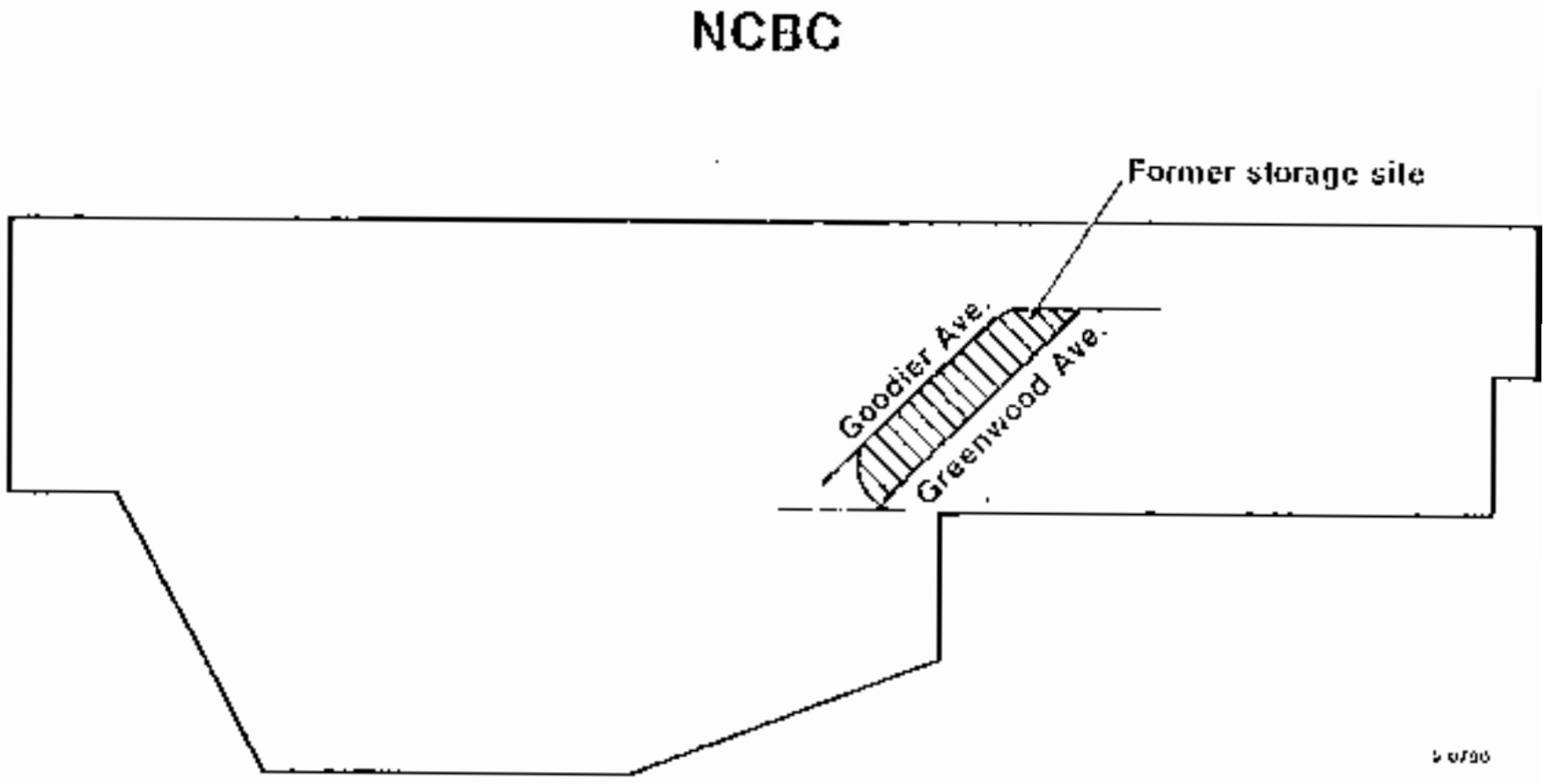


Figure 2. NCBC Perimeter and location of former Herbicide Orange Storage Site

Figure 5. Closeup of NCBC Herbicide
Orange Storage Site

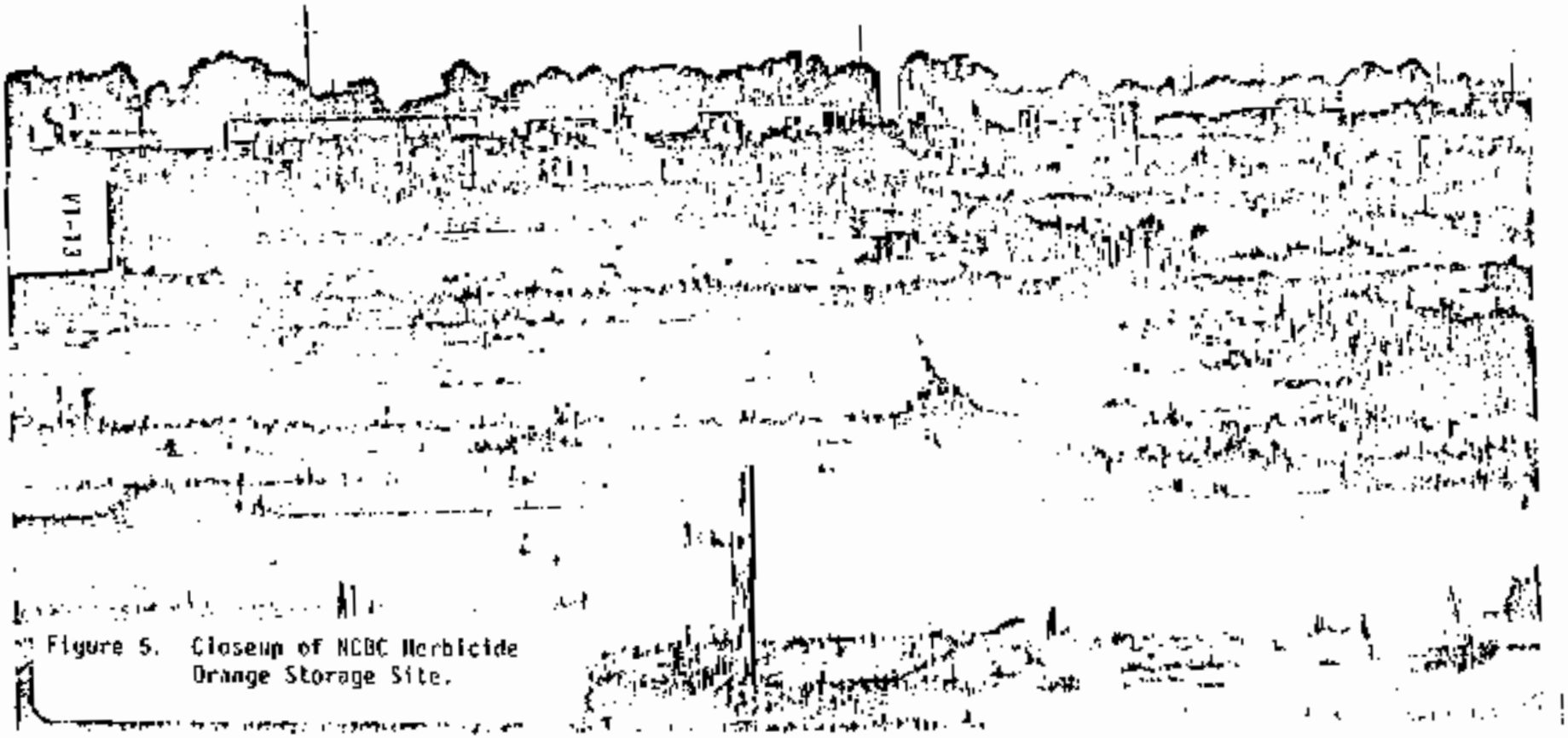
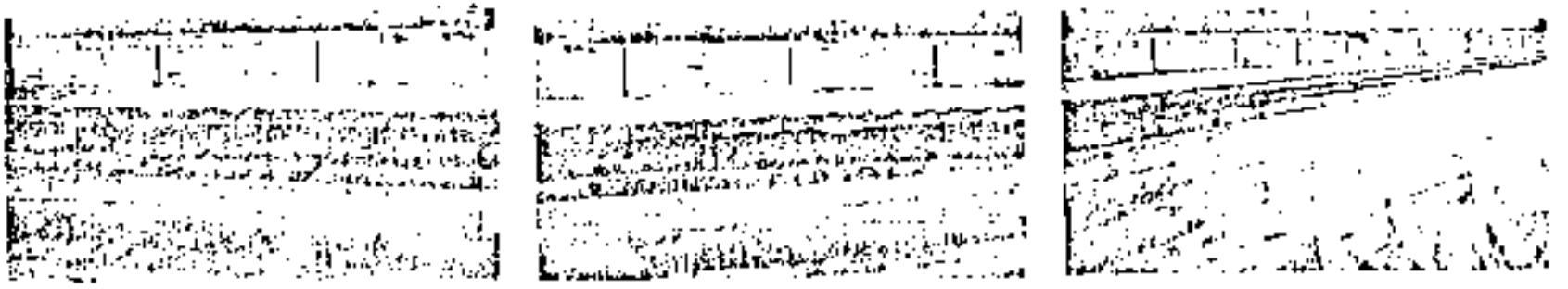


Figure 5. Closeup of NCBC Herbicide
Orange Storage Site.

Figure 4. Composite ground view of
HCBC Herbicide Orange Storage Site



re 4. Composite ground view of

The rocks beneath the NCBC consist of sand, gravel, silt, and clay. They are highly variable in short lateral distances. The water table is shallow and is only 4 to 6 feet below the land surface and stands about 25 feet above sea level in some areas. The water in the shallow deposits would have a southerly movement toward discharge into the Gulf of Mexico. Locally, the groundwater flow direction could vary depending on localized geology, recharge, discharge, and other factors. The flow direction can be determined by shallow wells and carefully measured water levels to give the hydraulic gradient.

At NCBC, the potential contaminant was stored relatively close to the facility boundary, about 600 feet from the southern site boundary and about 1200 feet from the northern boundary. Shallow monitoring wells are being designed to determine the geology, the water quality, and the hydraulic gradient. The water and geologic samples from the wells will be used to determine the extent of waste migration. The wells will enable water samples to be collected in the future. The monitoring wells will be positioned so that waste cannot migrate off site without detection. Some of the monitoring wells will be drilled to detect waste products if they have migrated downward to deeper sandy zones.

Figure 2 presents the drainage system from the Herbicide Orange storage site. This drainage proceeds off the Naval Construction Battalion Center to the local surface stream, Turkey Creek. Reports of sampling and anlysis of this drainage system have been published. Figure 3 presents the retention basins constructed during 1980 and the flow within the basin system.

CHAPTER 2. HYDROGEOLOGICAL DATA

A. NCBC, Gulfport, MS

The gulf coastal area has been slowly subsiding for millions of years, forming a trough known as the Gulf Coast geosyncline. As the trough sank, streams emptying into the Gulf of Mexico have kept the trough nearly full by depositing huge quantities of sand, gravel, and mud. These sand and gravel deposits make up the principal aquifers in the Gulfport area (Table 1).

Geologic units containing fresh water near Gulfport are of Miocene or younger age (the last 24 million years). These beds are more than 3,000 feet thick (Figure 1). There are no thick, consistently traceable clay beds (aquicludes). The sand and gravel beds are irregular in thickness and extent. However, some sandy zones (aquifers) can be traced for reasonable distances. All the rocks from the base of the Miocene to within 200 feet of the land surface are Miocene and Pliocene rocks. The rocks from near the land surface to about 200 feet are designated Citronell Formation. On the surface are terrace deposits, alluvium, and beach deposits. These deposits are from 10 to about 50 feet thick.

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

Deep wells in the Gulfport area had water levels about 100 feet above sea level about 100 years ago. Today, the water levels are at or below sea level. However, there is no evidence of saltwater encroachment as a result of the lowered groundwater levels. In fact, fresh water occurs more than 12 miles offshore (south of Gulfport).

Developed sand zones are generally permeable. For example, deep wells at Gulfport can be pumped at 500 gpm with 25 to 70 feet of drawdown.

The water quality increases with distance from the recharge area and with depth. Most groundwaters near Gulfport are soft and of good quality and contain less than 250 mg/l of dissolved solids. The temperature of the shallow groundwater near Gulfport is usually about 68°F and the geothermal gradient is about 1°F increase in temperature for every 62 feet of depth. The average annual rainfall at Gulfport is about 60 inches per year.

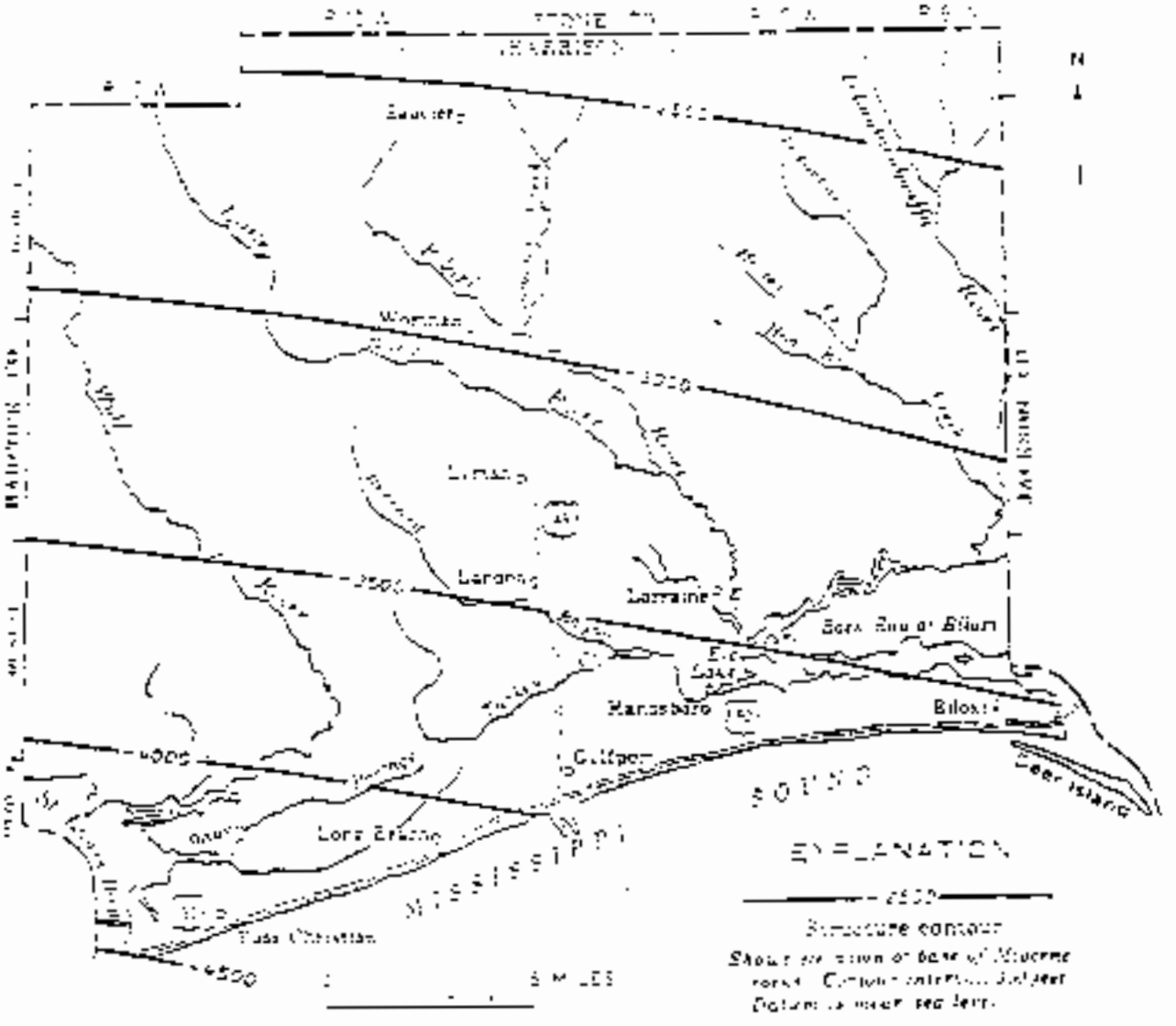
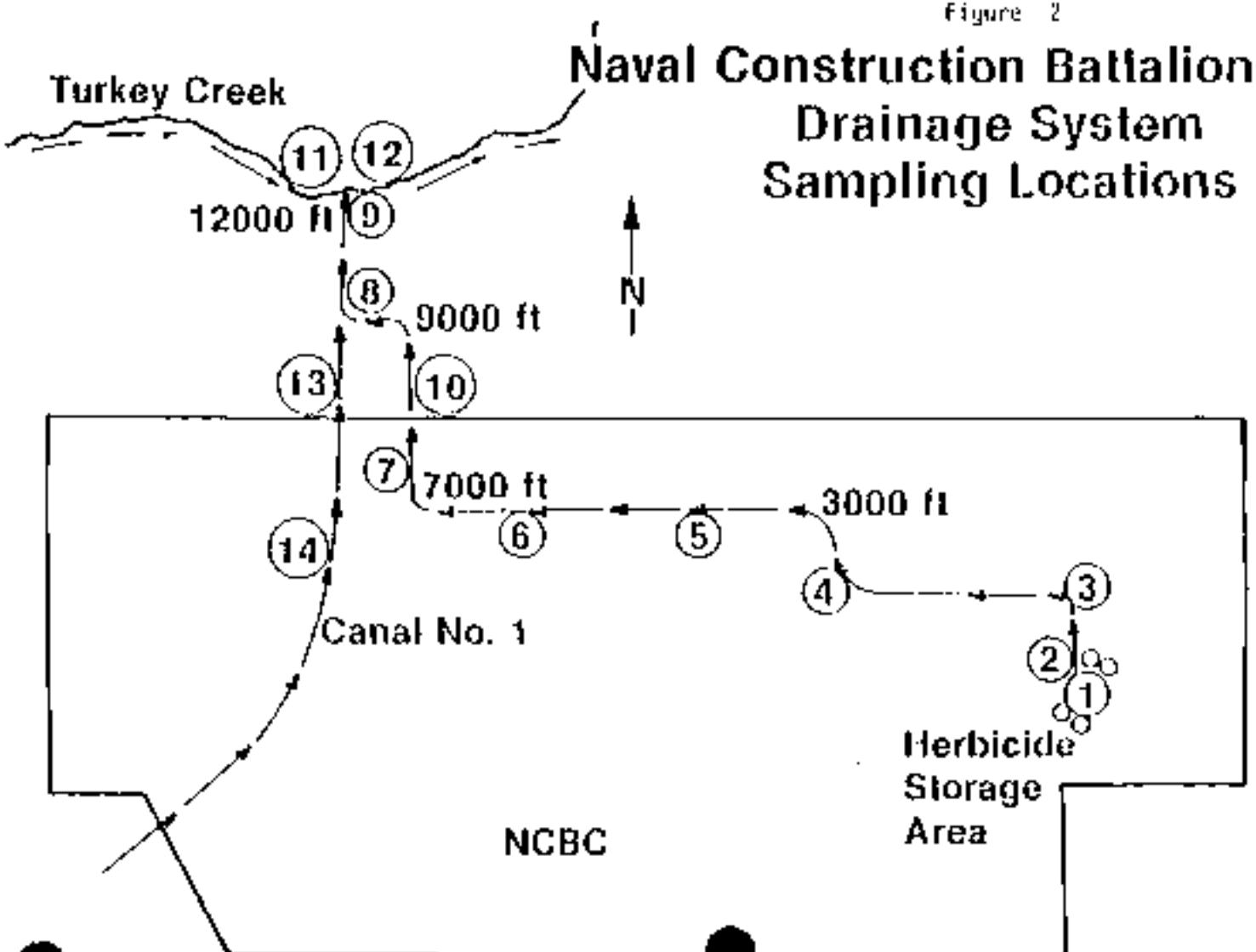


FIGURE 1.—Elevation of the base of the Miocene rocks.

Figure 2

Naval Construction Battalion Center Drainage System Sampling Locations



Footages indicate distance downstream, herbicide storage area

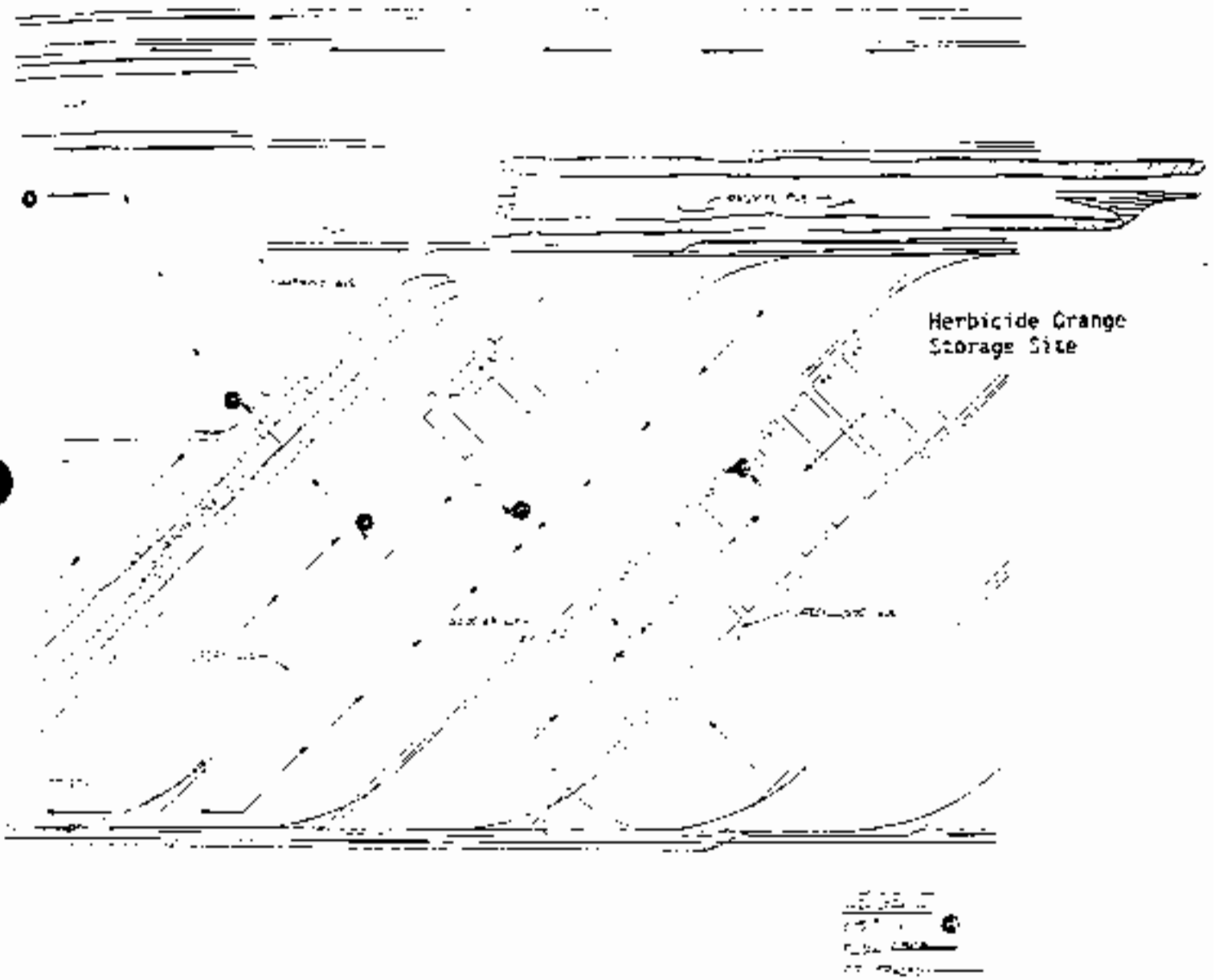


Figure 3: Retention Basin Drainage at NCBC
Herbicide Orange Storage Site

3. Johnston Island, Pacific Ocean

Johnston Island is a man-made island comprised of dredged coral material and concrete sea walls. The original 250-acre atoll has been expanded to the present size of 800 acres with the dredged coral material. The island has no fresh water lens and the underlying sea water flow (approximately 7 feet beneath the surface) is from northeast to southwest.

Because of this current direction, the intake for the fresh water desalinization unit is 10,000 feet up-current from the former HD Storage site. Subsurface sea water flow from the former HD Storage Site is out to sea since the site is at the extreme southwest point of the island.

CHAPTER VI: CONCENTRATION PLOTS

Figure 1 and Figure 2, Johnston Island (JI) and Naval Construction Battalion Center (NCBC), respectively, show preliminary data on concentrations of 2,3,7,8-TCDD in ppb units. These results are from the ongoing sampling and analysis program being conducted by EG&G Idaho, Inc. for HQ AFESC. The sampling effort will be complete May 1988 and the analytical portion will be complete late June 1988.

Figure 3 (JI) and Figure 4 (NCBC) indicate the concentrations of 2,3,7,8-TCDD obtained from previous sampling and analysis of soils at JI and NCBC.

Preliminary evaluation indicates little (if any) horizontal migration of 2,3,7,8-TCDD. Hot spots are localized, particularly at JI, although a few previous samples have indicated vertical penetration of both coral at JI and the cement stabilized soil at NCBC.

These concentration plots will be used to determine where soil will be removed for testing with the thermal treatment technologies. Likewise these plots will be used to determine the test plot for application of in-situ chemical treatment. It is the goal of the technology evaluation to treat soil contaminated with TCDD in the 100-200 ppb range.

Johnston Island

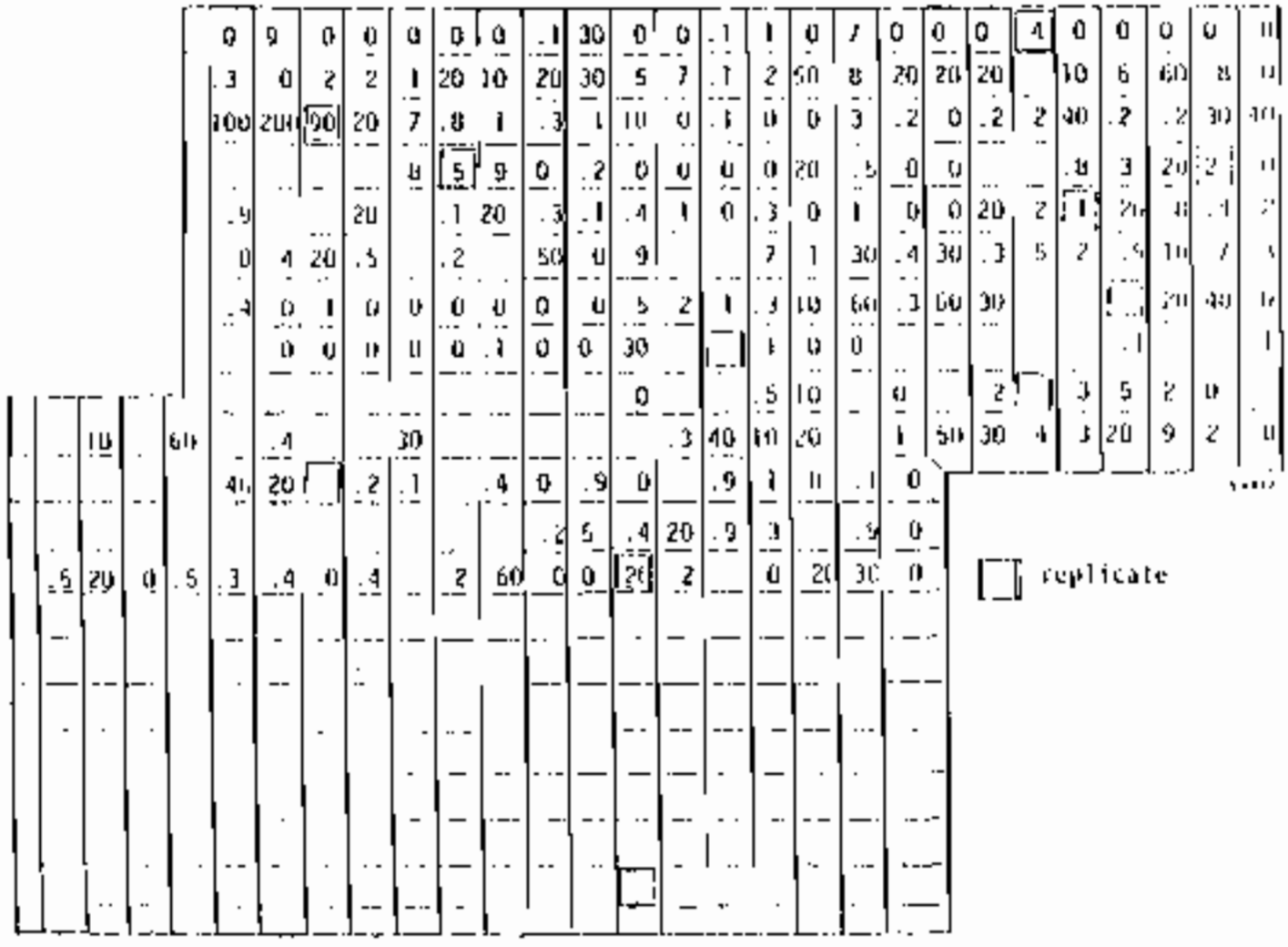


Figure 1. TCDD concentration (ppb) at Johnston Island

NCBC - Original

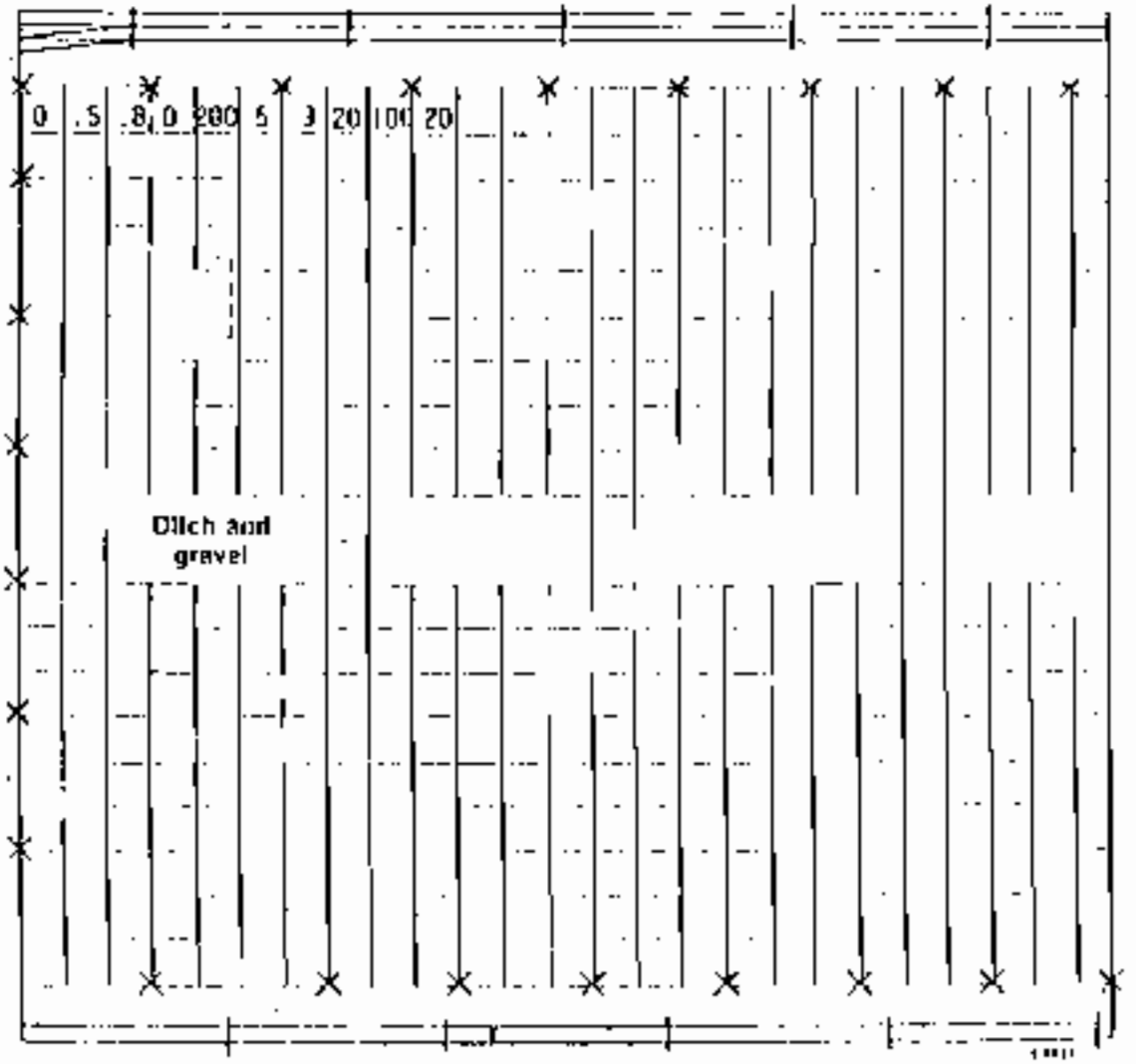


Figure 2. TCDD concentration (ppb) at NCBC (1 of 4)

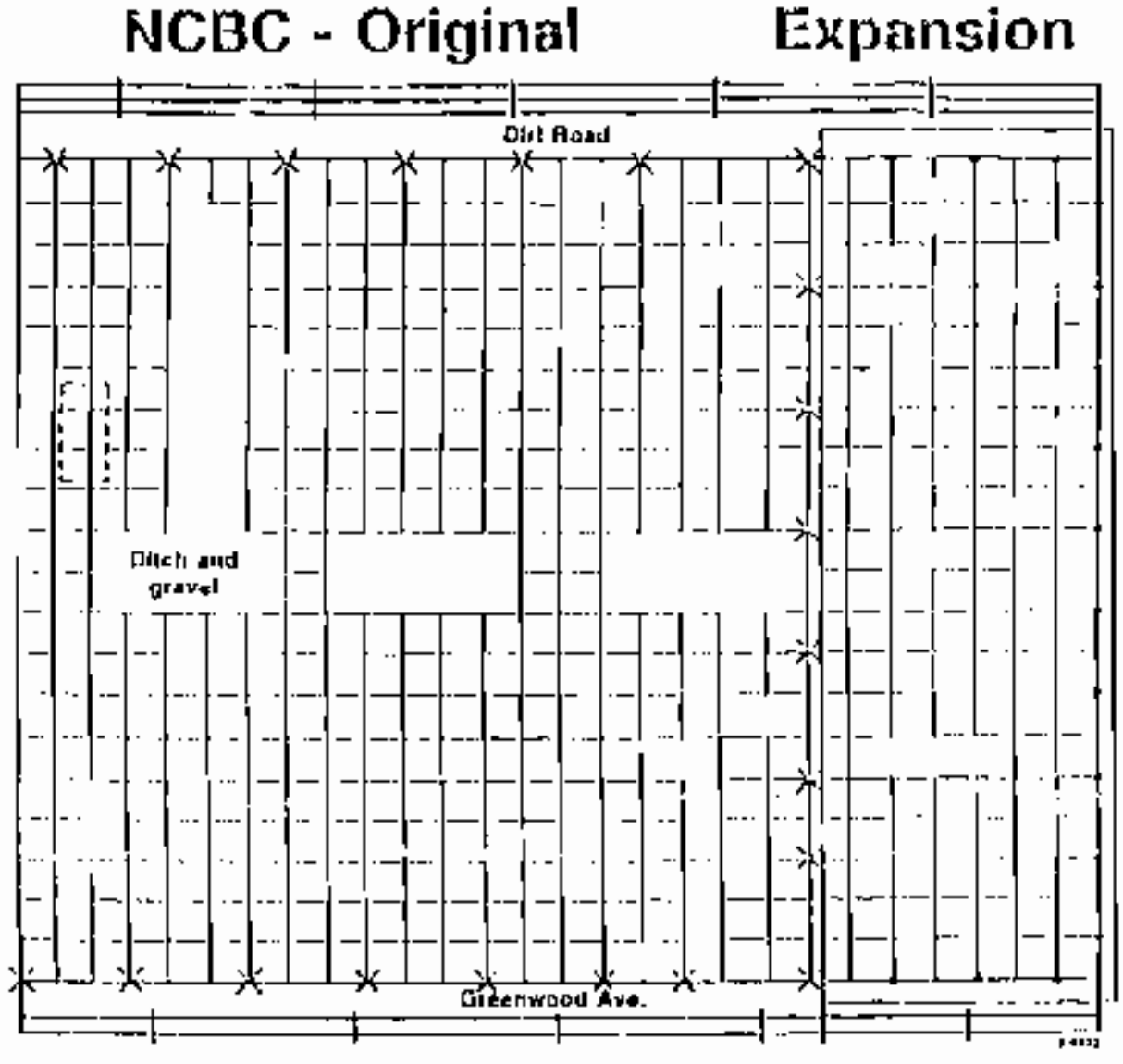


Figure 2. Continued: TCOD concentration (ppb) at NCBC (2 of 4)

NCBC - Expansion East

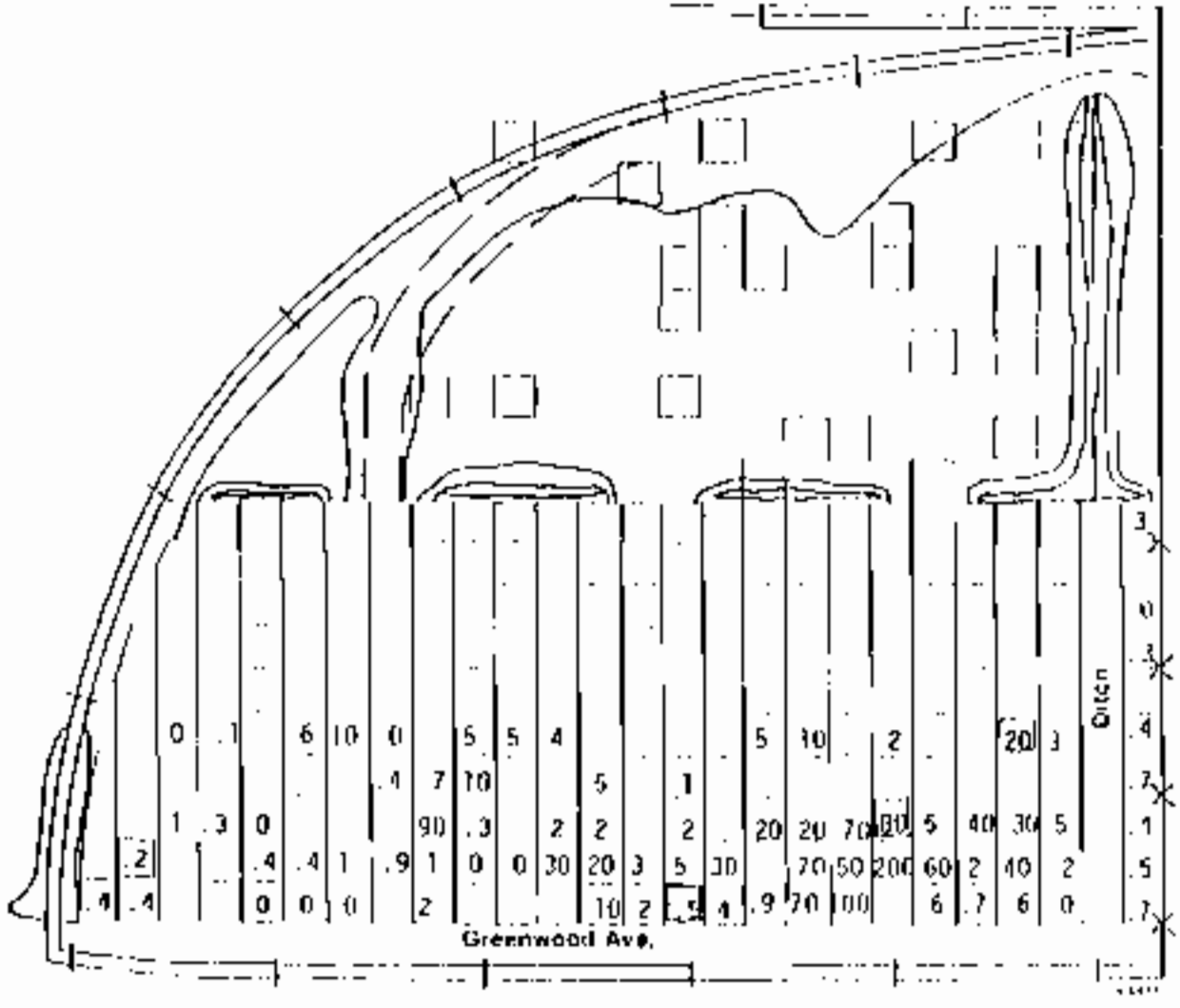
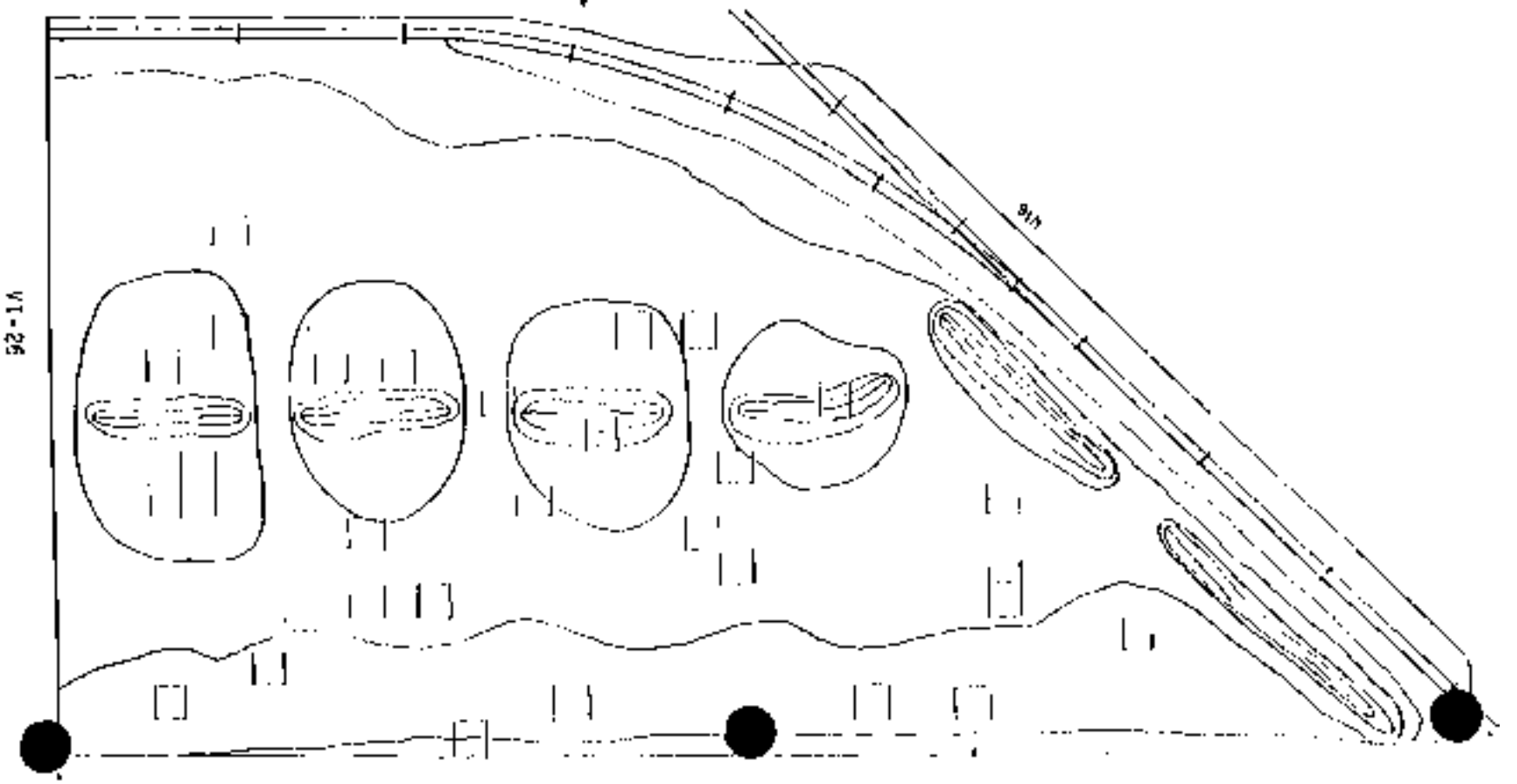


Figure 2. Continued: TCDD concentration at NCBC (3 of 4)

NCBC - Expansion West



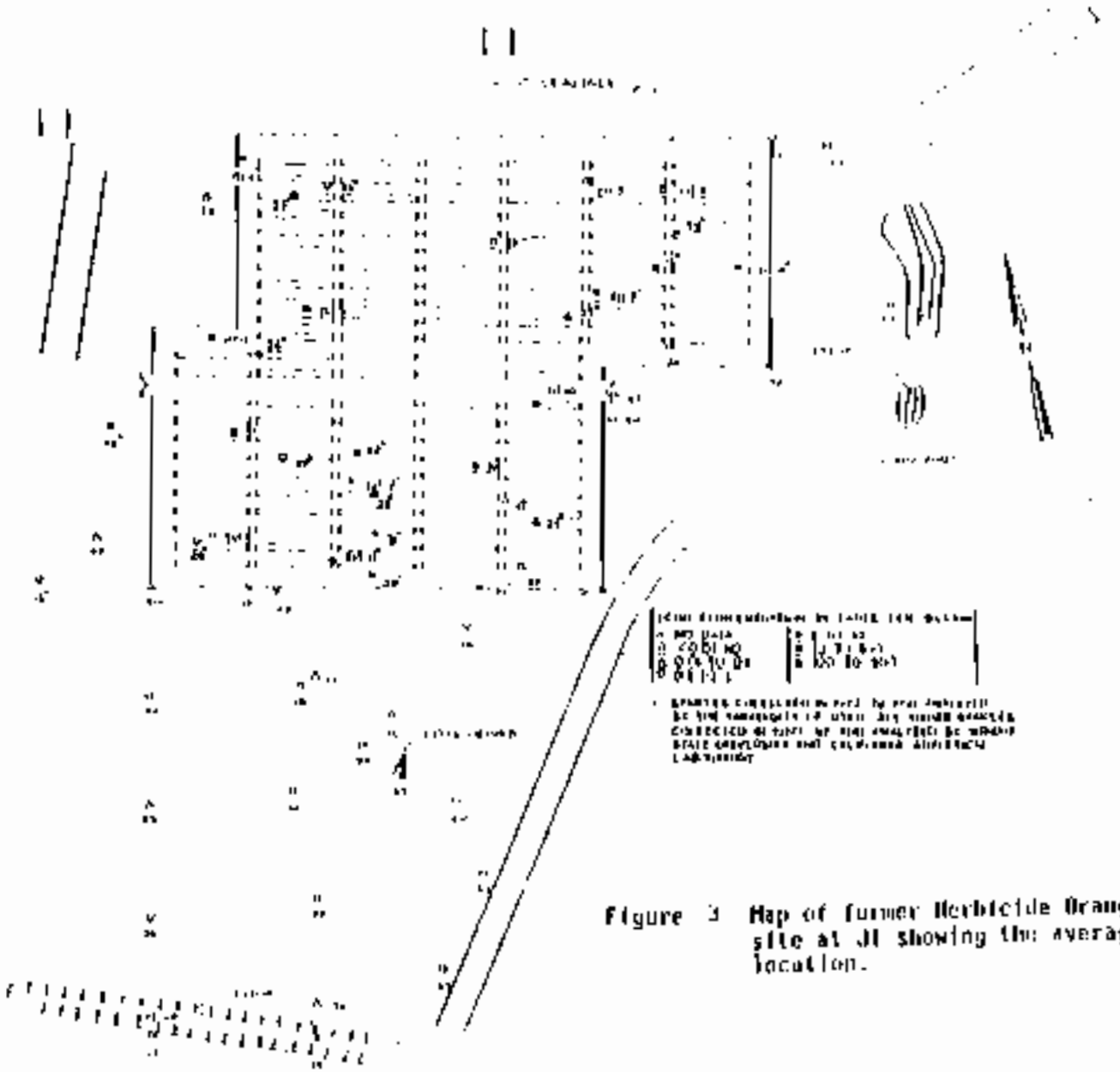


Figure 3 Map of former Herbicide Orange storage site at JI showing the average TCDD location.

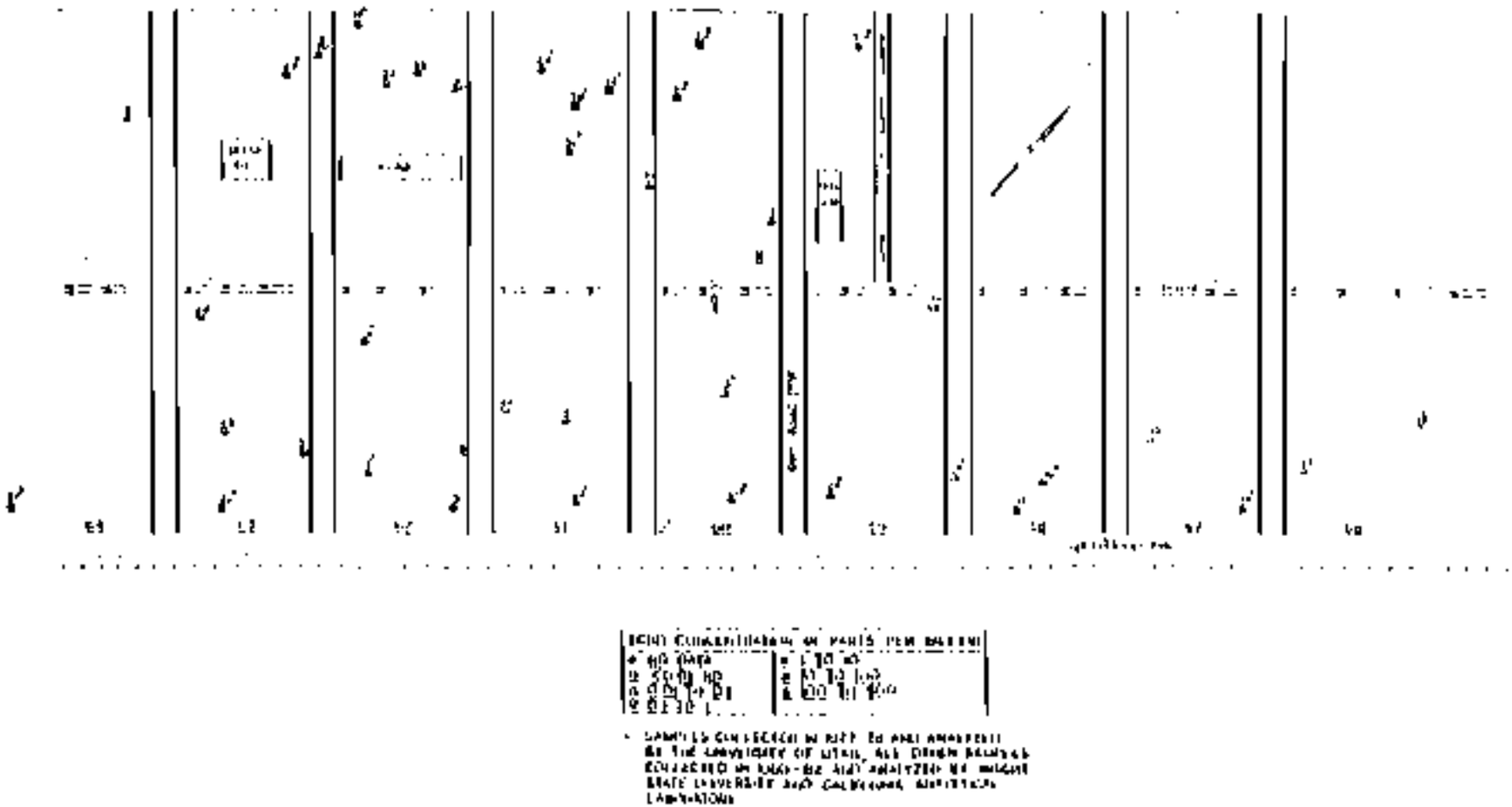


Figure 4 Map of former Herbicide Orange storage site at NCBC showing the average TCDD concentration for each sampling location.

CHAPTER 4: METEOROLOGICAL DATA

A. Naval Construction Battalion Center (NCBC)

The NCBC is located at Gulfport, MS., and the following meteorological data (Reference Table 1) are applicable to the general area. The mean daily temperature is from 61°F to 72°F with extremes of 10°F and 104°F. During the testing period of June/July 1985, the temperatures can be expected to vary from 74°F to 90°F with extremes of 57°F and 101°F. The mean monthly precipitation varies from 2.6 inches to 7.1 inches with extremes of 0 inches and 25.2 inches. During the testing period of June/July 1985, the precipitation (all rain) can be expected to be 5.2 to 7.1 inches in 9 to 13 days. Surface winds during the testing period will be from the south with a mean of 5-6 knots and extremes of 56 knots.

B. Johnston Island (JI)

Johnston Island, Pacific Ocean, is orientated NE-SW and lies in the east-central tropical Pacific about 900 statute miles SW of Honolulu, Hawaii. Attachment 1 is a National Oceanic and Atmospheric Administration publication for Johnston Island, 1982. During the testing period of August/September 1985, the following can be expected: Temperatures will vary from 77-85°F with extremes of 71-89°F. Precipitation will vary from 0.3-15.8 inches occurring over 30-35 days. Surface winds are NE to SW Trade Winds and can be expected to average 15-18 mph with highs of 32 mph.

NOTE: Both NCBC and JI have experienced hurricanes and though not expected during the testing period, hurricane precautions will be implemented should hurricane warnings be received.

Table 1. Meterological data for NCBC, Gulfport, MS.

PREPARED BY USAFETAC
April 1982

STATION NAME [illegible]
LOCATION [illegible]

PERIOD [illegible]
ELEV [illegible]

STN LTRS [illegible]
WBC NO [illegible]

AWS CLIMATIC BRIEF

Month	Temperature (°F) Mean Daily Max	Mean Daily Min	Mean Daily Mean	Extreme Max	Extreme Min	Precipitation (in) Monthly Mean	Monthly Max	Monthly Min	Max in 24 hrs	Snowfall (in) Monthly Mean	Monthly Max	Max in 24 hrs	Relative Humidity (%) Hour 01	Hour 13	Pressure (mb) Mean Station	Mean Sea Level	Pressure Tendency (mb)	Wind Speed (knots) Prevailing Direction	Mean Speed	Max Speed	Ceiling & Visibility %	Mean Number of Days Precipitation ≥ .01 in	≥ .1 in	Snowfall ≥ 1 in	≥ 5 in	Thunderstorms	Fog ≤ 1/4 mile	Temperature (°F) Max ≥ 90	Max ≤ 32	Min ≤ 32	Min ≤ 0
JAN	63	44	52	80	10	4.7	11.8	.8	6.5	0	4	4	77	69	.26	41	400	N	6	40	7	13	1	0	0	2	11	0	0	13	5
FEB	63	41	55	90	15	4.2	11.8	.2	4.5	0	1	24	78	60	.29	44	400	N	6	54	6	9	3	0	0	2	14	0	0	12	2
MAR	64	51	61	90	25	6.2	17.1	.4	3.7	0	1	1	80	66	.40	53	450	S	7	50	7	10	4	0	0	5	15	0	0	2	1
APR	74	62	69	93	39	4.9	14.7	0	7.0	0	0	0	82	62	.50	59	650	S	7	61	6	7	3	0	0	4	11	0	0	1	0
MAY	83	66	76	91	46	4.1	17.3	.1	5.7	0	0	0	82	67	.44	66	550	S	6	59	6	1	1	0	0	4	1	0	0	0	0
JUN	89	74	81	101	57	5.2	19.5	0	5.9	0	0	0	80	59	.24	70	300	S	6	56	3	9	3	0	0	9	4	0	10	0	0
JUL	90	76	83	101	60	7.1	25.7	.4	6.5	0	0	0	85	65	.85	79	150	S	5	56	6	13	4	0	0	13	3	0	16	0	0
AUG	90	75	83	104	62	6.1	12.4	.2	6.6	0	0	0	85	64	.82	75	200	S	5	40	6	12	4	0	0	14	1	0	14	0	0
SEP	85	72	79	98	45	1.0	18.1	.0	3.2	0	0	0	85	65	.74	70	250	N	5	58	6	10	4	0	0	8	1	0	7	0	0
OCT	79	61	70	93	36	2.9	10.6	.0	5.0	0	0	0	80	57	.49	54	250	N	5	57	4	6	2	0	0	2	11	0	0	1	0
NOV	69	51	60	85	25	3.3	11.1	0	5.0	1	0	0	81	60	.38	53	300	N	5	43	5	7	2	0	0	2	14	0	0	4	1
DEC	63	56	59	81	12	4.6	8.4	.1	3.0	0	0	0	74	61	.29	55	350	N	6	44	6	10	3	0	0	3	15	0	0	15	3
ANN	76	61	69	104	10	41.3	25.7	.0	10.7	0	0	0	81	62	.50	59	350	N	6	41	4	110	38	0	0	70	12	0	53	61	19
ANN	39	39	39	39	39	39	39	39	39	32	32	32	10	10	10	10	10	10	10	39	10	39	39	32	32	32	32	39	39	39	39

REMARKS

NUMBER OBSERVATIONS: [illegible]

		MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
(1)[illegible]	60MH	0/0	0/2	1/0	1/1	5/5	0/1	1/13		
(2) Hurricanes	120MH	0/0	0/4	3/1	5/4	9/15	1/6	17/16		
(3) Tropical Storms	240MH	0/1	3/11	4/10	15/13	19/16	5/14	46/91		

NOTE: DATA NOT AVAILABLE

ATTACHMENT 1

Local Climatological Data

Annual Summary With Comparative Data

1982

JOHNSTON ISLAND, PACIFIC

Narrative Climatological Summary

Johnston Island, an atoll oriented NE–SW, lies near the heart of the trade wind zone in the east-central tropical Pacific about 900 statute miles SW of Honolulu, Hawaii. The maximum elevation is less than 20 feet, and prior to 1960 the land area was less than 250 acres. Extensive dredging and filling extended nearly all of the original shoreline and increased the land area of Johnston Island to over 500 acres by 1970. Shallow waters extend well outward in all directions. Three small islands, each with an area of about one-half square mile in 1970, built up by deposit of dredging spoil, lie one to two miles offshore to the north and east. There is no appreciable variation in climatic conditions from one to another part of the island. Due to the original vegetation having been removed during the course of various construction projects, there is very little vegetation on the island. A few palm trees have been planted and there are some seeded grass areas.

Surface trade winds are dominant at all times of the year. Winds from between NE and E (inclusive) are experienced 62 percent or more of the time in every month, with the annual average being 85 percent (10-year average). Very broadly, two seasons can be distinguished. The first extends from December through March. During each of the four months of this "winter" season the wind is from trade directions (NE through E) less than 80 percent of the time, with a low frequency value of 62 percent for January. Correspondingly, this is the season when light variable winds are most frequent. December–March is also the rainier of the two seasons, with a mean of 11 inches as contrasted with a mean of only 15 inches for the "summer" season, which is eight months long. And winter rains, unlike summer ones, are frequently associated with organized disturbances, such as easterly waves, the passage of troughs aloft, or weak cold-front passages.

During the summer season -- from April through November -- the rainfall is dominantly in the form of trade wind showers. However, in April and again in September–October–November, identifiable organized disturbances are not uncommon, and these may bring very heavy rains, as when a tropical depression or tropical storm passes close by. Observations from weather satellites indicate that tropical storms in the Johnston Island area, although infrequent, may not be as unusual as was once supposed. But until August 19, 1972, there was no reliable evidence that the island had ever experienced a true hurricane (winds of 64 knots or more). On that date, however, the center of Hurricane CELESTE, which had first appeared off the southern coast of Mexico nearly two weeks earlier and 3,000 nautical miles to the east, passed only about 25 miles to the northeast of Johnston. Although the island had been entirely evacuated as a precaution against the possible escape of toxic gases stored there, automatic weather instruments recorded hurricane-force winds from the northern quadrant between 3:54 a.m. and 9:18 a.m. on the 19th, with a fastest mile of 105 miles an hour (by far the highest ever observed on Johnston), a minimum sea level pressure of 29.04 inches and 6.21 inches of rain. Damage to the island and to its facilities appears to have been minor, although details were classified by the military.

Temperatures are slightly higher at Johnston Island during the summer than during the winter. Thus the monthly means during July–October are 80°–81°; whereas during December–March they are 76°–78°. The mean diurnal range is 7°–8°, with little seasonal variation. Humidities are generally high throughout the year. Conditions for terminal aircraft operations are excellent as compared with most locations. However, visibility is occasionally a limiting factor because of torrential showers, especially during the winter season.

noaa NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION / NATIONAL ENVIRONMENTAL SATELLITE DATA AND INFORMATION SERVICE NATIONAL CLIMATIC DATA CENTER ASHEVILLE, N.C.

Meteorological Data For The Current Year

Normals, Means, And Extremes

Average Temperature

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
[illegible]													

Heating Degree Days

Season	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Total

Cooling Degree Days

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
[illegible]													

Precipitation

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
[illegible]													

Snowfall

Season	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Total

VOLUME 2

ADVANCED ELECTRIC REACTOR

INTRODUCTION

The J. M. Huber Corporation is continuing the development of its high-temperature pyrolysis device, which is called the Advanced Electric Reactor (AER) for the permanent treatment of hazardous waste.

On September 17, 1984, Huber notified the Dioxin Disposal Advisory Group (DDAG) of its intent to perform on-site dioxin demonstrations in Borger, Texas and Times Beach, Missouri. The purpose of that notification was to provide information to EPA to ensure satisfaction of the Toxic Substances Control Act (TSCA) Vertac Rule notification requirement. The Borger, Texas tests were restricted to treating octachlorodibenzo-p-dioxin, a laboratory-prepared product, whereas, the Times Beach tests were directed to detoxifying soil contaminated with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD).

In both of these tests, no dioxin was found in any of the treated streams (i.e., treated solids or nitrogen off gas). Huber believes that this is the first successful demonstration of a dioxin-treatment technology in the field. Attachment 1 to this Introduction is the Final Report summarizing the results of the Times Beach tests.

Huber plans to conduct another test for the research and test evaluation of the AER to treat soil contaminated with Herbicide Orange/dioxin at the Naval Construction Battalion Center (NCBC) in Gulfport, Mississippi. This test will be conducted under contract to EG&G Idaho, Inc., Idaho Falls, Idaho. The purpose of this Volume is to again provide information to EPA to ensure satisfaction of the Vertac Rule notification requirement.

Included in this Volume are: (1) a summary of the work/run plan, test conditions, and description of the bench-scale AER, (2) an Industrial Hygiene, Health and Safety Plan as will be used in the NCBC tests (which was also used for the Times Beach tests), and (3) a description of the QA/QC that is implemented during operation of the bench-scale unit.

Attachment 1

TIMES BEACH, MISSOURI

FIELD DEMONSTRATION OF THE DESTRUCTION OF DIOXIN IN CONTAMINATED SOIL

USING THE

J. M. HUBER CORPORATION ADVANCED ELECTRIC REACTOR

Analytical Results and Report by:

Roy F. Weston, Inc.
One Weston Way
West Chester, Pennsylvania 19380

and

York Research Consultants
938 Quail Street
Denver, Colorado 80215

Weston Project #2552-01-01

Weston Program Director: Kay H. Jones, Ph.D.

Weston Program Manager: Barry M. Jackson

Weston Analytical Team Manager: David Ben-Bur, Ph.D.

York Project Manager: Robert Collins

February 11, 1985

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SECTION 1
EXECUTIVE SUMMARY

Roy F. Weston, Inc., was employed by J. M. Huber to provide independent analytical support for HUBER's dioxin destruction demonstration in Times Beach, Missouri.

Triplicate testing was conducted on November 13, 1984, at the Missouri Department of Natural Resources' (MDNR) Dioxin Research Facility in Times Beach, Missouri, using Huber's mobile 3" I.D. Advanced Electric Reactor (AER) under the supervision of MDNR.

Times Beach soil contaminated with approximately 30 parts per billion (ppb) of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) and other chlorinated organics was fed through the mobile reactor. All streams exiting the AER process were carefully sampled/analyzed for 2,3,7,8-TCDD and products of incomplete pyrolysis (PIP's).

No 2,3,7,8-TCDD or PIP's were detected in the treated soil at detection limits of 0.11 ppb for the 2,3,7,8-TCDD and 10 ppb for the PIP's. Similarly, no 2,3,7,8-TCDD or PIP's were detected in the stack gas stream at detection limits of 0.55 ng/m³ on the 2,3,7,8-TCDD and 25 ng/m³ on the PIP's. The treated soil analyses for 2,3,7,8-TCDD and PIP's were independently verified by Environmental Research Group, Inc. (ERG), Ann Arbor, Michigan, and by Envirodyne Engineers, Inc. (EEI), St. Louis, Missouri, under the supervision of MDNR.

The on-site analyses provided by YORK/WESTON were possible with the REM-MS2 mobile GC/MS/MS system. In addition to sampling and analytical services, WESTON also provided industrial hygiene training, on-site monitoring, and certification of equipment detoxification following the demonstration.

MDNR and HUBER believe this to be the world's first successful field demonstration of a dioxin treatment technology. Subsequent to this demonstration, a dioxin burn by Ciba-Geigy in late November 1984 at Basal, Switzerland, and plans for a dioxin burn in January 1985 by the U.S. EPA using a rotary kiln incinerator in southwest Missouri were announced.

WESTON has been presented with HUBER test reports documenting a number of tests that have been conducted over the previous 14 months using the mobile 3" AER as well as a stationary 12" AER at HUBER's Borger, Texas, research facilities. For example, tests with a variety of thermally stable wastes and waste surrogates such as Aroclor 1260 polychlorinated biphenols (PCB's), carbon tetrachloride (CCl_4), and octachlorodibenzo-p-dioxin (OCDD) (as reported by WESTON) have demonstrated destruction and removal efficiency (DRE) results on the order of 99.99999 percent (seven 9's) at feed rates up to 2500 pounds per hour. References 11-14 document previous test reports.

More detailed information describing how the Times Beach tests were conducted and the results analyzed is provided herein.

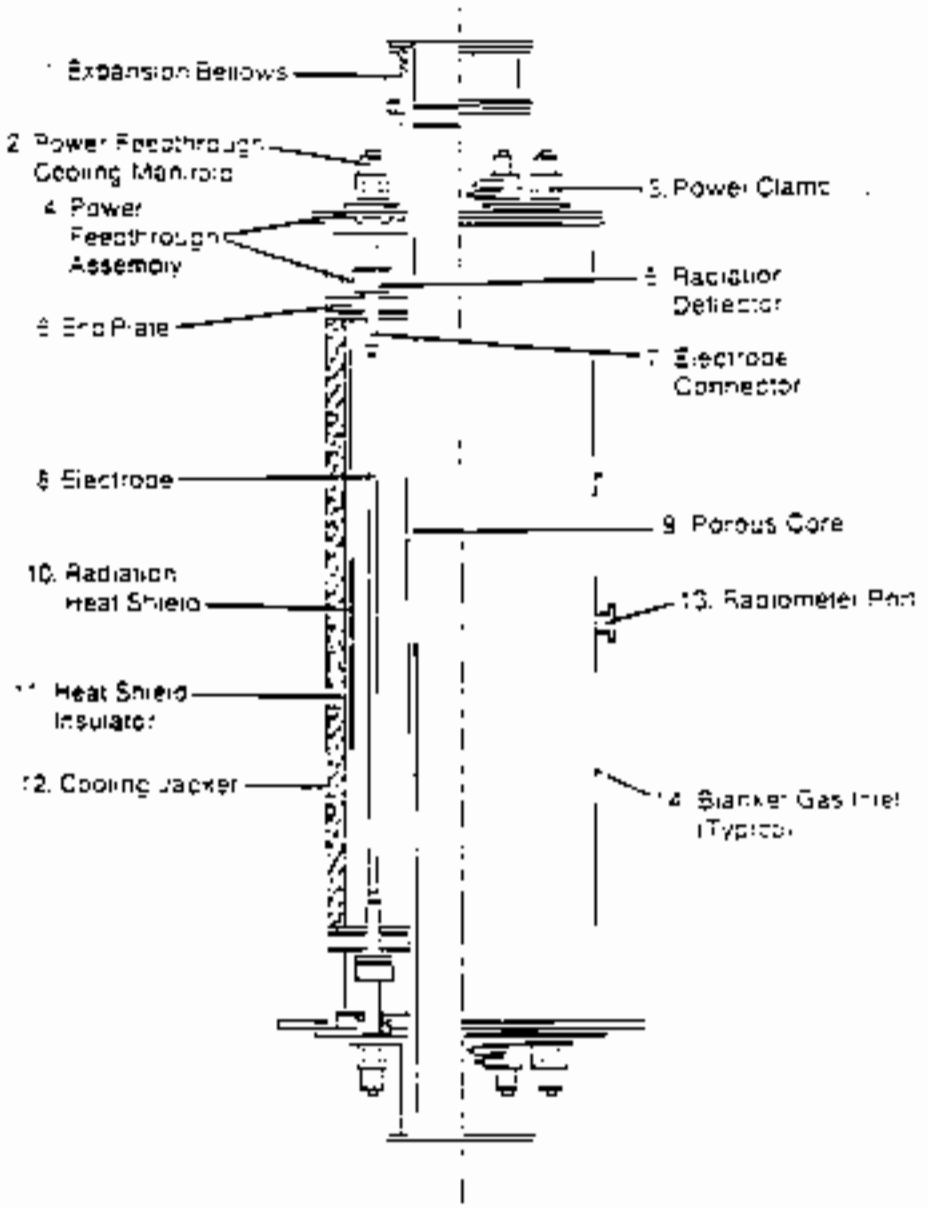

FIGURE 3-1 VERTICAL CROSS-SECTION OF ADVANCED ELECTRIC REACTOR

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5.3.4 Gaseous Emissions Analytical Procedures	5-
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6.3 Qualification of Results	6-
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SECTION 4
TEST PLAN AND PROJECT PERSONNEL

4.1 TEST PLAN

The test plan called for a series of three runs to take place in Times Beach, Missouri, using native soil contaminated with 2,3,7,8-TCDD and other dioxin isomers. The Times Beach runs were to be a public demonstration of the HUBER technology and as such required a firmly cast test plan.

The primary test plan and QA/QC plan documents prepared by WESTON are listed in References 2 and 4. These documents address sampling and analytical procedures including preparations, testing and equipment, confirmation of final results, and reporting of the project. Virtually all the details of these plans are presented in Section 5. HUBER process operation plans and run plans are outlined in Appendix A.

Table 4-1 presents the sampling plan for the Times Beach Test. The corresponding performance table is presented in Section 5, Table 5-2. The original sampling plan, found in Table 2-1 of the Test Plan (Reference 3), was modified slightly upon experience gained in the preliminary dioxin tests in Borger, Texas. For example, inter-test feedstock samples and baghouse catch samples were eliminated for reasons relating to safety and industrial hygiene.

The Times Beach test plans were rigorously followed by all project personnel.

4.2 INDUSTRIAL HYGIENE PLAN

The "Industrial Hygiene and Safety Plan" (Reference 5) addressed three tasks. The first was training of HUBER employees in appropriate procedures and methods for handling dioxin. The second provided for an on-site qualified industrial safety person with specific dioxin-related field experience. The third task detailed atmospheric dioxin monitoring, personnel exposure, and equipment decontamination procedures. Table 4-2 presents the Industrial Hygiene Sampling Plan. The corresponding table of performance results is presented in Section 5, Table 5-3.

4.3 PROJECT PERSONNEL

The project team organizational chart is presented in Figure 4-1, and the field team organizational chart is shown in Figure 4-2. Profiles of key project participants are provided in Appendix G.

SECTION 1
EXECUTIVE SUMMARY

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The on-site analyses provided by YORK/WESTON were possible
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analytical services, WESTON also provided industrial hygi
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detoxification following the demonstration.

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9's) at feed rates up to 2500 pounds per hour. References 11-
document previous test reports.

More detailed information describing how the Times Beach
were conducted and the results analyzed is provided herein.

TABLE 4-2

INDUSTRIAL HYGIENE SAMPLING PLAN

	PRETEST	TEST	DECON
A. Feeder hopper			1
B. Charge end of reactor		1	
C. Discharge end of reactor		1[1]	
D. Collection vessel			1
E. Air pollution control system - inside first elbow		1	
F. Air pollution control system - discharge		1[2]	
G. Flat surface near reactor charge		1	
H. Flat surface in discharge area		1[3]	
I. Additional sample		1	
- Pretest wipe sample	1		
- Pretest wipe sample	1		
Air Sampler			
A. Hi-vol at control panel		1	
B. Hi-vol at trailer door		1	
C. Personal at reactor feed		1	
D. Personal at reactor discharge		1	

Footnotes:

1. Analyze C only if B or F positive.
2. Analyze F only if B and D positive.
3. Analyze H only if G positive.

SECTION 3
PROCESS DESCRIPTION

The HUBER AER employs a new technology which rapidly heats organic compounds to temperatures in the 4000°-5000°F range using intense thermal radiation in the near-infrared region.

Figure 3-1 presents a cross-section of the Advanced Electric Reactor (AER). Feed material is isolated from the reactor walls by means of a gaseous blanket formed by introducing nitrogen radially inward through the porous core walls. Organic compounds in the feed are pyrolytically reduced to elemental forms of carbon, hydrogen, oxygen, and chlorine.

Heat transfer is accomplished by radiative coupling from the core to the feed materials. The reactor core is heated by graphite electrodes.

The only feed streams to the reactor are the contaminated soil and the blanket nitrogen gas. Destruction of dioxins is accomplished by pyrolysis rather than oxidation. Therefore, typical incineration products such as carbon dioxide, oxides of nitrogen, and others are formed, if at all, in insignificant concentrations. The treated soil is a detoxified granular sand-like material.

Figure 3-2 shows a simplified process diagram for the Times Beach demonstration unit. The feed material is introduced at the top of the reactor by means of a metering screw feeder connecting the sealed bin to the reactor. Nitrogen is introduced to the reactor annulus formed by the external containment vessel and the porous graphite core.

The solid feed passes through the reactor undergoing organic pyrolysis at over 4000°F. The gaseous reactor emissions and the granular solids pass through a radiatively cooled post-reactor zone. The treated soil as a granular solid is collected in a sealed insulated vessel.

Fine particulates suspended in the gaseous emissions are collected in a baghouse. A series of two activated carbon canisters provide for removal of any trace residual PIP's.

Flue gas flow is measured by a calibrated dry gas test meter downstream of the carbon beds. The clean flue gas, composed almost entirely of nitrogen and moisture, is emitted to the atmosphere.

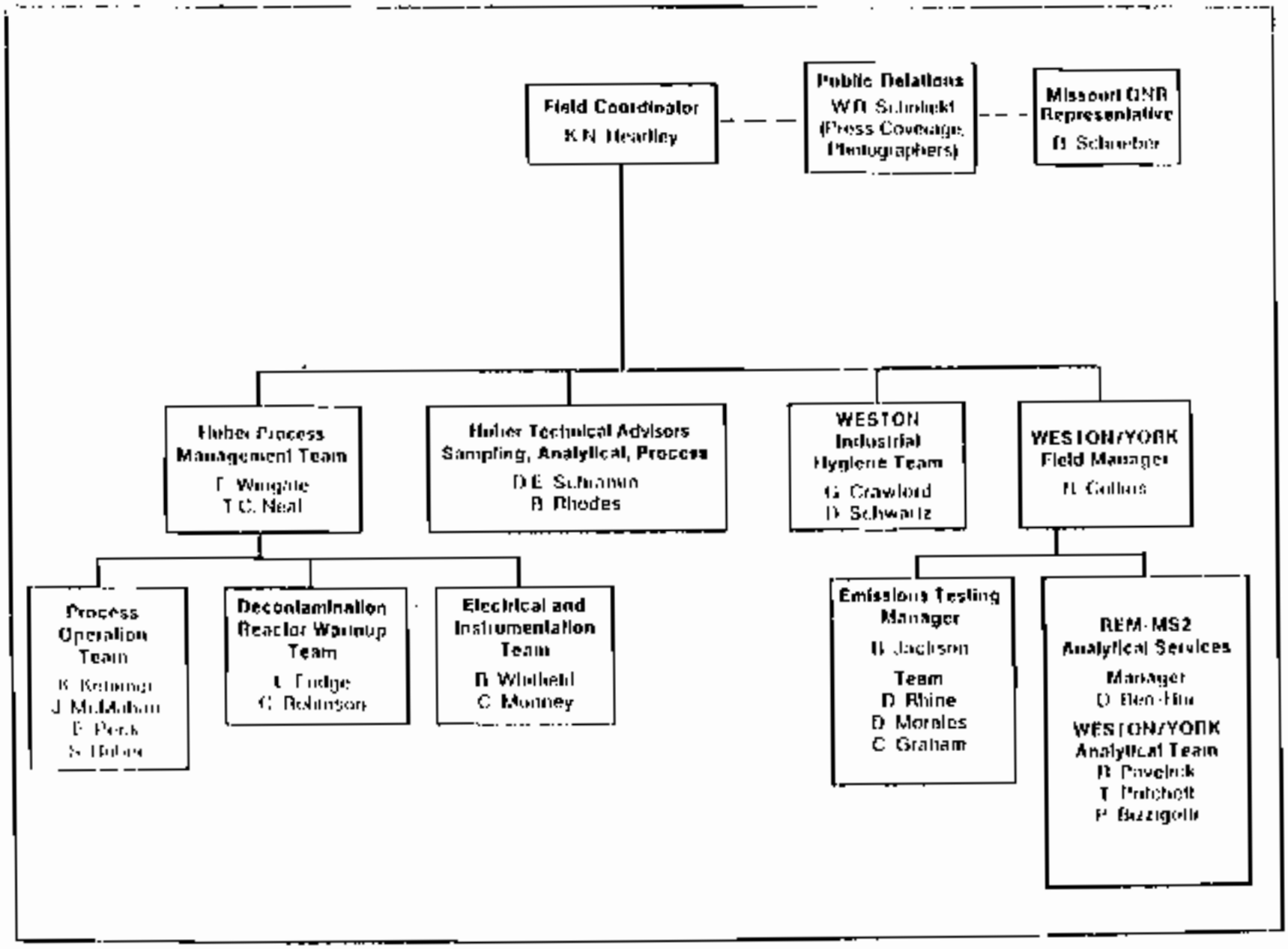

FIGURE 4-2 FIELD TEAM ORGANIZATIONAL CHART

TABLE 4-1

SAMPLING METHODOLOGY AND FREQUENCY OF SAMPLING

SAMPLING METHODOLOGY	SAMPLING POINT	NUMBER OF SAMPLES PER RUN RUN #1	RUN #2	RUN #3
Process gas; centerpoint, constant rate, integrated	Reactor emissions	1_1	1_1	1_1
Process gas; centerpoint, constant rate, integrated	Stack emissions	1_2	1_2	1_2
Thief Modified SW846EPA**	Feed bin	10_2	*	*
Scoop Modified SW846EPA**	Collection vessel	1_1-D_1	1_1-D_1	1_1-D_1
Scoop Modified SW846EPA**	Baghouse	*	*	4_2
Total		13 2	3 0	7 0

Subscripts:

D = Duplicates

1 = First priority analysis
2 = Second priority analysis
3 = Analyze only upon request

*Feedstock samples were all to be taken prior to connecting the feed bin to the reactor before the runs. One baghouse sample was to be taken from each of the four baghouse bags following the third run.

**Reference 15: SW 846 EPA document.

Baghouse Catch

Following the test period, one 10g sample was taken from each of the four primary baghouse compartments using Scoop Method M-SW846 EPA (Reference 16). These four samples were stored in 500 ml amber teflon septum jars.

Activated Carbon

Before the tests were initiated, one 10g activated carbon sample was taken from the top and bottom of each activated carbon canister using the thief technique M-SW846 EPA (Reference 16). Following the test period, four corresponding samples were obtained. These samples were stored in 40 ml teflon septum bottles.

5.3.2 PROCESS STREAM SOLIDS ANALYTICAL PROCEDURES

Each process stream solids sample, except the activated carbon, was analyzed for dioxin content and chlorinated organics or PIP's using the YORK/WESTON REM-MS2 GC/MS/MS. Preliminary dioxin tests in Borger, Texas, indicated that the retention of the stable-label 2,3,7,8-TCDD spike on the carbon during extraction interfered with the analytical techniques for measuring dioxin in the samples. This indicates how effective the carbon is at preventing dioxins and PIP's from being emitted to the atmosphere.

Dioxin

The analytical method for 2,3,7,8-tetrachlorodibenzo-p-dioxin in soil is shown in the Test Plan (Reference 3) and as follows.

The surrogate standard and parent and daughter ions were:

	Parent Ion m/z	Daughter Ion m/z
Surrogate, $C_{12}O_2H_4{}^{37}Cl_4$	328	261

Five grams of the feedstock, treated soil, or baghouse catch samples were spiked with 20 ug of the surrogate 2,3,7,8-TCDD stock spiking solution. They were then extracted with an acetonitrile-dichloromethane mixture using a continuous agitation technique for about 30 minutes. The resulting solutions were concentrated to a final volume of between 50 and 1000 ul and an aliquot injected into the GC/MS/MS for analysis. Extraction efficiency was confirmed by standard spiking technique.

PIP's

Determination of chlorinated organics or PIP's (products of incomplete pyrolysis) required a second injection of the concentrated extract into the GC/MS/MS. The first step of this analysis required setting the instrument to monitor and identifying the molecular weight of all species capable of a neutral loss of chlorine. When the screening [illegible] neutral loss of chlorine [illegible] positive results, a [illegible] was made with the

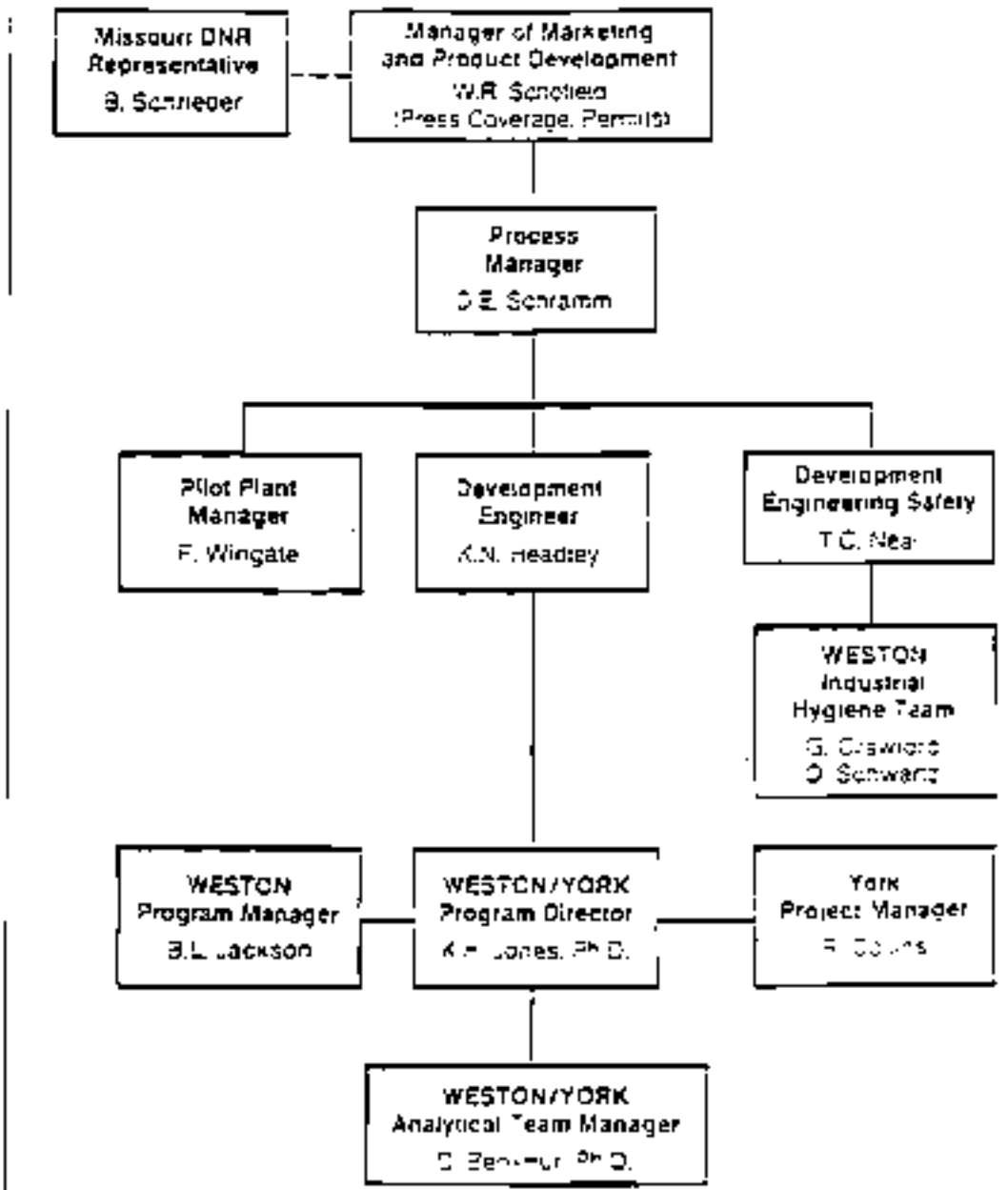

FIGURE 4-1 PROJECT TEAM ORGANIZATIONAL CHART

Figure 5-2 presents the MM5 train sampling procedures flow chart. Sampling for CO_2, O_2, and CO content of the stack emissions also took place during soil treatment and immediately following the gaseous emissions sampling. Analyses were performed by the Orsat method. The Orsat apparatus consisted of the following components:

- A stainless steel probe with a plug of glass wool to remove particulate.
- A squeeze bulb with flexible tubing to move the sample gases to the analyzer.
- An Orsat analyzer.

The carbon monoxide content of the stack emissions was also checked using NIOSH certified detector tubes. Preliminary dioxin tests in Borger, Texas, indicated that CO levels would be in the detector tube range, up to 3000 ppm. The Orsat detection limit was 1000 ppm for CO, CO_2, or O_2. The Orsat was leak-checked prior to and following each analysis.

5.3.4 GASEOUS EMISSIONS ANALYTICAL PROCEDURES

Each MM5 train, including a blank which was set up and sealed for the duration of the test, was recovered in a clean area remote from the operation. It was presented to the laboratory for determination of particulate, dioxin, PIP's, HCl, and moisture. Figure 5-3 presents the sample recovery procedures flow chart and Figure 5-4 presents the preparation procedures flow chart.

Recovery and Preparation

Material collected in the nozzle, in the front half of the filter holder, and in the glass fiber thimble was first analyzed gravimetrically for particulate and then the residues were solvent extracted. The extract of the front half catch was combined with the rinses/extract of the probe, connectors, condenser, and sorbent for determination of dioxin and PIP's. The liquid from the condensate trap and from the impingers containing NaOH, plus associated component rinses, was combined and analyzed for HCl. Moisture content was determined by measuring the increase in weight/volume of the impinger contents.

Dioxin and PIP's

The analysis for dioxin and PIP's proceeded as follows:

- The preweighed spiked thimble was placed in an amber jar and the post thimble rinse added (sample type 1). The thimble-rinsate mixture was stirred for half an hour with a magnetic stir bar with the jar sealed. When necessary, additional methylene chloride was added to assure recovery of dioxin from the thimble and particulate.

SECTION 5
ON-SITE PERFORMANCE

This section provides details of process operating parame sampling and analytical equipment/procedures, and industri hygiene monitoring. Analytical results determined or calculat are presented and discussed in Section 6.

5.1 OPERATING PARAMETERS

For each of the three runs, the reactor core temperature as indi cated on a radiometer was held between 4100° and 4200°F. Tota nitrogen rates were set at 4-5 scfm prior to the testing. Durin the first ten minutes of each run, feed rates were adjusted b the operations team. The run plan provided for feed rates of .2 lb/min, and the actual rates were .225, .313, and .332 lb/min respectively for the three runs. Gas stream emissions samplin was initiated as soon as the operations team confirmed that steady state feed rate and steady state process conditions wer achieved. Table 5-1 presents the operating parameters for eac run.

5.2 FREQUENCY OF SAMPLING AND ANALYSIS

Table 5-2 presents the frequency of sampling and analysis activi ties corresponding to the sampling plan of Table 4-1. Samplin was performed as planned. Analyses were performed as describe in the documents "Test Plan" (Reference 3) and "QA/QC Plan (Reference 4) and as described in Section 5.3.

5.3 SAMPLING AND ANALYTICAL PROCEDURES

5.3.1 PROCESS STREAM SOLIDS SAMPLING PROCEDURES

Solids samples were collected by the HUBER engineer D. Schramm a W. Rhodes with assistance from the HUBER process manager, F Wingate or T. Neal. Sampling was witnessed by the YORK/WESTC field manager, R. Collins, and the industrial hygienist, G Crawford or D. Schwartz.

Feedstock

Prior to the test period, thirteen representative 10g feedstoc samples were taken using Scoop Method M-SW846EPA (Reference 16 as the feed bin was being loaded. These were transferred into 4 ml teflon septum bottles.

Treated Soil

Following each of the three triplicate runs, four 10g granula treated soil samples were retained in 40 ml teflon septum bottle and a 100g sample of fused soil discharge was secured in a 500 m amber teflon septum jar using Scoop Method M-SW846EPA (Referenc 16).

The thimble was desiccated at ambient temperature and pressure, then weighed to the nearest 0.1 mg to constant weight. "Constant weight" means a difference of no more than 0.5 mg or 1 percent of total weight less tare weight, whichever is greater, between two consecutive weighings performed at least two hours apart.

- A 10 percent aliquot of agitated sample type 2 was placed in a tared beaker, evaporated to dryness at ambient temperature and pressure, desiccated, and then weighed to a constant weight on an analytical balance to the nearest 0.1 mg. The remainder of the front half rinse (90 percent of original sample) was reserved for chemical analysis.

The total weight of material measured in the front half methylene chloride wash fraction (based on the entire sample) plus the weight of material collected in the glass fiber thimble represents the particulate catch for each run. Solvent blank corrections were made on all wash sample weights.

HCl

Analysis of the HCl collected in the condensate trap and in the impingers containing 0.1 N NaOH was done according to the argentometric method described in the 13th Edition of "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association in 1980 (Reference 8). The total volume of the impinger/rinse liquid sample was adjusted to 300 ml with distilled water and a 50 ml aliquot titrated with silver nitrate to determine its inorganic chloride content. The titration was repeated with a second aliquot of sample and the values averaged. Replicate titrations had to agree within 1 percent or 0.2 ml, whichever was greater. A blank was also run on the 0.1 N NaOH used in the impinger trains. Chloride standard and reagent blank samples were analyzed in like manner with each batch of field samples to establish lab data validity.

Dry Gas Composition, CO_2, O_2, CO

Analytical procedures for CO_2, O_2, and CO determinations were performed as specified in Section 4 of EPA Method 3 (Reference 1).

5.4 INDUSTRIAL HYGIENE MONITORING

Area air samples were collected on mixed cellulose ester filters using personal and high-volume sampling pumps during all test periods. They were analyzed for dioxin by on-site GC/MS/MS to ascertain that worker exposure levels to dioxin were within established limits. The analytical data obtained for the industrial hygiene program is presented in Table 5-1. Equipment surface wipe tests were performed to establish adequacy of decontamination activities prior to moving equipment or lifting Level C personnel safety equipment requirements.

instrument set to transmit through the first quadrupole those parent masses that exhibited the neutral loss of chlorine. The third quadrupole was set to analyze the fragments of each such parent compound, thus producing a mass spectrum for each chlorinated organic in the extract. Identification of each PIP was based on the mass spectrum of the compound.

5.3.3 GASEOUS EMISSIONS SAMPLING PROCEDURES

Triplicate emissions sampling was conducted by the TORX/WESTON Emissions Testing Team at two points. Refer to the Field Team Organizational Chart, Figure 4-2, and the Process Schematic, Figure 3-2.

The reactor emissions duct was downstream of the baghouse. Preliminary dioxin tests in Borger, Texas, indicated that the sampling train could not operate under the particulate load upstream of the baghouse. The stack emissions duct was on the flue, and stack emissions were sampled as discharged to the atmosphere.

Emissions from these two ducts were sampled simultaneously at the centerpoints and at a constant rate of 0.6 cubic feet per minute for 45 to 60 minutes to obtain integrated samples. Sampling for particulate, dioxin, PIP's, HCl, and moisture followed EPA Modified Method 5 (MM5) (Reference 2). The sampling train as shown in Figure 5-1 consisted of the following components connected in series:

- A 316 stainless steel nozzle 5/8" or 1" inside diameter, sized for approximate isokinetic sampling. (The 5/8" I.D. nozzle was used in the stack sampling.)

- An unheated 316 stainless steel thimble holder containing a preweighed glass fiber thimble-type filter meeting the 99.95 percent DOP (dioctylphthalate) efficiency test.

- An unheated 316 stainless steel probe attached to an impinger train via borosilicate tubing.

- An impinger train consisting of a Graham (spiral type) ice water cooled condenser, an ice water jacketed sorbent module containing a 40 ml volume of 30/60 mesh XAD-2 (pre-extracted), a temperature sensor, a one liter condensate trap, two HCl traps each containing 100 ml of 0.1 N NaOH, and a final impinger containing 200g of dry silica gel.

- An umbilical cord connecting the outlet of the impinger train to a Nutech Control Module.

- A control module containing a 1 cfm carbon vane vacuum-pressure pump, a calibrated dry gas meter, a calibrated orifice, and inclined manometers.

- A switchable, calibrated digital pyrometer to monitor sample gas temperatures.

TABLE 5-1

PROCESS OPERATING PARAMETERS

	RUN 1	RUN 2	RUN 3
Duration, minutes	89	82	94
Feed rate, lb/min	.225	.211	.232
Estimated* treated soil rate, lb/min	.168	.234	.248
Estimated* particulate rate, lb/hr	0.46	0.64	0.68

	TEST PARAMETERS
Reactor core temperature, °F	4100-4200
Nitrogen rate, scfm	4.75
Feedstock charge, lb	63.58
Treated soil discharged, lb	47.49
Bag filter catch, lb	1.02

*Estimated values were used in calculating mass rates for Table 6-3. Values for treated soil rate and particulate data were estimated from the known feed rate by the ratio of the total treated soil or particulates discharged to the total feedstock charged.

- The slurry from the preceding step was filtered through a teflon membrane filter with rinsing. The fraction of the solvent equal to that reserved from the front half rinse (90 percent) was combined with the remaining filtered (teflon membrane) front half rinse.

- The XAD-2 (sample type 4) was extracted for one-half hour with a volume of toluene equal to 1-2 times the trap volume in a sealed jar using a magnetic stir bar. The extract was filtered through a teflon membrane filter with rinsing, combined with the sample from the preceding step to form a single analytical sample, then gently reduced in volume to 100 ul under a stream of nitrogen.

- A 1-5 ul aliquot of the preceding sample was analyzed on the calibrated GC/MS/MS system. The detection limit was approximately 0.5 ng per injection.

- The PIP's were determined using the GC/MS/MS by analyzing another 1-5 ul aliquot of the concentrated sample. For more explanation see Section 5.3.2.

Particulates

The analysis procedure and calculations for particulate determinations were performed as specified in Sections 4 and 6 of EPA Method 5, respectively, with some modifications and are as follows:

- All loose particles contained in the nozzle were quantitatively transferred to the thimble.

- The thimble was removed from the holder and placed in a sealed amber teflon septum jar (sample type 1).

- The inside surfaces of the sampling train components prior to the thimble (nozzle and front of holder) were rinsed/brushed in triplicate with a total of approximately 50 ml of methylene chloride and the wash placed in an amber glass container fitted with a teflon-lined closure (sample type 2).

- The inside surfaces of the sampling train components downstream of the thimble but prior to the sorbent module (back-half thimble holder, probe, connectors, and condenser) were rinsed in triplicate with methylene chloride and the wash placed in an amber glass/teflon container (sample type 3).

- The XAD-2 module was sealed with ground glass caps (sample type 4).

- In the laboratory, the thimble and sample type 1 were each injected with 100 ul of 2,3,7,8-TCDD spiking mixture. The thimble was allowed to air dry.

TABLE 5-3

INDUSTRIAL HYGIENE MONITORING:
2,3,7,8-TCDD PERFORMANCE RESULTS

	PRETEST (ng)	DURING TEST (ng)	DURING TEST (ng/hrs.)	DURING TEST (ng/m³)	AFTER DECONTAMINATION (ng)
Sample Location or Type:					
A. Feed hopper					< 0.55
B. Charge end of reactor		< 0.33			
C. Discharge end of reactor		< 1.16			
D. Collection - Vessel					< 0.55
E. Air pollution control system - Inside first elbow					Not run
F. Air pollution control system - Discharge after carbon beds					Not run
G. Platform near charge end	< 0.33	< 0.33			
H. Wipe sample of trailer floor after final sweep-up					< 0.55
I. Electrical cable tray	< 0.55	< 0.55			
Respirator Filters:					
Tom Neal					Not run
Air Sample Pump Type/Location:					
A. Hi-vol/near collection vessel		< 0.55	6.33	< 0.002	
B. Personal/near cable tray[a]		< 1.1	6.73	0.00	
C. Personal/near feed		< 0.33	8.22	< 0.44	
D. Personal/above collection vessel and beneath reactor		2.33	9.17	0.42	
Personal field blank	< 0.55				
Hi-vol field blank	< 0.55				

[a] Failed laboratory quality assurance criteria.
NOTE: Samples "Not run" were not [illegible]; "Q" could analysis was [illegible] by the laboratory [illegible] sample flow as noted in Table 4-1 of [illegible]. Revisions were made [illegible] multiplier room.

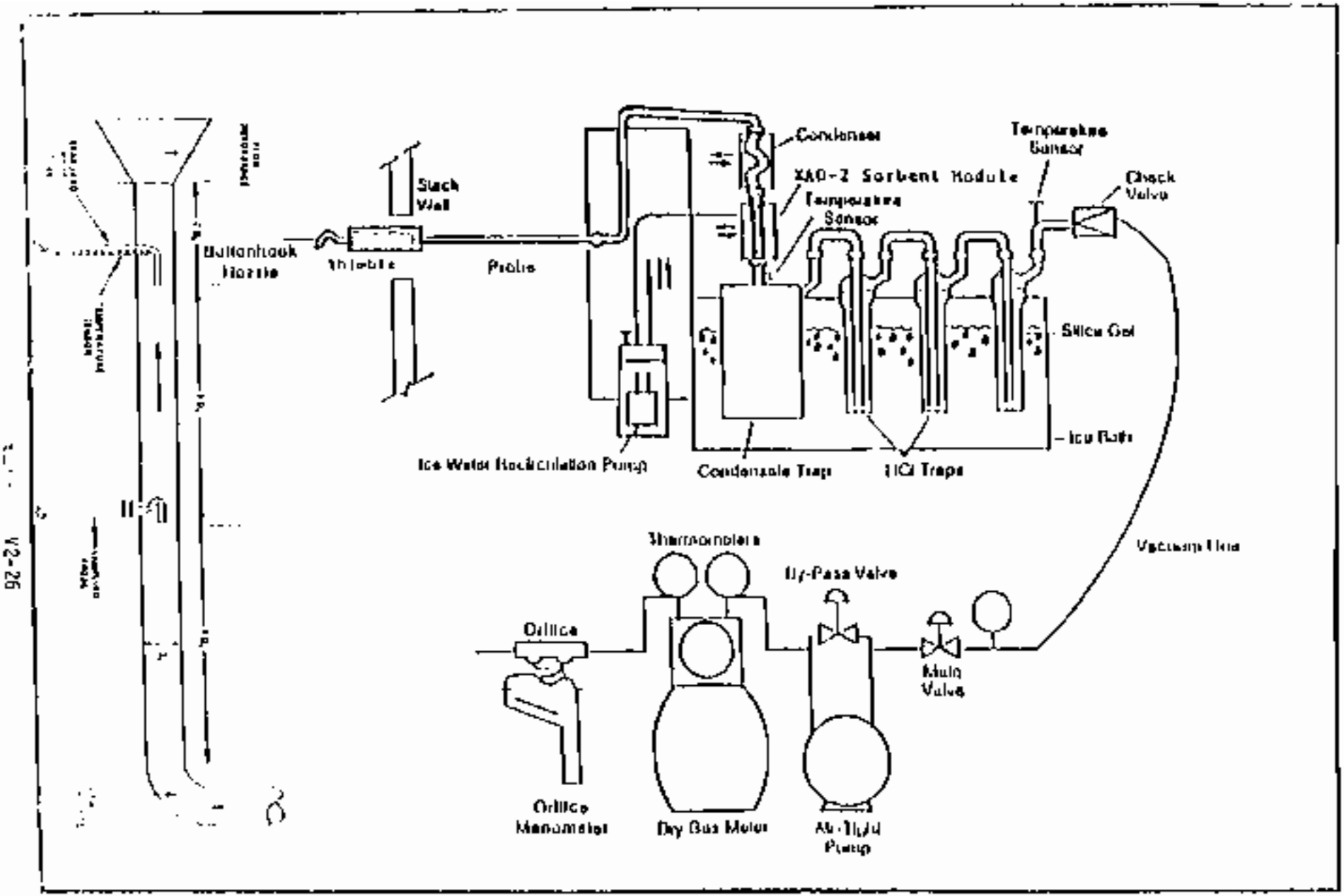

FIGURE 5-1 MODIFIED METHOD 5 SAMPLING TRAIN FOR PARTICULATE, DIOXIN, PIP'S, HCl AND MOISTURE

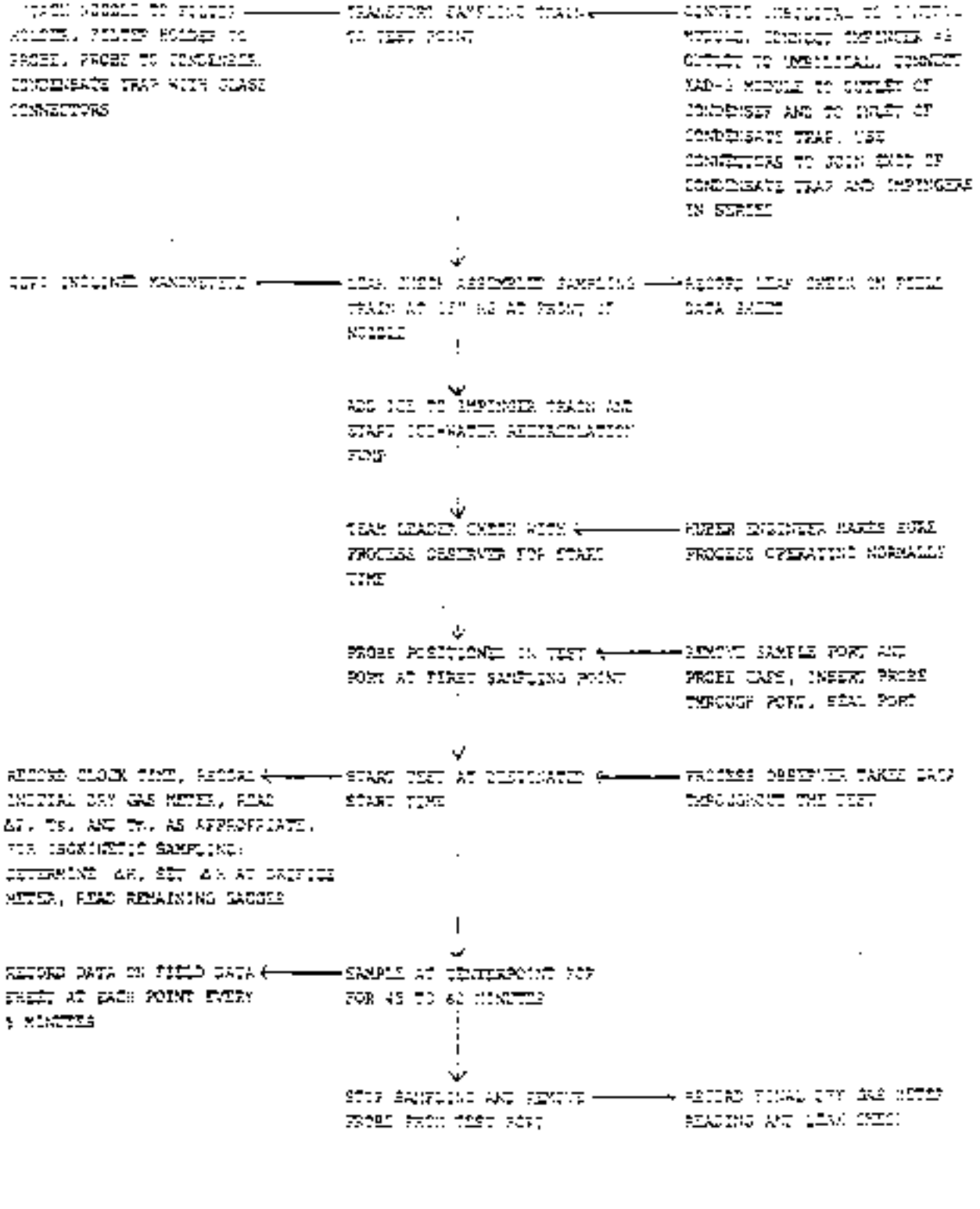

FIGURE 5-2

SAMPLING PROCEDURES FOR PARTICULATE, DIOXIN, PIP'S, HCl, AND MOISTURE SAMPLING TRAIN

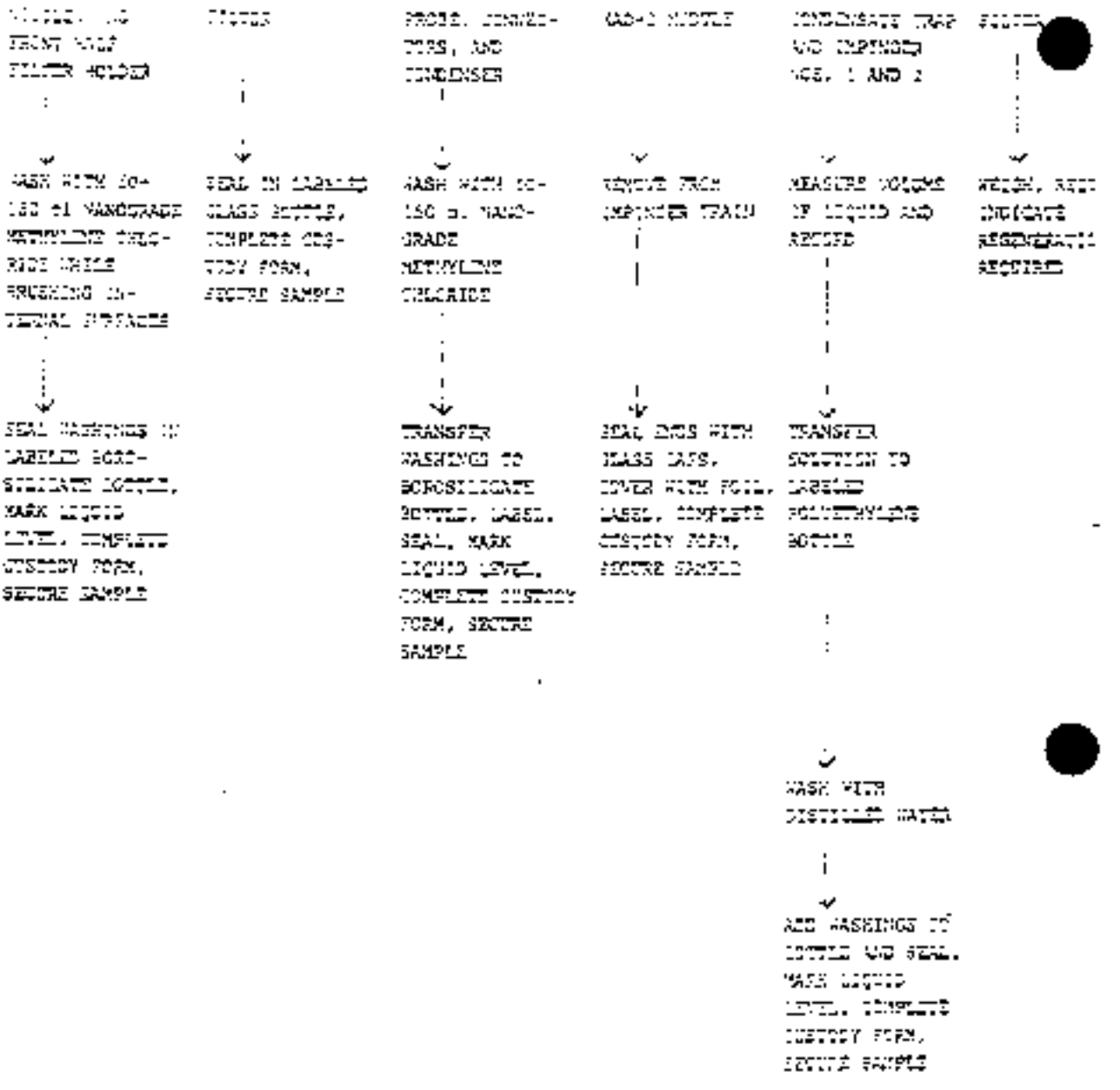

FIGURE 5-3

SAMPLE RECOVERY PROCEDURES FOR PARTICULATE, DIOXIN, PIP'S, HCl, AND MOISTURE

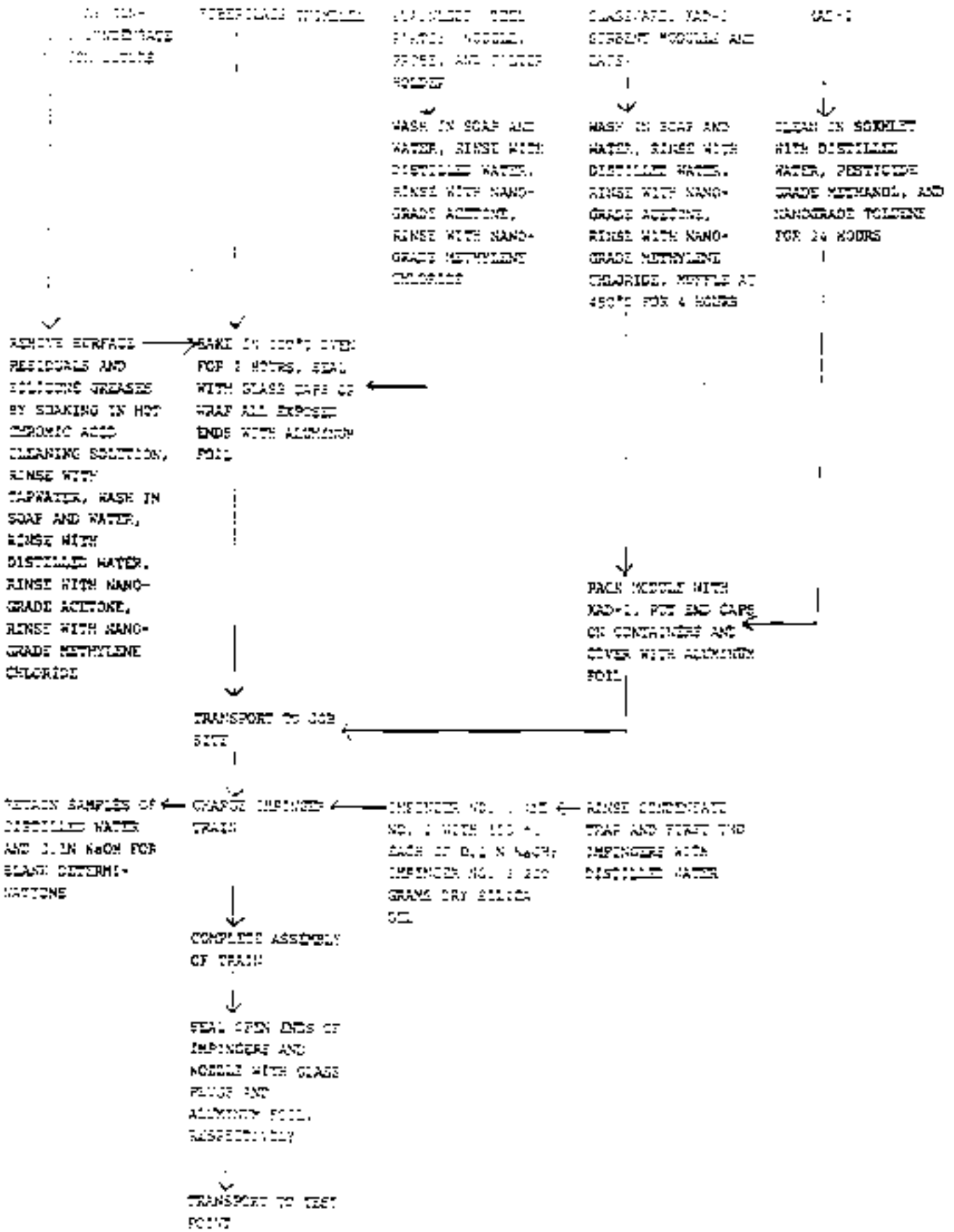

FIGURE 5-4

PREPARATION PROCEDURES FOR PARTICULATE, DIOXIN, PCP'S, HCl, AND MOISTURE SAMPLING TRAIN

SECTION 6
RESULTS AND CONCLUSIONS

The Huber Technology Group of J. M. Huber Corporation demonstrated the ability of their ASR to destroy 2,3,7,8-TCDD prese in native contaminated soil at the Times Beach Superfund site St. Louis County, Missouri. The tests were conducted Novem 13, 1984.

To determine the degree of success of the Times Beach dio test, the contaminated soil feedstock and the treated soil we sampled and analyzed for 2,3,7,8-TCDD on state-of-the-a analytical equipment: the YORK/WESTON REM-MS2 Mobile GC/MS, system. Treated soil was certified to be free of 2,3,7,8-TC against detection limits at least an order of magnitude below t 1 ppb (1 ng/g) standard established by the Missouri Department Natural Resources.

In addition, gaseous emission parameters, including chlorinat organics, chlorine, and particulate loading were measured at t point of atmospheric discharge. Nothing was detected again detection limits at least two orders of magnitude below the E standards for hazardous waste disposal facilities.

The Industrial Hygiene Audit (Reference 6) demonstrates that 2,3,7,8-TCDD was found in the local test environment: neither the air after 8-9 hours of high volume sampling within t process enclosure; nor on the surfaces of the work area platfor floor, or inside the air pollution control system piping. T detection limits of these tests were over three orde magnitude below the EPA standards.

6.1 PROCESS STREAM SOLIDS ANALYTICAL RESULTS

Dioxin

Table 6-1 presents a summary of dioxin datapoints including tho for the feedstock, the treated soil, and the baghouse catc Table 6-2 presents dioxin concentrations and mass flow rate The feedstock averaged 79 ng/g 2,3,7,8-TCDD and the thirte sample analyses ranged from 67.9 to 99.8 ng/g, providing standard deviation of 810 ng/g.

No 2,3,7,8-TCDD was found in the treated soil at detection limi of 0.11 ng/g for ten sample analyses from Runs 1 and 2. The 3 2 detection limit is shown in Table 6-1 as a weighted average five sample analyses at .14 ng/g.

No 2,3,7,8-TCDD was found in the baghouse catch. Samples fr each of the four bags were analyzed following the test against detection limit of .10 to .55 ng/g.

PIP's

Table 6-1 presents the chlorinated PIP results including for the treated soil and the baghouse catch. No indiv

organics were detected in the treated soil against detection limits estimated at 10 to 25 ppb. The spectral scans indicate that traces of chlorinated phenols and possibly some other organics as indicated in the table were present in the reactor emissions and the baghouse catch; however, even if this were quantitatively confirmed, the levels would be much less than established standards for such materials. For example, the EPA cancer assessment guideline number for 2,4,6 trichlorophenol (the only chlorinated phenol which has been identified as a potential human carcinogen) indicates that it is 2000 times less toxic than 2,3,7,8-TCDD (Reference 13 and communications from Clemet Associates to Dr. Ray H. Jones).

HUBER has determined that the baghouse catch is a porous high surface area material and, as such, serves as a trap for fugitive reactor emissions. Therefore, in future commercial operations, this material would be mixed with feedstock material and recycled.

6.2 GASEOUS EMISSIONS ANALYTICAL RESULTS

Dioxin

Table 6-1 presents a summary of dioxin datapoints including those for the reactor emissions and the stack emissions. Table 6-2 presents dioxin concentration and mass flow rates including the destruction efficiency (DE, percent) determined from the reactor emissions data and the destruction and removal efficiency (DRE, percent) calculated from the stack emissions data.

No dioxin was found in the reactor emissions or the stack emissions at detection limits of .54 to .74 ng/m³. This provided DE's and DRE's of at least of 99.999 percent. The low flow rates utilized in this test prevented the demonstration of higher DRE's. Preliminary high flow rate commercial scale testing on Borger, Texas, using OCDD provided quantitative DE's and DRE's in the order of 99.99999 percent (seven nines), which is the expected destruction level for commercial ADR process soil decontamination operations (References 11, 12, 13, and 14).

PIP's

Table 6-3 presents the chlorinated PIP's including those for the reactor emissions and the stack emissions. No chlorinated organics were detected in the stack gases against detection limits estimated at 15 ng/m³.

Fixed Gases, Moisture, Chlorine, Particulate Loading

Table 6-4 presents the results of stack emissions for O_2, CO_2, CO, H_2O, HCl, and particulate loading.

No chlorine (as HCl) was detected at detection limits of .3 to .4 mg/m³. Chlorine emissions (less than [illegible] lb/hr) were sim

[illegible] of magnitude below the applicable EPA standard of [illegible] (Reference 17).

No particulate matter was detected against detection limits of 1.0 to 1.3 mg/m³. For all runs, the particulate loading (less than 1.3 mg/dscm) was more than two orders of magnitude less than the EPA emissions limit of 130 mg/dscm (Reference 17).

The dry stack gases were comprised of nitrogen, about 2 percent carbon monoxide, and approximately 1 percent oxygen. The carbon monoxide levels were not expected and may be due to organic levels of approximately 7 percent in the feedstock (Appendix C). The Times Beach dioxin is in a matrix with heavy oils and tars. The oxygen levels are believed to result from slight air in-leakage to the Orsat sampling system.

Moisture content of the stack gases, seven-tenths of a percent by volume, was as expected due to the moisture content of the feedstock, about nine-tenths of a percent (Appendix C).

6.3 QUALIFICATION OF RESULTS

WESTON developed a detailed QA/QC Plan (Reference 4) for this program with the objective of producing quality data of known precision, accuracy, and completeness. The plan delineates responsibilities for quality control and defines quality criteria for all aspects of the program.

The analytical data were initially reported by the bench chemist or instrument operator. The spectral data from the analyses were then independently reviewed by the QA officer, Dr. David Ben-Hur. Finally, Dr. Kay Jones, the WESTON/YORK program director, reviewed all analytical results for compliance with the QA/QC procedures. Following completion of the confirmation process, all results were thoroughly evaluated and assessed. As a QA step, WESTON provided assistance in reviewing and confirming computations and conclusions.

.4 CONCLUSIONS

The J. M. Huber Corporation has successfully demonstrated on-site treatment of soil contaminated with about 79 ppb of dioxin (2,3,7,8-tetrachlorodibenzo-p-dioxin or 2,3,7,8-TCDD) at the Times Beach Superfund site in St. Louis County, Missouri, using their Advanced Electric Reactor technology (AER process). The apparent absence of other documented successful dioxin tests strongly suggests that this is the world's first successful field demonstration of permanent dioxin destruction.

No 2,3,7,8-TCDD or chlorinated organics were measured at or above the detection limits in any effluent stream. Thus the AER process was proven to be a high performance system for permanent treatment of dioxin.

No 2,3,7,8-TCDD was found in the local test environment during nine hours of high volume sampling. Thus the AER process was proven to be sealed and functionally risk-free.

EPA standards for hazardous waste treatment facilities were excelled by at least two orders of magnitude for PIP's, chlorine emissions, and particulate loading, none of which were detected in the stack gases.

The Missouri DNR standard for 2,3,7,8-TCDD (1.0 ppb), based on CDC Standards (Center of Disease Control), was excelled by at least a factor of nine, in the treated soil discharge from the AER process (less than .11 ppb).

APPENDIX I

PHOTOGRAPHS & FIGURES

TABLE 6-2

DIOXIN CONCENTRATIONS AND MASS RATES, DE'S AND DRE'S

	RUN 1	RUN 2	RUN 3
Feedstock			
Concentration (ng/g)	79±10	79±10	79±10
Mass rate (ng/min)	8040	11,200	11,900
Treated Soil			
Concentration (ng/g)	0.11	< 0.11	< 0.14*
Mass rate (ng/min)	< 8.4	< 11	< 16
Bag Filter Catch			
Concentration (ng/g)	< 0.55	< 0.55	< 0.55
Mass rate (ng/min)	< 1.4	< 2.0	< 2.1
Reactor Emissions			
Concentration (ng/m³)	< 0.54	< 0.54	< 0.74
Mass rate (ng/min)	< 0.07	< 0.07	< 0.10
DE %	> 99.9991	> 99.9991	> 99.9993
Stack Emissions			
Concentration (ng/m³)	< 0.55	< 0.55	< 0.71
Mass rate (ng/min)	< 0.07	< 0.07	< 0.10
DRE %	> 99.9991	> 99.9991	> 99.9993

*Weighted average: 90% treated soil, aggregate
10% treated soil, granular

All < or > signs indicate that no dioxin was found at the analytical detection limit.

TABLE 6-3
PRODUCTS OF INCOMPLETE PYROLYSIS

	RUN 1	RUN 2	RUN 3
Treated Soil	*Trace di-chlorophenol (Possibly chlorobenzene)	*None detected (Possibly chlorobenzene.	None detec
Reactor Emissions	None detected	Trace di-chlorophenol (Possibly trichlorophenol)	None detec
Stack Emissions	None detected (Possibly chlorobenzene)	None detected	None detec
Bag Filter Carbon All runs - end of test			Trace di-chlorop (Possibly benzylmeth ether)

*WESTON analyzed these two treated soil samples for chlorinate PCP's against an estimated detection limit of 10 ppb.

ERG (Environmental Research Group, Inc.) analyzed the same samples (and only the two shown) for all PCP's against a detection limit of 1.0 ppm. ERG data indicated no chlorinated organics at the lower detection limit.

Reports from both WESTON and ERG are presented in Appendix C.

TABLE 6-4

STACK EMISSIONS
FIXED GASES, MOISTURE, CHLORINE, PARTICULATE LOADING

	RUN 1	RUN 2	RUN 3
Dry Gas Composition (volume %)			
Carbon dioxide[b]	0.6	<0.1	<0.1
Oxygen[a]	1.6	1.1	1.1
Carbon monoxide	0.0	0.1	0.1
Nitrogen	96.4	96.8	96.8
Moisture Content (volume %)	0.7	0.7	0.7
Chlorine as HCl[b]:			
Concentration, mg/m³	<0.3	<0.3	<0.4
Mass rate, lb/hr x 10^{-6}	<5.4	<5.4	<7.0
Particulate Loading[b,c]:			
Concentration, mg/m³	<1.0	<1.0	<1.3
Mass rate, lb/hr x 10^{-3}	1.3	<1.6	<2.3

a) Slight ambient air in-leakage to Orsat sampling system.

b) All < signs indicate results below analytical detection limit.

c) Standard conditions are 20°C and 760 mmHg.

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CHAPTER II: DESCRIPTION AND TEST PLAN

Attachment 1 is a General Engineering Description of the Toxbuster as i was configured for the Times Beach tests. This description is a part o the AER RCRA permit application which is currently being reviewed by TDW and is expected in March-April 1985. Some modification is necessary t the Toxbuster for the NCSC tests. The modification is to enlarge the fee bin and solids collection vessel so that 1000 pounds of soil can be handled As was the case with the Times Beach configuration, this modification wil be made so the entire system is closed during the test.

The internal components of the AER are illustrated in Figure 1. The reacto consists of two concentric cylinders. The inner cylinder is a porous graph ite core which is surrounded by six graphite electrodes. The outer cylin der is lined with graphite insulation to confine the heated chamber. Opera tion of the reactor is very simple. The procedure consists of (1) startin the flow of nitrogen into the reactor to purge oxygen and form an iner blanket which protects the walls of the inner core, (2) supplying electricit to the electrodes which in turn heat the core up to the desired temperature (3) introduce the wastes into the reactor and process them, (4) drum the treated soil during operation, (5) shut down the reactor at completion, and (6) decon the system.

Among the advantages of the AER process are its mobility, extremely treatment efficiencies (because of the high process temperatures and gas residence times), intrinsic safety features (such as the activated carbon beds, fail safe design, electrical driven solids feeder, and large amount of thermal inertia in the reactor), essentially no stack or fugitive emissions, and the ability to detoxify wastes in a pyrolytic atmosphere, thereby avoiding products of oxidation such as dioxins and furans.

In September 1983, huber embarked on an aggressive program to demonstrate the capability of the AER to decontaminate soil. This program includes the treatment of soils contaminated with PCB, PCB, carbon tetrachloride, octochlorodibenzo-p-dioxin, and TCDD. Tests were conducted using PCBs in September 1983 to seek EPA certification under the auspices of the Toxic Substances Control Act (TSCA). This certification was received in May 1984. Another test series was performed using carbon tetrachloride over a wide range of test conditions in May 1984 to provide additional information for a Texas Department of Water Resources permit application in compliance with RCRA. The RCRA permit is expected in March-April 1985 and will probably be the most versatile RCRA permit issued. In both of the above tests, no results were below 99.9999% destruction and removal efficiency (DRE).

In October 1984, the AER was used to successfully destroy a highly stable, laboratory-prepared, TCDD surrogate octachlorodibenzo-p-dioxin (OCDD) mixed with soil at up to 17,000 ppb. The mobile bench-scale AER (referred to as the Toxbuster) was tested in Borger, Texas, on October 29, 1984; the pilot-scale unit was tested on October 30, 1984.

On November 15, 1984 the Toxbuster was used to treat soil containing 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in Times Beach, Missouri. No TCDD or products of incomplete pyrolysis (PIPs) were detected in the treated soil at detection limits of 0.11 ppb on the TCDD and approximately 10 ppb on the PIP's. Similarly, no TCDD or PIPs were detected in the stack gas stream at detection limits of 0.52 ng/m^3 on the TCDD and 25-50 + ng/m^3 on the PIP's.

Attachment II is a summary of the test conditions as is proposed for the NCBC tests. As shown, Huber intends to process nominally 1000 pounds of soil contaminated with between 100-200 ppb TCDD. Three tests will be conducted over a 3-day period, and each test will be about 10 hours long at a feedrate of 0.6 lb/min (about 360 pounds of soil per test). Testing is scheduled to begin on June 24 and end on June 26, 1985.

Attachment III is the preliminary run plan for the NCBC tests. This run plan is patterned after the run plan that was used for the Times Beach tests. Also shown in Attachment III is the suggested on-site analytical testing and sampling that is expected during the NCBC tests. The present run plan is based on this sampling schedule and will be modified when the final sample plan is established.

Attachment IV is an overview of the proposed activities associated with the AER tests at NCBC. As shown, the major equipment will arrive on June 14 and be set up on June 17 and 18. A shakedown test is scheduled on June 19 to identify any equipment problems. June 20 is reserved to perform any necessary repairs before a pre-test meeting of all test participants on June 21.

The coordination meeting will be held to ensure that all participants of the tests are fully aware of their responsibilities. This will include a brief review of the emergency procedures and a review of the health and safety procedures that will be followed during the tests. All of the information in the Test Plan will be reviewed with the appropriate participants, and a checklist will be given to each participant so that he/she can verify that all of his/her duties will be performed at the proper time.

Final test preparations will also be performed on June 21 and the feed bin (containing about 1000 pounds of soil) will be placed in position and connected to the AER flow train. Testing will begin on June 24 and complete on June 26. Decontamination procedures will be performed on June 27, and the equipment will be dismantled on June 28 and 29 in preparation for return to Borger. No equipment will be removed from the test site until analytical results certify that the equipment has been properly decontaminated.

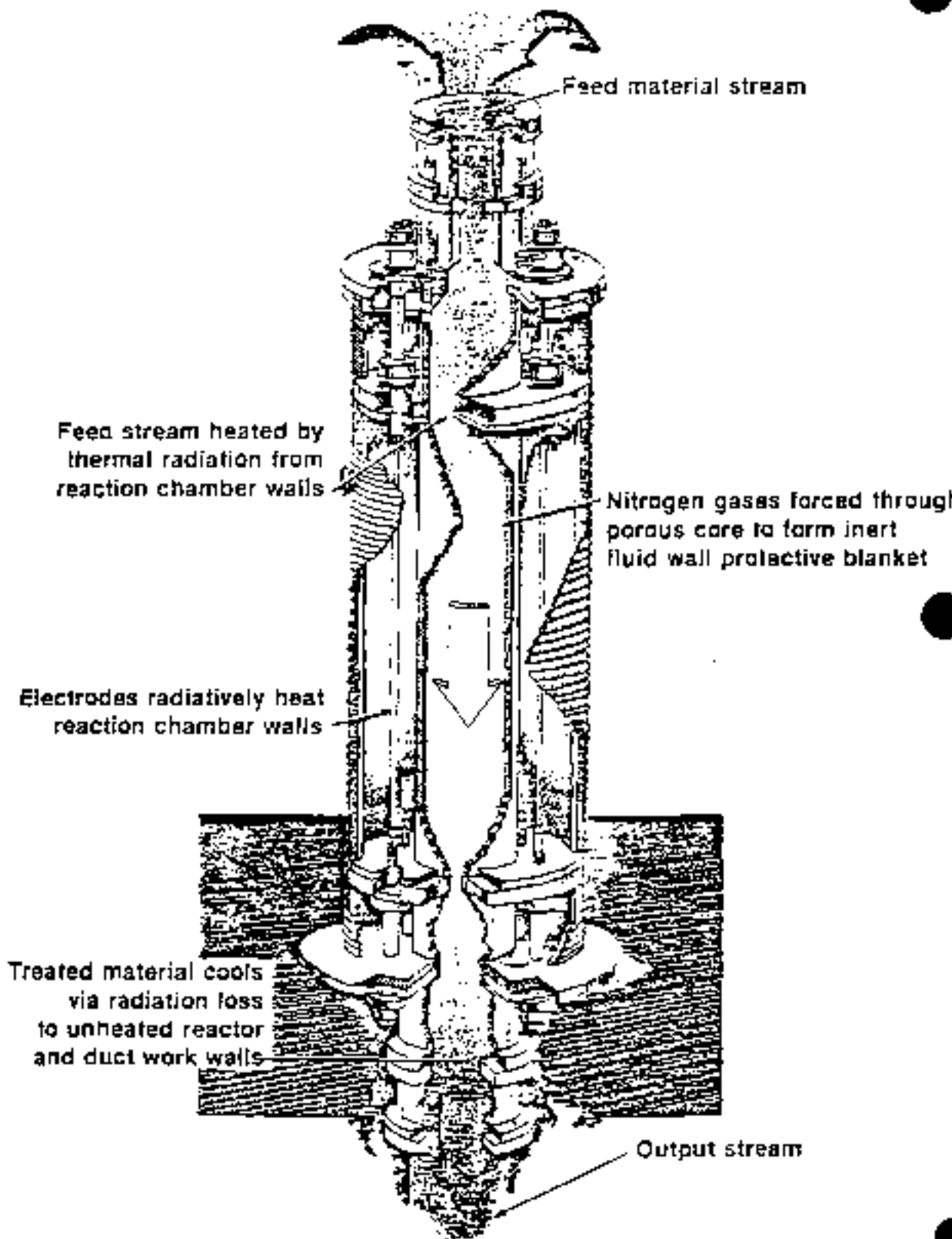


FIGURE 1: Advanced Electric Reactor

ATTACHMENT 3

GENERAL ENGINEERING DESCRIPTION

1.0 GENERAL INFORMATION

This engineering report describes in detail J. M. Huber's bench scale advanced electric reactor which is usually located at HTG' Borger, Texas, research facility. All figures, photographs, an references for equipment used in this process are contained i the appendix.

1.1 Description

Huber's smallest reactor (AERI) is a bench-scale advanced elec tric reactor with an inside core diameter of three inches and heated length of three feet. This unit is installed in a covere truck/trailer to provide mobility and is used for proof-of concept experiments and on-site demonstrations.

The reactor, post reactor treatment zone (PRTZ), and solid collection vessel form a vertical process flow train with a height of approximately 110 inches inside the covered truck trailer (see Figure 1). Wastes or surrogates are introduced at the top of the reactor and gravity fed through a metering screw feeder. As the wastes enter the reactor, they are rapidly heated to the 4000°F range in the absence of oxygen where they are pyrolyzed to their elemental constituents; i.e., C, H_2, CO_2, etc. After leaving the reactor, the product gas and waste solids pass through a PRTZ. The PRTZ is a water-cooled vessel which provides additional residence time but primarily cools the gas and solids to less than 1000°F prior to downstream particulate cleanup.

Solids exiting the PRTI are collected in a solids collection vessel which is sealed to the atmosphere. Additional solids in the product gas are removed by a baghouse located just downstream from the PRTI. Immediately after the baghouse, the product gases pass through two activated carbon beds (55-gallon drums each) for the removal of any residual organics or chlorine that may be present. The organic, particulate, and chlorine-free product gas composed almost entirely of nitrogen and moisture is then released to the atmosphere through the process stack which exits through the top of the trailer. Because this is a highly effective pyrolysis process with all product gases passing through activated charcoal filters, little or no hydrocarbons are anticipated at the stack.

1.2 Potential AERI Equipment Variations

This is a bench-scale unit and will be used with a wide range of materials. As a result, it may be necessary to utilize specific equipment variations to achieve optimum performance for a given application. Listed below are specific examples of such potential variations:

1. The water-cooled PRTI might be replaced or used in conjunction with an insulated PRTI which would increase high-temperature residence time and may be necessary to achieve sufficiently high destruction efficiencies at high feed rates.

2. In a specific application, a heat exchanger might be added after the bagfilter for recovery of a valuable high boiling pyrolysis by-product.

3. A scrubber may be added before the activated carbon beds for the treatment of product gases which may contain a high amount of acid gases such as HCl.

4. A larger capacity feeder may be required.

5. A larger capacity solids collection vessel may be used so that longer run periods can be performed without changing the vessel.

6. Changes in interconnecting piping might be necessary to facilitate safe and effective process decontamination.

7 The baghouse may be replaced with a larger or smaller unit to facilitate more efficient particulate removal from the process gas.

This is not intended to be an exhaustive list of all possible variations but rather a list of examples to illustrate the type of equipment change that could be required to safely and efficiently operate this bench-scale unit.

1.3 AERI Controlled Variables

Actual operation of the AERI is relatively simple. The major process variables are nitrogen flow rates, reactor power, and waste feed rate. To ensure correct operation of the AEP, the following data is recorded manually at five-minute intervals:

- Reactor power (in kilowatts)
- Nitrogen purge to the radiometer
- Blanket nitrogen
- Water cooling temperatures
- Volts and amps for reactor power
- Water flow rates
- Solids collection vessel temperature
- PRTZ temperature
- Feed rate

2.0 Detailed Plans and Specifications

This section contains detailed plans and specifications for t bench-scale AERI and its ancillary components. The subsyster that will be described in detail include the covere truck/trailer, reactor feed and measurement system, reactor body post reactor treatment zone, solids collection vessel, an pollution control system.

2.1 Covered Truck/Trailer

The bench-scale AERI is housed inside a 1975 44-foot long Ken tucky manufacturing trailer (see Photo No. 1 and Figure 2). Thi drop frame furniture van has a single axle and is capable o 20,000 pounds of cargo weight. The van has been speci modified to accommodate the bench-scale AERI unit. During setu and operation, the 10-foot slipping roof door is opened and temporary canvas structure is erected. The canvas structure i supported by a pipe frame. Lighting is installed on both the inside and outside of the canvas structure for night illumination. As shown in Figure 2, there are four exterior doors.

2.2 Solid Feed System

Solid feed that is to be passed through the bench-scale reactor can either be prepared on site using the combination feed/mix bin or it can be brought into the R&D facility already mixed and placed in the specially designed feed bin shown in Figure 3.

feed bin is a high-security bin designed with a capacity of approximately 100 pounds and is constructed of 10-gauge, 316 stainless steel (volume of 2.2 cubic feet). The overall height of the bin is 35½ inches, and the upper diameter is 13½ inches. The bottom 11½ inches of the feed bin is conical to facilitate solids flow. At the bottom of the conical section is a three-inch Dezurik knife valve followed by a blind flange. As a safety precaution, the blind flange is placed over the knife valve whenever the feed bin is not in use. As shown in Figure 3, a spiral flight is installed on the interior of the feed bin so that the feed bin can also be used to prepare the feed material. Once the desired materials are placed in the feed bin, the feed bin is placed in a rotating device (i.e., a modified cement mixer) and rotated so that a homogeneous mixture of material can be prepared within the feed bin. This practice minimizes the amount of equipment that will be contaminated in the preparation of runs on the bench-scale unit.

The top of the feed bin has two openings. The first is used to install a one-way filter so that a vacuum is not created as the material is fed into the reactor. The feed opening is used whenever the feed bin is being filled and is sealed when not in use. A metal lifting lug on the top of the feed bin is used whenever the feed bin is being lifted.

After the feed bin has been filled and the material is homogeneously mixed, it is lifted to the top of the reactor prior to the test and connected to the metered screw feeder (see

Photograph No. 1). The blind flange is removed from the bot of the feed bin and the bin is connected to the feeder. Th metered screw feeder is then positioned over the top of tr reactor. An electric scale is located underneath the retere screw feeder to provide periodic feed rate checks (see Photo No 2). The connection between the metered screw feeder and th reactor head is flexible, allowing the weight of the feed bin an the metered screw feeder to be supported solely by the checkmat scale. This arrangement allows the checkmate scale to dynam ically measure changes in weight during experiments.

2.3 Reactor Body

The reactor chamber nominally consists of a cylindrical, porou graphite core of three inches in diameter (see Photo No. 3). Th carbon electrodes are spaced around the core's circumference The core and electrodes are insulated within the reactor jacke by graphite materials. The core is designed to allow the per meation of an inert gas (such as nitrogen) through the core wal into the interior core, creating a gaseous momentum barrier. This prevents the feed material from coming into contact with the core walls. The reactor body has a 14-inch outside diameter anc is approximately 36 inches long.

The reactor is designed for a maximum temperature of 5000°F. The normal operating core temperature will be between 3500-4500°F with a maximum temperature of 4700°F. The normal operating

electrode temperature will be between 3500-4800°F with a maximum temperature of 5000°F.

The reactor body is equipped with cooling water tubing which is aluminized to the reactor wall to facilitate heat removal. During normal operation, a glycol water mixture flows through the reactor shell at 25 gallons per minute. An optical pyrometer is used to monitor the temperature of the core (see Photo No. 4). The reactor can accept solid feed rates of up to 0.6 pound per minute and liquid feed rates of up to 0.1 gallons per minute. Required nitrogen flow rates are between 0 and 5 scfm, depending upon load conditions. Cryogenically purified nitrogen is supplied to the reactor by external connections on the covered trailer.

A 200 kw power supply is used to operate the bench-scale AER; however, no more than 60 kw is ever required during operation. Power requirements vary depending upon operating temperature and solids and nitrogen flow rates. The power supply has a 480-volt, three-phase SCR controlled primary. The secondary is wye connected and delivers 2000 amps at 50 volts. Although this power supply is grossly oversized for this application, it was designed to accommodate upgrades for potential use on larger reactors in the future.

2.4 Post Reactor Treatment Zone (PRTZ)

Photograph No. 5 provides details of the PRTZ. This circular vessel is 51 inches long and has an outer diameter of 9¾ inches. The walls of the PRTZ are water cooled. The vessel is constructed of 316 stainless steel. The PRTZ is connected air tight to the reactor and solids collection vessel.

2.5 Solids Collection Vessel

The solids collection vessel is shown in Photograph No. 6. This vessel is constructed of two concentric pods. The inner pod has an inside diameter of 10 1/4 inches and is 11 inches deep. The outside pod has an outside diameter of 11 3/8 inches and is 11 inches deep. These pods are separated by ceramic insulation. The inner pod is made of 316 stainless steel with a 1/8 inch thickness, and the outer pod is also made of 316 stainless steel but with a 1/4 inch wall thickness. The inner pod has a volume of approximately 0.5 cubic feet and is equipped with a thermocouple so that the temperature of the solids in the vessel can be monitored.

2.6 Pollution Control System

2.6.1 Baghouse

As shown in Photograph No. 7, a two-stage bagfilter is used to remove fine particulate from the gas flow. The primary bagfilter

consists of four modified NW Criswell bags with a diameter of five inches and a length of 90 inches. The bag material is typically a filament glass cloth, style T415-18-038. The bags are mounted with the opening towards the top of the bagfilter to facilitate easy removal and cleaning. After exiting the bottom of the bagfilter, the process gas goes to the top of the secondary chamber and passes through the two remaining bags for secondary cleanup. The dimensions of the bagfilter compartment are one foot by two feet by 98 inches high. The walls of the baghouse are 14-gauge mild stainless steel, and the end plates are constructed of ¼ inch mild steel.

The bags are not pulsed and do not use any form of repressure.

2.6.2 Activated Carbon Beds

After exiting the baghouse, the flue gases are routed through two activated carbon filters (see Photo No. 8). Any remaining organics and chlorine are removed by passing the product gas through active carbon which is arranged in a series of two 55-gallon drums. Each Nixtox filter (Model N100) consists of granular, vapor-phase, activated carbon in 55-gallon drums. Relevant data concerning these filters is provided in the appendix.

Breakthrough on the activated carbon beds will be determined by the same procedure as outlined in the permit application for the 12" AER system.

2.7 Dry Gas Meter

The dry gas meter is located just downstream of the Ni filters and is used for accurate measurements of the process flow (see Photo No. 9). The Rockwell positive displace meter, Model 415, has a polyethylene diaphragm and is made carbon steel construction with an accuracy of ±1%. The meter a maximum acceptable inlet pressure of 25 psig and a capacity 415 atmospheric cubic feet per hour at ½ inch water column d pressure (300 acfh at two inches water column delta p).

The process pipe to and from the dry gas meter is 2-inch sche 40 mild steel pipe. Bypass piping is available to omit the meter if required.

2.8 Cincinnati Fan

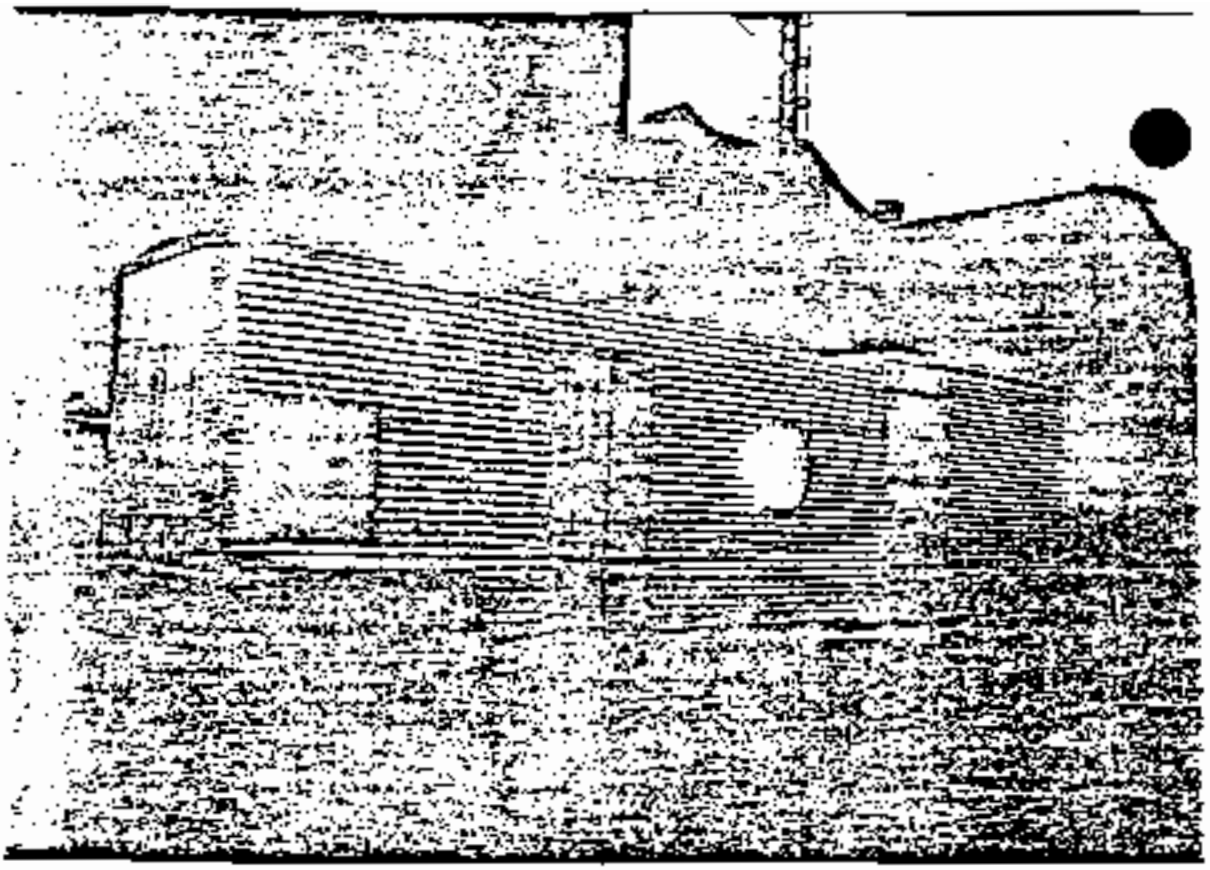
Following the dry gas meter, a Cincinnati 11-inch diameter with a three-quarter hp, direct coupled, three-phase, 220-v motor is used to balance flows (see Photo No. 10). Man control valves upstream of the Cincinnati fan are capable throttling the flow between 0 and 5 acfm.

2.9 Stack

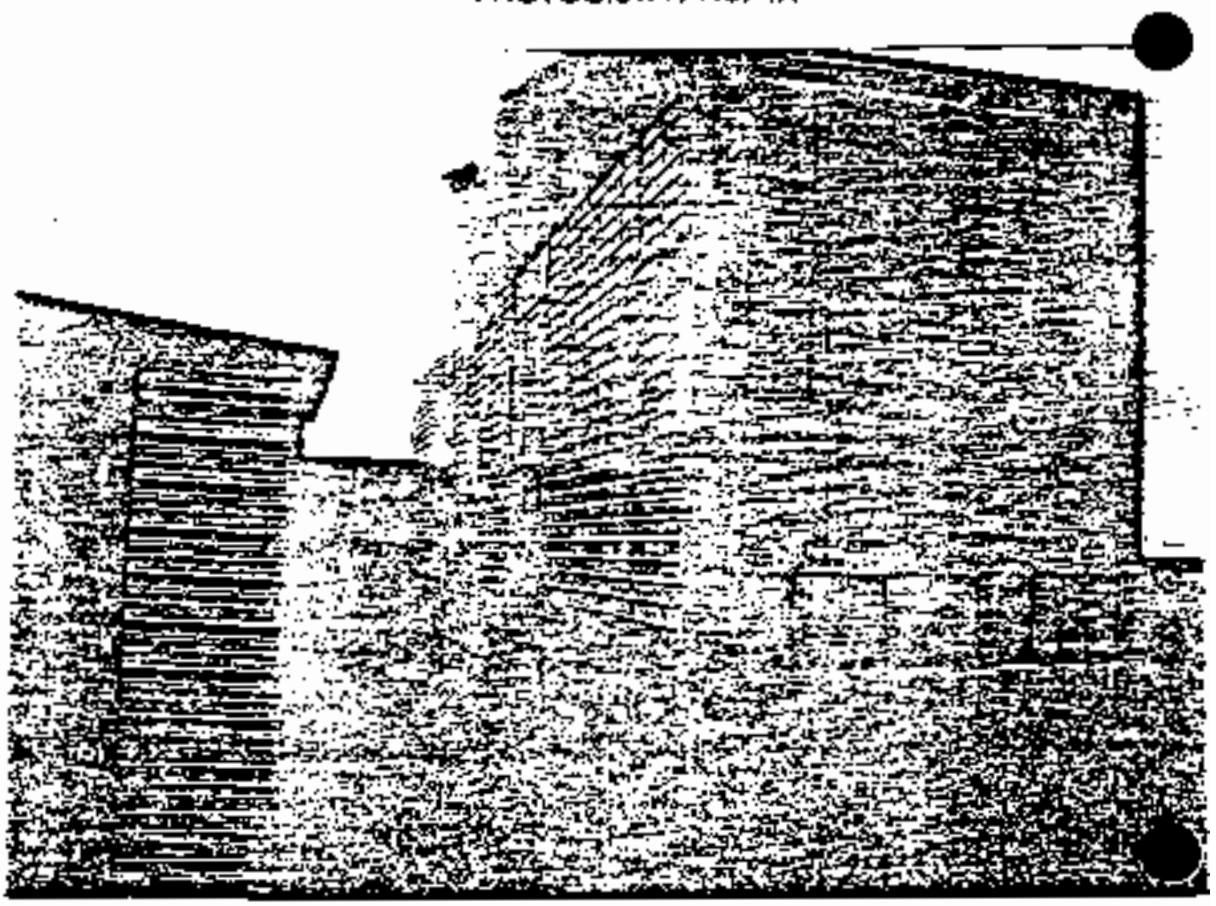
After exiting the Cincinnati fan, the process gases are direc through a three-inch stack (schedule 40, mild steel pipe) wh exits through the top of the trailer.

APPENDIX I

PHOTOGRAPHS & FIGURES

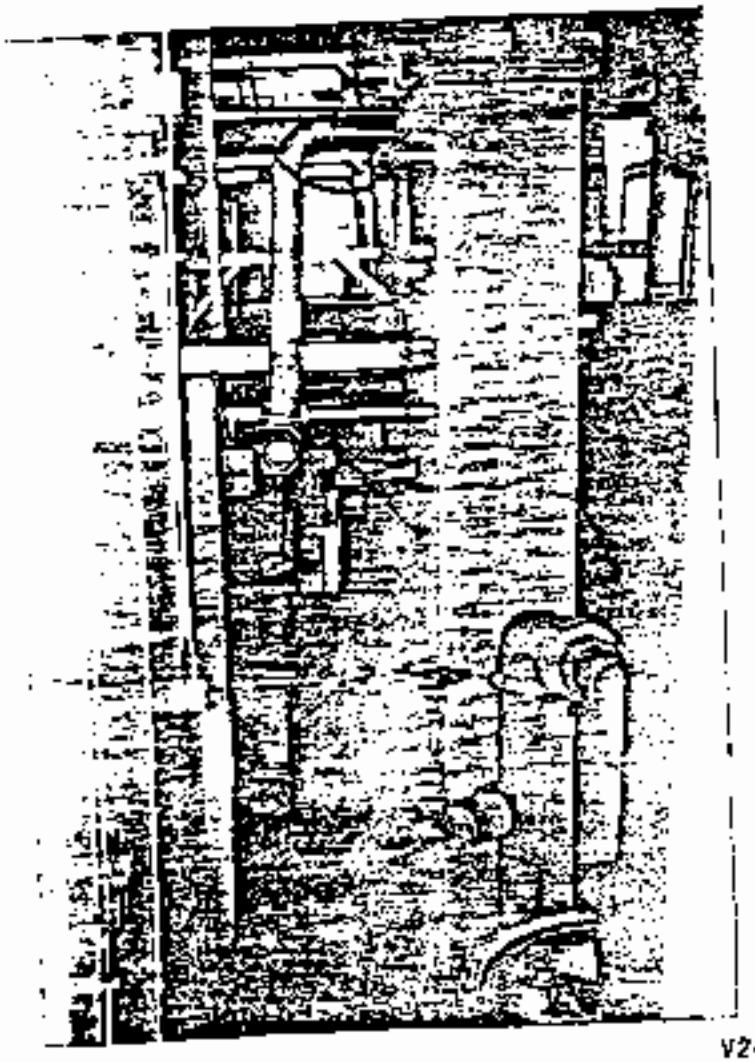


PHOTOGRAPH No. 1A



PHOTOGRAPH No. 1B

PHOTOGRAPH No. 6



PHOTOGRAPH No. 7

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2.7 Dry Gas Meter

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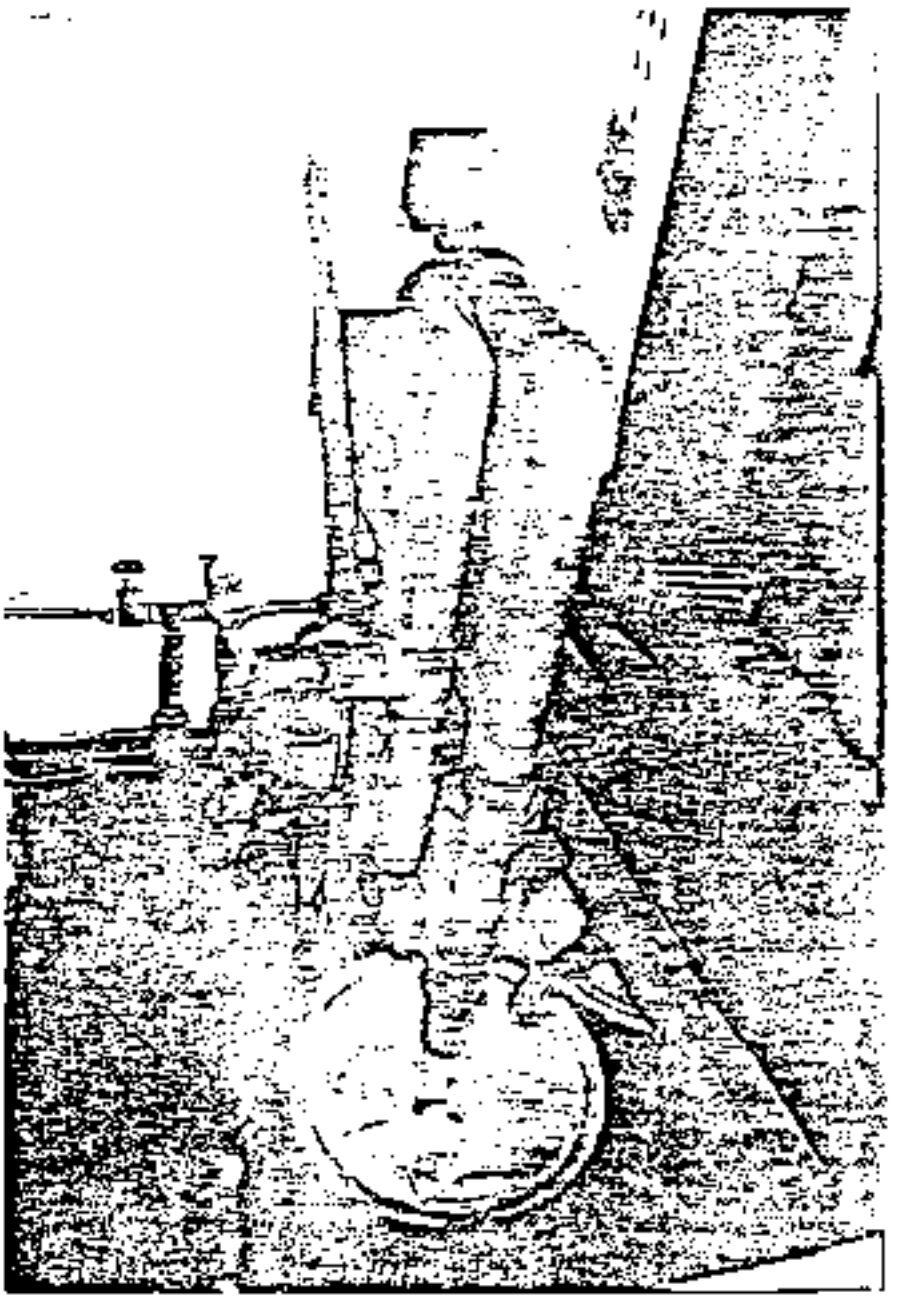

PHOTOGRAPH No. 10

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is used for accurate measurements of the process g
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Cincinnati Fan

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ack

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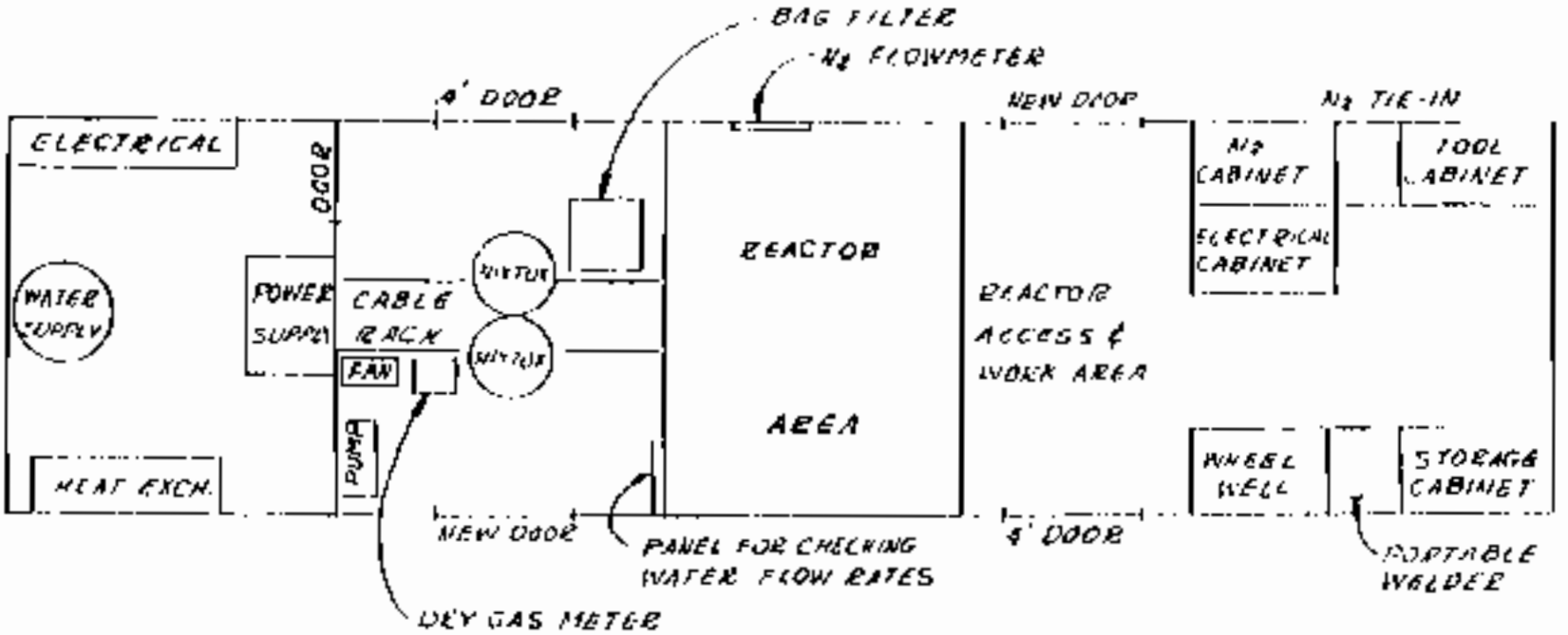
three-inch stack (schedule 40, mild steel pipe) which
the top of the trailer.

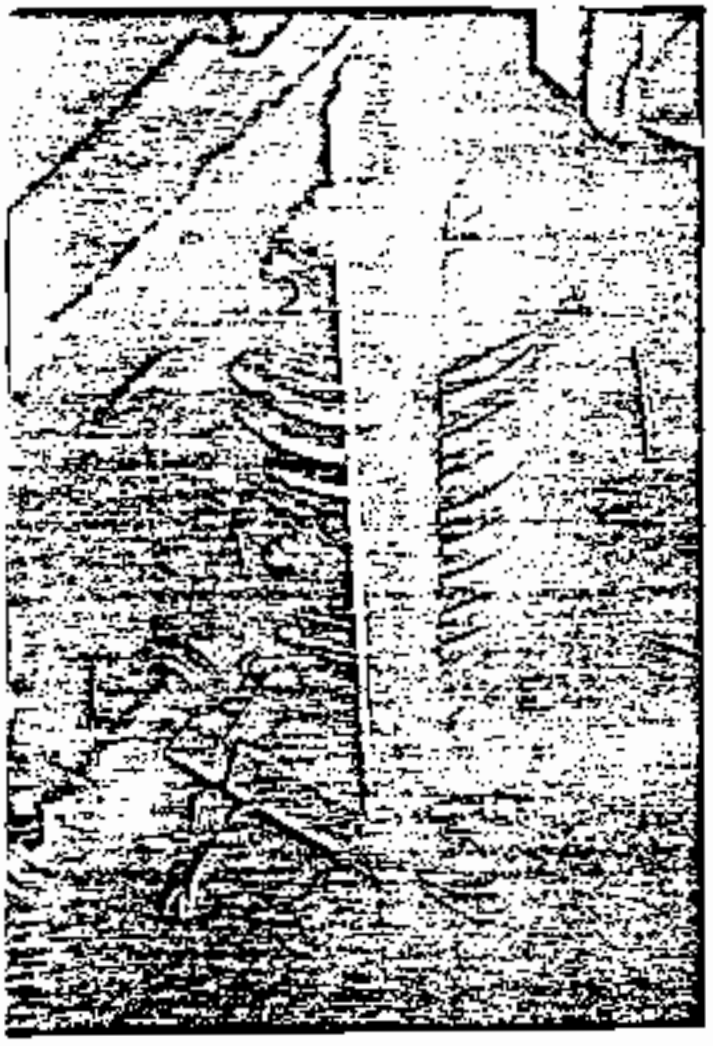
BENCH SCALE ELECTRIC REACTOR



TOP VIEW

EQUIPMENT LAYOUT

Figure 2A



PHOTOGRAPH No. 4

PHOTOGRAPH No. 5

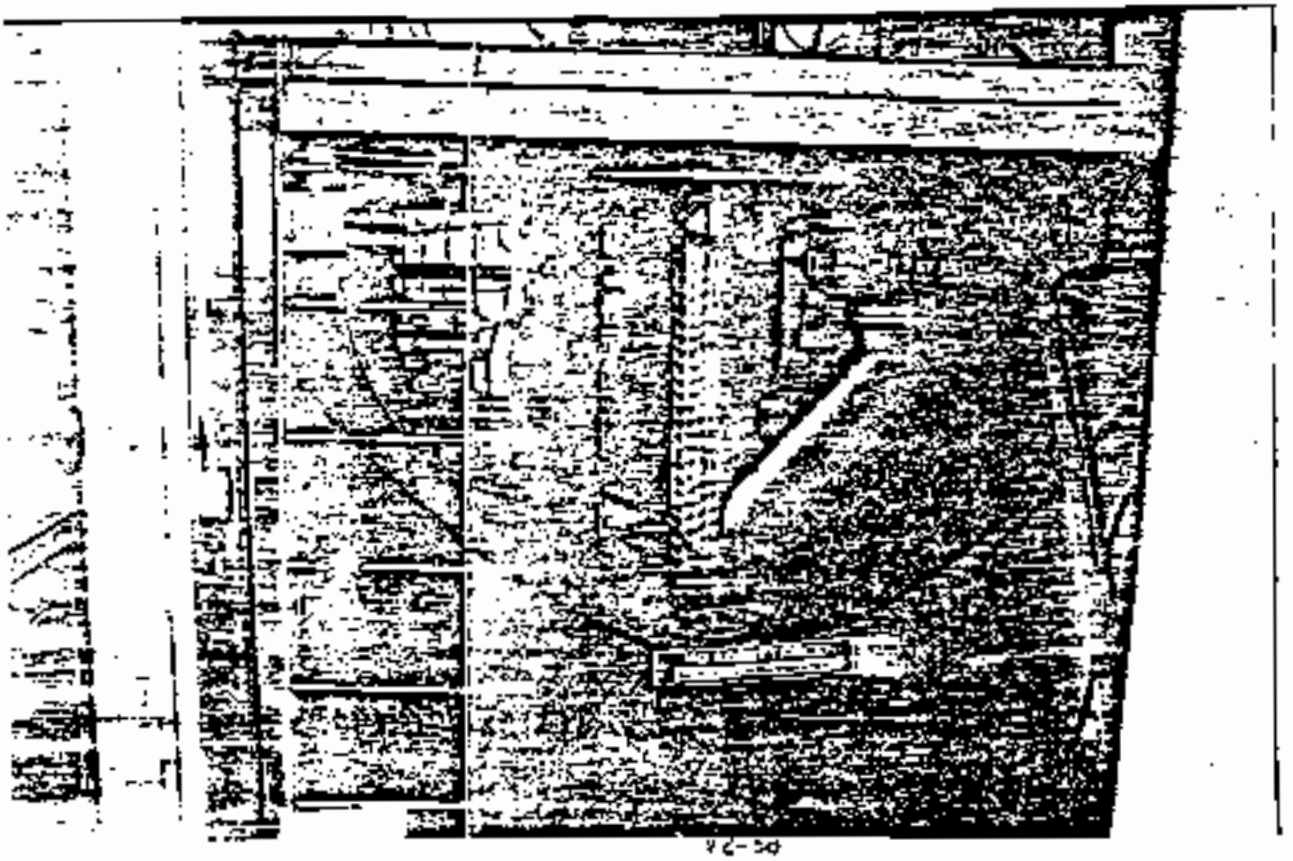


Figure 3

FEED AND MIXING BIN

DWG. No. 412010-D-5000

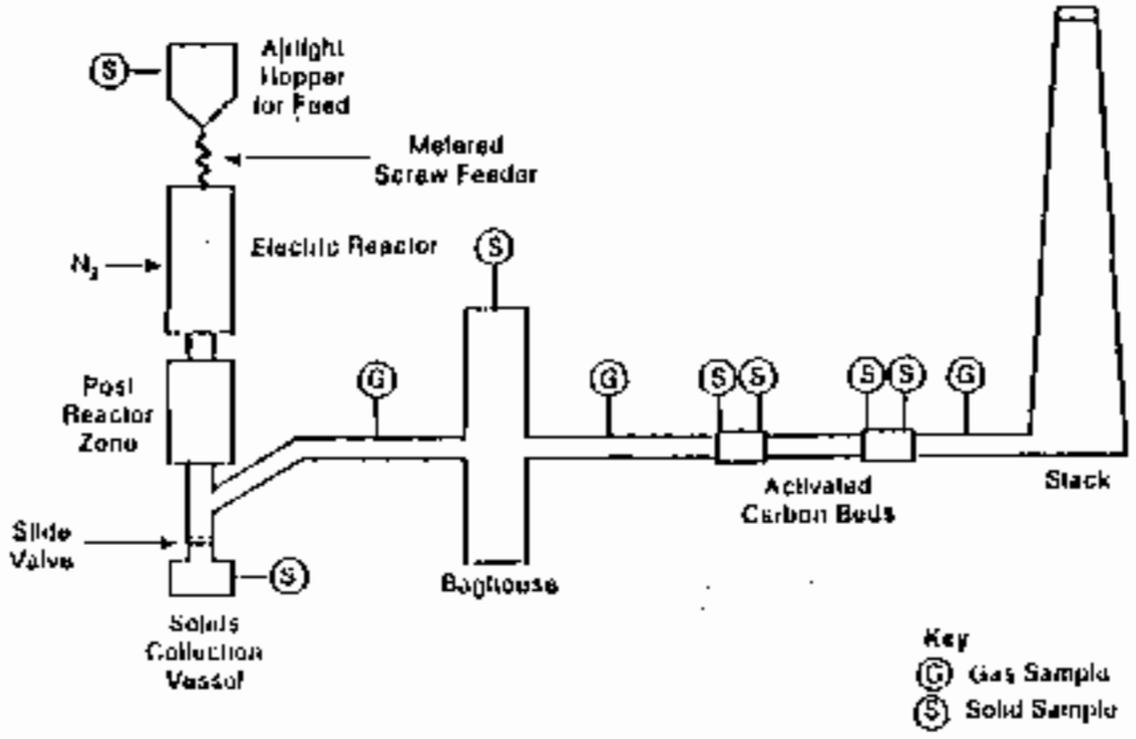


FIGURE 1

AER 3 PROCESS SCHEMATIC

ATTACHMENT II

SUMMARY OF TEST CONDITIONS

ATTACHMENT II

SUMMARY OF TEST CONDITIONS

1. Location: Naval Construction Battalion Center, Gulfport, Mississippi (maps attached)

2. Test to be conducted in cooperation with EG&G Idaho Falls, Idaho.

3. Date: Late June, 1985 (nominally June 24, 1985)

4. Number of Tests: Three (3)

5. Feed Rate: Approximately 0.6 lb./min.

6. Test Duration: Approximately 10 hours each

7. Dioxin Concentration: Approximately 100 - 200 ppb TCDD

8. Total Quantity of Soil to be Tested: Approximately 1,000 lbs.

9. Total Quantity of Dioxin to be Destroyed: Approximately 2×10^{-4} lbs. or 0.09 grams TCDD

10. Results Expected:

    a. Greater than 99.9999% DRE or TCDD not detected in gas phase

    b. Greater than 99.9999% DRE or TCDD not detected in the solid phase

11. Expected Reporting Date: Late 1985

In every previous demonstration test, the safety and hygienic practices which Huber implemented have adequately protected personnel, equipment, and the environment. Therefore, the procedures shown in the safety plan (also enclosed) have been tested and proven effective. Previous tests have verified that during actual operation, Huber's system is completely closed. Therefore, Level C protection will be utilized only when the system is open. As presently envisioned, an open system will be said to exist when preparating feed material, filling feed hoppers, switching treated soil hoppers, and inspecting equipment component internals.

ATTACHMENT III

RUN PLAN

RESEARCH AND TEST EVALUATION

PRELIMINARY GULFPORT RUN PLAN

REVISION NO. 0

February 26, 1985

TIME AND PLACE	ACTION
18:00 6/23/85	Samples Record weights Preparation

The Process Team will weigh the filter bags and the feed bin and record these weights on the data sheets. The Nixtox will be sampled by the Analytical Subcontractor, top and bottom of each drum. The feed bin will be filled with about 1,000 pounds of soil, which will be previously dried and sized. Samples will be taken in prelabeled jars by the Analytical Subcontractor.

08:00 6/24/85	Test 1 Samples Record process data

The reactor core will be brought to 4,200°F for Test 1. Ten to twenty minutes is allowed for the Process Team to optimize the feed rate and the nitrogen rate. This will provide some time for the system to equalize. The control data will be recorded every 15 minutes starting at 8:00 and continuing until shutdown. The Decon Subcontractor will take two pretest wipe samples. These will be turned over to the Field Coordinator for later analysis. In addition, two Hivols and two personnel pumps will be set up for sampling during the entire testing period.

08:20	Process gas sampling

The start of emission testing will be determined by the Field Coordinator. No further process changes will take place (other than emergency shut-down procedure in Safety Plan).

09:25	O_2, CO_2, CO

The emission testing team will be taking Orsat and Draeger tube samples at the stack. All other functions will continue.

18:30 Samples

The solids collection and bag filter vessels will be removed and sampled four times from the surface. Each vessel will be sealed, weighed, and stored outside of the trailer. All weights will be recorded by the Process Engineer and Lead Operator.

19:00

System sealed up for the night. Nitrogen purge of 4-6 SCFM remains on RER.

08:00 6/26/85 Test 3
Samples
Record process data

The reactor core will be brought to 4,200°F for Test 3. Ten to twenty minutes is allowed for the Process Team to optimize the feed rate and the nitrogen rate. This will provide some time for the system to equalize. The control data will be recorded every five minutes starting at 8:00 and continuing until shutdown. These will be turned over to the Field Coordinator for later analysis. In addition, two divols and two personnel pumps will be set up for sampling during the entire testing period.

08:20 Process gas sampling

The start of emission testing will be determined by the Field Coordinator. No further process changes will take place (other than emergency shut-down).

09:25 O_2, CO_2, CO

The emissions testing team will be taking Orsat and Draeger tube samples at the stack. All other functions will continue.

16:00 End Test 3
Samples

The Field Coordinator will determine the end of Test 3. The shutdown procedure is contained in the Safety Plan. Reactor emissions samples will be taken by the Analytical Subcontractor for later analysis. The Nixtox will be sampled, top and bottom of each drum.

18:30 Samples

The collection and bag filter vessels will be removed and sampled four times from the surface. Each vessel will be sealed, weighed, and stored outside of the trailer. All weights will be recorded by the Process Engineer and Lead Operator.

The feed bin will be taken down, weighed, and recorded.

The Industrial Hygiene air filters will be turned over to the Field Coordinator for later analysis.

20:00

Process Team will secure system in preparation for decontamination procedures on the following day.

08:00 6/27/55 — Decontamination Samples

The Process Teams will decontaminate the feed bin and feed hopper. The Decon Subcontractor will take wipe samples on the feed hopper, the "charge end" of the reactor, and the discharge end of the reactor. In addition, four other surfaces will be wipe tested.

13:00 — Decontamination Analysis

The Process Team will coordinate with the Decon Subcontractor to decontaminate all other Toxbuster equipment under review of the Industrial Hygiene Engineer.

The Analytical Subcontractor will perform the process emissions analyses, activated carbon analyses, and air filters analyses. If any of these are positive for TCDD, EG&G will determine if any of the "Priority 3" samples need analysis.

PROCESS OPERATING PARAMETERS

	RUN 1	RUN 2	RUN 3
Duration, Hours	10	10	10
Feed rate, lb./min	0.6	0.6	0.6

	TEST PARAMETERS
Reactor core temperature, °F	4,100 - 4,200
Nitrogen rate, scfm	4 - 6
Feedstock charge, lb.	1,000
Estimated bag filter catch, lb.	25

SUGGESTED
ON-SITE TESTING

Sampling Location/ Measurements	Proposed Sampling/ Analytical Methods	No. of Samples or Measurements During Test* (Number to be Analyzed)
N_2 Inlet/Velocity	10 SCFM Flow Meter	3
Stack/O_2, CO, CO_2 Level	Gas Bomb/Wet Chemical or GC	15 (1 every 2 hrs)
Stack/Dioxins and Furans**, PIP's***, and Moisture	Modified Method 5 or VOST/ GC/MS and gravimetric	3 (3)
Reactor/Dioxins and Furans**, PIP's**, and Moisture	Modified Method 5 or VOST/ GC/MS and gravimetric	3 (3)
Feed/(Dioxins and Furans)*	SW846 Grab Sampling/GC/MS	9 (9)
Treated Solid Waste/Furans, Dioxins**, and PIP's***	SW846 Grab Sampling/GC/MS	9 (9)
Baghouse Catch (Post-Treat) /Dioxins, Furans**, and PIP's***	As Above	9 (9)
Activated Carbon (Pretest)/ Dioxins and Furans	As Above	2 (1)
Activated Carbon (Post-test)/ Dioxins and Furans	As Above	4 (1)
Industrial Hygiene and Detox samples as needed/Dioxins and Furans	Wipe Test/GC/MS	15 (11)

* Add 10% duplicates and 10% blanks as appropriate.

** Dioxins and furans will be reported as a total vs. a selected isomer such as 2,3,7,8-tetrachlorodibenzo-p-dioxin.

*** PIP's - Products of Incomplete Pyrolysis.

SUGGESTED SAMPLING METHODOLOGY
AND FREQUENCY OF SAMPLING

SAMPLING METHODOLOGY	SAMPLING POINT	NUMBER OF SAMPLES PER RUN		
		RUN #1	RUN #2	RUN #3
Process gas: Flow meter	Nitrogen inlet	1_2	1_2	1_2
Process gas: center point, constant rate, integrated	Reactor emissions	1_1	1_1	1_1
Process gas: center point, constant rate, integrated	Stack emissions	1_2	1_2	1_2
Process gas: Gas bomb/ Wet chemical or GC	Stack for C_2, CO, and CO_2	5_2	5_2	5_2
Thief Modified SW846EPA**	Feed bin	9_2	*	*
Thief Modified SW846EPA**	Mixtox	1_2+D_3	*	1_2+3D_3
Scoop Modified SW846EPA**	Collection vessel	1_1+2D_3	1_1+2D_3	1_2+2D_3
Scoop	Baghouse	1_1+2D_3	1_1+2D_3	1_1+2D_3
TOTAL		20 50	10 40	12 60

Subscripts:

D = Duplicates

1 = First priority analysis
2 = Second priority analysis
3 = Analyze only upon request

* Feedstock samples were all to be taken prior to connecting the feed bin to the reactor before the runs.

** Reference 16: SW 846 EPA document.

SUGGESTED INDUSTRIAL
HYGIENE SAMPLING PLAN

	PRETEST	TEST	DECON
A. Feed Hopper			1
B. Charge end of reactor		1	
C. Discharge end of reactor		1[1]	
D. Air pollution control system - inside first elbow		1	
E. Air pollution control system - discharge		1[2]	
F. Flat surface near reactor charge		1	
G. Flat surface in discharge area		1[3]	
H. Additional sample		1	
- Pretest wipe sample	1		
- Pretest wipe sample	1		
Air Samples			
A. Hi-vol at control panel		1	
B. Hi-vol at trailer door		1	
C. Personnel at reactor feed		1	
D. Personnel at reactor discharge		1	

Footnotes:

1. Analyze C only if D or F positive.
2. Analyze F only if E and G positive.
3. Analyze H only if G positive.

ATTACHMENT IV

PROPOSED GULFPORT DEMO TEST PLAN

USAF/EGBG HERBICIDE ORANGE PROJECTS

MONTH JUNE

Monday	Tuesday	Wednesday	Thursday	Friday
3	4	5	6	7
10	11	12	13	14 EQUIPMENT ARRIVES IN GULFPORT
17 o Level Rx o Connect Power o Unpack o Rx Assembly	18 o Feed system setup o Hookup Nitrogen	19 o Shakedown Test	20 o Minor repair & Test prep.	21 o Test prep. o Prelest meeting
(Sunday) 23 o Set feed bin in place (Monday) 24 o Begin GP demo o Test 1 complete	25 o Test 2 complete	26 o Test 3 complete	27 o Decontamination	28 & 29 (Fri. & Sat.) o Equipment disassembly & loading

PROPOSED GULFPORT DEMO TEST PLAN

CHAPTER 2: HAZARD ASSESSMENT AND SAFETY ASSURANCE

In every previous demonstration test, the safety and hygienic practices which Huber implemented have adequately protected personnel, equipment, and the environment. As part of this project, Huber will develop a field safety manual specifically for the NCBC tests. This manual will be very similar to the safety plan used during the Times Beach tests (see Attachment 1). The guidelines set forth in the Times Beach safety plan are the result of an initial field safety manual prepared by Roy F. Weston & Associates and perfected by Huber in the field during the Borger and Times Beach demonstrations.

Previous tests have verified that during actual operation, Huber's system is completely closed. Therefore, Level C protection will be utilized only when the system is open. As presently envisioned, an open system will be said to exist when (1) preparing feed material, (2) filling feed bins, (3) switching treated soil bins, and (4) inspecting equipment component internals.

An integral part of the AER system design is safety redundancy (see Figure 1). A granular feed stream is introduced at the top of the reactor by means of an electrically driven, metered screw feeder which connects the airtight feed bin to the reactor. The solid feed passes through the reactor where pyrolysis occurs at temperatures above 4000°F. After leaving the reactor, the product gas and waste solids pass through a post-reactor treatment zone (PRTZ) which cools the gas to less than 1000°F prior to downstream particulate cleanup.

Solids exiting the PRTZ are collected in a bin which is sealed to the atmosphere. Smaller solids in the product gas are removed in a bag filter before being passed through activated carbon beds just downstream of the emission stack. The organic-, particulate-, and chlorine-free product gas composed almost entirely of nitrogen (some moisture) is then emitted to the atmosphere through the process stack.

If electricity was accidently shut off to the AER process, the electrical screw feeder would stop feeding solids. Within one to two seconds all solids would be purged from the reactor. The large amount of thermal inertia in the reactor would sustain a reactor temperature above 3800°F for at least 30 minutes. Furthermore, if for some unknown reason, dioxin (or other contaminants) did pass through the reactor, they would be captured in the activated carbon beds. The use of activated carbon beds is possible in the AER process because of the extremely low process gas flow rates (4 to 6 scfm in the Toxbuster). In the event that the activated carbon became contaminated, it would be replaced. The contaminated carbon would be sized and treated as contaminated soils, adhering to applicable safety procedures contained in this chapter.

Normal and emergency shutdown of the ACR process is relatively simple. Normal and emergency shutdown consists of the following: (1) turn off power to screw feeder, (2) visually verify that no material is being feed to the reactor, (3) close ball valve which isolates the screw feeder to the reactor, (4) turn off power to reactor. The nitrogen purge remains on the reactor until the reactor temperature is about 200°F (normally this will take about 3 to 4 hours). After the reactor is cooled to less than 200°F, the nitrogen flow is stopped.

Special care and attention will be given to the transport of dioxin contaminated soil from the pulverizer into the feed bin. The feed bin will be placed in near proximity to the pretreatment area for filling. When open soil is handled, level C personnel protection will be used. In the event of inclement weather (i.e., rain, wind, etc.), the feed bin will be filled under cover to mitigate fugitive dust emissions. Where applicable, dust shrouds will also be used to minimize dust emissions.

During the Huber test, a total of approximately 1000 pounds of soil will be handled and treated. Based on a maximum concentration of 200 ppb dioxin, this represents 2×10^{-4} pounds or 0.09 grams of TCDD.

APPENDIX A

INDUSTRIAL HYGIENE, HEALTH

AND

SAFETY PLAN

J. M. HUBER, INC.

HAZARDOUS WASTE TREATMENT DEMONSTRATION

Introduction

The J. M. Huber Corporation has successfully and safely tested the use of a new technology for the degradation/destruction of dioxin in soil. This process, an Advanced Electric Reactor, has been utilized to destroy octachlorodibenzo-p-dioxin in soil in two separate tests in Borger, Texas. Additionally, a highly successful and efficient test was recently completed in Times Beach, Missouri detoxifying tetrachlorodibenzo-p-dioxin contaminated soil. This technology has also been demonstrated to be highly effective in the destruction of polychlorinated biphenyls (PCB) and hexachlorobenzene (HCB) in soils and other organics such as CCl_4 as liquids or on soils.

In every previous demonstration test, the safety and hygienic practices which Huber implemented adequately protected personnel, equipment, and the environment. Therefore, the procedures detailed in this safety plan have been tested and proven effective.

The following Industrial Hygiene, Health, and Safety Plan addresses the use of Huber's Advanced Electric Reactor for destruction of dioxin and other similar compounds.

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8.	Emergency Response Procedures	A8
9.	Special Safety Considerations	A9
10.	Addendum A - Classification, Medical Aspects, and Prevention of Heat Illness	A12
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12.	Addendum C - Industrial Hygiene Sampling Plan	A21
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MATERIAL CONTROLS

In order to minimize employees exposure to dioxin, the contaminated soils will be transferred from the ground to the pretreatment facility and then to the reactor in enclosed containers. These will be filled utilizing techniques which prohibit direct personal contact with the material and inhibit fugitive dust emissions.

PROCESS CONTROLS

The destruction process is essentially a closed system due to the many safeguards Huber has built into the system. This includes the use of closed feed bins and hoppers for the decontaminated product and carefully fitted connections between the mixers, feed bins, reactor product bins, and the air pollution control system (bag filters and activated carbon beds).

TEST AREA CONTROL

The test area will be roped off using caution tape allowing an area sufficient to permit all of the operations which are part of the test to occur unhindered. Access to and departure from the site will be carefully controlled with specifically designated entrances and exits. Until testing confirms otherwise, (Ref. 1), all persons entering the restricted area will be in Level "C" protection.

It is assumed that the equipment will be initially placed on a clean, uncontaminated site situated near the test plots. Since the equipment will also be uncontaminated at this point, all set up and equipment installation will be considered clean and, thus, not requiring Level "C" protection.

Previous tests have verified that during actual operation, Huber's system is completely closed. Therefore, Level "C" protection will be utilized only when the system is open. Open systems include preparations of the feed material, filling of the feed hoppers, switching of hoppers, and inspection of equipment component internals.

In instances when Level "C" protection is not required, normal personal protection will include uncoated Tyvek coveralls, rubber boots, gloves, disposable dust masks, hard hats, and safety glasses.

Persons and equipment leaving the area will be decontaminated. Extensive equipment decontamination (i.e., steam or solvent cleaning using methylene chloride or 1, 1, 1-trichloroethane) may be foregone if sampling (See Addendum C) shows less than 1 ppb or 1 microgram of dioxin. The decontamination procedures are listed below.

Personal Protection

Training

All project personnel have been trained regarding the hazards involved, use and care of protective equipment, and the Industrial Hygiene and Safety Plan. An additional site specific training course will be provided each employee prior to initiation of any site work. Prior to each set of tests, a Safety Meeting will be held to review procedures and key items of the Safety Plan.

Equipment

Level "C" protection provides the following:

Personnel are to be fitted with a full face air purifying respirator. The fit test procedures includes the use of isoamyl acetate and irritant smoke.

Combination NIOSH/MSHA approved pesticide and/or organic vapor/-particulate filter cartridges or canisters will be utilized.

Saran Coated Tyvek Coveralls with complete coverhood (Ref. 1) will normally be worn. Uncoated Tyvek coveralls may be used if appropriate.*

VITON Gloves - inner

NITRILE Gloves or Cotton Gloves - outer

Steel toe Rubber boots or Rubber boots (decontaminatable) to pull over leather safety shoes.

Disposable Boots - Latex

Inner Cotton garment, either coveralls or long underwear

Sleeves, pant cuffs and coverhoods of coveralls, will be attached to gloves, boots and coveralls, using duct tape.

* IF AMBIENT WORK STATIONS TEMPERATURE IS ABOVE 70 DEGREES F. AND HEAT BECOMES A PROBLEM, THE SARAN COATED TYVEKS MAY BE REPLACED BY PLAIN TYVEK IN ORDER TO PREVENT ACUTE HEAT STRESS.

HEAT STRESS

The use of the above protective gear will increase the risk of heat stress. Because of this, a very stringent heat stress monitoring program will be instituted.

Workers in the exclusion zone will work in pairs. "Buddies" must be alert for signs of distress and will frequently check on each

other. An additional employee assigned for decontamination will serve as a safety watch. The Safety Watch will be dressed in Level C when required. He will monitor the activities of on site persons, watching for signs of heat stress. The Safety Watch will have a buddy who remains in contact with him and is stationed in the non regulated zone.

A shower or hose must be readily available to enable rapid cool down of persons exposed to heat.

A break area must be available to allow workers to cope with heat or cold conditions.

Depending on the ambient temperature, a work/rest ratio is worked out to enable workers to adjust to heat. (See Addendum A.)

Heat Stress Monitoring specifics are expounded upon in Reference 2.

Prior to workers going on site for the first time each day, the following vital signs will be recorded when ambient temperatures are above 70 degrees F.

Weight
Heart Rate
Oral Temperature
Blood Pressure

Heart rate, blood pressure and oral temperature will be monitored each time an individual comes off site when the employee's work site temperature exceeds 70 degrees F. This monitoring will determine rest time and further monitoring needs. The method of decision making for these incidences is shown in Addendum A. Medical data will be collected and interpreted by a medically trained person supplied by the sampling subcontractor.

Attachment A includes discussion of different heat stresses, monitoring, and protection.

Persons on site must replace body fluids. As workers come off site they must be encouraged to drink 8 ounces of water, fruit juice or fruit juice flavored water. Commercial electrolyte drinks (for example Gatorade) may be used but the proper electrolyte balance can be achieved by following the above recommendations and by generously adding salt to meals.

MEDICAL MONITORING

The J. M. Huber Medical Monitoring program includes all tests currently recommended. Reference 1 contains the recommended medical program. Addendum D contains the Huber program.

NOISE

A survey of the test area and trailer carrying the 3" reactor to identify any high noise sources was conducted. According to J. M. Huber personnel, hearing protection is not required unless employees work for more than 1-1/2 hours in the Heat Exchanger Room when the heat exchanger motors are operating.

DECONTAMINATION

A strictly controlled contamination reduction program must be established for both personnel and equipment. Guidelines are listed below.

Decontamination procedures will be arranged to generate as little excess liquid as possible. Decontamination solution will be strong Trisodium Phosphate Solution with a "Wet Water" amendant added to increase cleaning capacity. Mix 0.4 pounds of Trisodium phosphate into 1 gallon of water. [Ref. 3.]

The contamination reduction corridor will have a ground-cover of 2 layers of 6 mil plastic sheeting.

PERSONNEL

Personal decontamination materials needed will be provided inside of a containment area. Inside the area at the Test Site will be three large flat pans of sufficient size for a person to stand in. The first pan will contain decontamination solution, a long handled soft bristle scrub brush and several large sponges. The second pan will contain rinse water, scrub brush, and sponges. The third tray will contain 1" - 2" of sand. Following this, there will be containers for disposal of outer boots and gloves, and respirators which will be decontaminated, sanitized and dried prior to reuse.

The personal decontamination sequence will be as follows:

1. Worker enters the contamination reduction area (CDA).

2. Samples, tools, etc. are placed within the decontamination zone on plastic.

3. Enter shuffle pit, stepping directly into the first pan containing decontamination solution.

4. Use scrub brush to clean boots and outer gloves.

5. Use sponge for all other surfaces including respirator. The exposed portion of the respirator is to be sponged off while still on the face.

6. Repeat process in rinse pan.

7. Step into sand tray to drip off.

8. Step out of sand and begin removing personal protection in the following order:

   a. Tape
   b. Outer boots - wipe inner boots with damp decon sponge
   c. Outer gloves - wipe inner gloves with damp decon sponge
   d. Coveralls
   e. Respirator
   f. Inner gloves

9. Leave CDA immediately and go to break room for heat monitoring and fluid intake.

10. Employees must shower before leaving the plant premises. Under garments must be laundered before reuse.

11. For care and cleaning of respirators, see Addendum B.

EQUIPMENT

Every effort will be made to reduce need to decontaminate equipment. Small tools, sample containers, etc. will be decontaminated with a damp decon solution wipe off. The procedures used for large equipment decontamination are:

1. Purge with clean sand, when possible.

2. Scrape clean, and vacuum out all loose material.

3. Wash out with trisodium phosphate water using sponge and scrub brush.

4. Sponge rinse with clean water.

The suggested acceptable level for contamination reduction on equipment (Ref. 1, 4.) is 1 ppb based on a 5 gm bulk sample or 1 microgram of TCDD in a wipe sample.

EMERGENCY RESPONSE PROCEDURES

MEDICAL

Any worker suspected of being exposed to dioxin via inhalation, ingestion, or skin contact may be taken immediately, following decontamination, to the J. M. Huber designated Medical Facility and will be examined. The need for medical attention will be determined on a case by case basis by the on-site medical personnel and the J. M. Huber Project Manager. Blood and urine samples will be collected and analyzed for appropriate

parameters, namely liver function indicators and others as designated by G. M. Huber's Medical Consultants.

SPILL

Any spill or release of dioxin standard or dioxin contaminated soil will require remedial action. Small spills will immediately be vacuumed up and contaminated surfaces will be washed with soap and water. Large spills, which require more extensive decontamination, will be evaluated by on-site management and appropriate actions followed as the situation directs. Shovels, sand, absorbents, etc., will be maintained on-site to accommodate these situations.

FIRE

Personnel are trained in use of portable fire extinguishers. These will be maintained on site. Additional fire reporting, response, and evacuation procedures at the specific site will be followed. A fire will require use of SCBA for personnel protection.

SPECIAL SAFETY CONSIDERATIONS

Heat From the Reactors

In addition to ambient heat, there will also be heat generated by the reactors. This will add to the heat burden on the workers, making heat stress monitoring all the more essential.

Workers must be carefully observed and monitored.

Some of the reactor associated equipment is also a hot object contact hazard. Because workers may have impaired visibility and hampered movement due to the personal protection, it is important to remind them of this hazard.

Falls

The reactor must be accessed and attended by ladder and elevated platforms. Safeguards are built into the system, but the use of the personal protection equipment will make these areas and access to them more hazardous.

Electrical

High voltage electrical components are safely guarded. However, workers will be reminded of these potential hazards. If there is a need for electrical service during the test, a special protection protocol will be worked out by the site safety manager, the project manager, and the workers so the electrician will be protected from exposure, but will still be able to work safely with the electrical gear.

INDUSTRIAL HYGIENE MONITORING

There are no formally established personal monitoring procedures yet developed for workers potentially exposed to lickins. The site safety monitor will supervise an air monitoring program using both Hi-Vol and personal sampling pumps to determine airborne indications of potential exposure. Samplers will be placed in the work area. Personal pump samples will be analyzed after each days work, Hi-Vol samples will be analyzed more frequently depending on the filter loading to give an indication of almost real-time potential for exposure. Analysis of samples will be a modification of the procedure used for stack sample analysis and wipe sample analysis.

Personal air sampling pumps will be pre and post calibrated at 2.5 liters per minute using rotameters supplied with the Gillian Industrial Hygiene Calibrator Pack. Pump performance will be checked at 20 and 10 inches of pressure drop to determine that no pump air leakage is present.

References

1. A proposal to provide support for a Hazardous Waste Treatment Demonstration, prepared for J. M. Huber Corporation, Borger, Texas. Proposal No. P-84-1828, Site Safety Plan, submitted jointly by Roy F. Weston, Inc., West Chester, PA, and York Research Consultants, Denver, CO, 1984.

2. RPA-ERT Internal Standard Operating Safety Guidelines Rev. September, 1982 and as later revised and WESTON-SPER Division internal policy.

3. WESTON-SPER Health and Safety Training Manual Roy F. Weston, Inc., in association with Jacobs Engineering Group Inc., Tetra Tech, Inc., and ICF Incorporated, 1982.

4. CDC recommended action level for soil.

Addendum A

CLASSIFICATION, MEDICAL ASPECTS, AND PREVENTION OF HEAT ILLNESS

Introduction

Weather conditions are a serious consideration in planning and conducting site operations. Hot, humid weather can cause physical discomfort, loss of efficiency, personal injury, and in the extreme, can be life threatening. The TAT is highly susceptible to these effects due to the wearing of protective clothing which decreases natural body ventilation and hence cooling. There are six generally recognized types of heat illness briefly described in decreasing order of severity below.

Heatstroke and Heat Hyperpyrexia

Clinical Features: Heatstroke: (1) hot dry skin: red, mottled, or cyanotic skin; (2) high rising core temperature, 40.5 degrees C and over; (3) brain disorders: mental confusion, loss of consciousness, convulsions, or coma, as core temperature continues to rise. Fatal, if treatment delayed.

Heat hyperpyrexia: a milder form; core temperature lower; less severe brain disorders; some sweating.

Underlying Physiological Disturbance: Heatstroke: failure of the central drive for sweating (cause unknown) leading to loss of evaporative cooling and an uncontrolled accelerating rise in core temperature.

Heat hyperpyrexia: partial rather than complete failure of sweating.

Predisposing Factors: (1) Sustained exertion in heat by unacclimatized workers, (2) obesity and lack of physical fitness, (3) recent alcohol intake, (4) dehydration, (5) individual susceptibility, (6) chronic cardiovascular disease in the elderly.

Treatment: Heatstroke: immediate and rapid cooling by immersion in chilled water with massage, or by wrapping in wet sheet with vigorous fanning with cool dry air. Avoid overcooling. Treat shock if present. Obtain emergency medical care.

Heat hyperpyrexia: less drastic cooling required if sweating still present and core

temperature 40.5 degrees C. Obtain emergency medical care.

Prevention: Medical screening of workers. Selection based on health and physical fitness. Acclimatization for 8 to 14 days by graded work and heat exposure. Monitoring workers during sustained work in severe heat.

Heat Exhaustion

Clinical Features: (1) Fatigue, nausea, headache, giddiness; (2) skin clammy and moist, complexion pale, muddy, or with hectic flush; (3) may faint on standing, with rapid thready pulse and low blood pressure; (4) oral temperature normal or low, but rectal temperature usually elevated (37.5 to 38.5 degrees C). Water-restriction type: urine volume small, highly concentrated. Salt-restriction type: urine less concentrated, chlorides less than 3 milligrams per liter.

Underlying Physiological Disturbance: (1) Dehydration from deficiency of water and/or salt intake; (2) depletion of circulating blood volume; (3) circulatory strain from competing demands for blood flow to skin and to active muscles.

Predisposing Factors: (1) Sustained exertion in heat; (2) lack of acclimatization; (3) failure to replace water and/or salt lost in sweat.

Treatment: Remove to cooler environment. Administer salted fluids by mouth or give intravenous infusions of normal saline (0.9 percent) if patient is unconscious or vomiting. Keep at rest until urine volume and salt content indicate that salt and water balances have been restored. Obtain emergency medical care.

Prevention: Acclimatize workers using a breaking in schedule for 1 or 2 weeks. Supplement dietary salt only during acclimatization. Ample drinking water to be available at all times and to be taken frequently during work day.

Clinical Features: Painful spasms of muscles used during work (arms, legs, or abdominal). Onset during or after work hours.

Underlying Physiological Disturbance:	Loss of body salt in sweat. Water intake dilutes electrolytes. Water enters muscles, causing spasms.
Predisposing Factors:	(1) heavy sweating during hot work; (2) drinking large volumes of water without replacing salt loss.
Treatment:	Salted liquids by mouth, or more prompt relief by intravenous infusion, massage the cramped muscles. Obtain medical care as required.
Prevention:	Adequate salt intake with meals. In unacclimatized men, provide salted (0.1 percent) drinking water.

Heat Syncope

Clinical Features:	Fainting while standing erect and immobile in heat.
Underlying Physiological Disturbance:	Pooling of blood in dilated vessels of skin and lower parts of the body.
Predisposing Factors:	Lack of acclimatization.
Treatment:	Remove to cooler area. Recovery prompt and complete.
Prevention:	Acclimatization. Intermittent activity to assist venous return to heart.

Heat Rash

Clinical Features:	Profuse tiny raised red vesicles (blister like) on affected areas. Pricking sensations during heat exposure.
Underlying Physiological Disturbance:	Plugging of sweat gland ducts with retention of sweat and inflammatory reaction.
Predisposing factors:	Unrelieved exposure to humid heat with skin continuously wet with unevaporated sweat.
Treatment:	Mild drying lotions. Skin cleanliness to prevent infection. Obtain medical care as required.

Prevention:	Cooled sleeping quarters to allow skin to dry between heat exposure.

Heat Fatigue-Transient

Clinical Features:	Impaired performance of skilled sensorimotor, mental, or vigilance tasks in heat.
Underlying Physiological Disturbance:	Discomfort and physiological strain.
Predisposing:	Performance decrement greater in unacclimatized and unskilled men.
Treatment:	Not indicated unless accompanied by other heat illness.
Prevention:	Acclimatization and training for work in the heat.

Prevention

Heat illness is not 100% preventable; however, by using physically and medically fit workers (no colds, sunburns, etc.), careful planning, work distribution, and personnel monitoring the likelihood of heat illness can be drastically reduced. A first planning step is to consider the weather conditions and level of protective clothing. Then a decision as to work time versus rest time can be made using the chart below.

Recommended Work and Rest Times
as a Function of Level of Protection
and Weather Conditions

Level of Protection	70°F	74°F	78°F	82°F
A	50/50	75/25	75/25	75/25
B	50/50	50/50	75/25	75/25
C	Continuous	25/75	50/50	75/25
D	Continuous	25/75	25/75	50/50

Addendum 5

CARE AND CLEANING OF RESPIRATORS

I. GENERAL REQUIREMENTS

Any organization using respirators on a routine basis should have a program for their care and cleaning. The purpose of a program is to assure that all respirators are maintained at their original effectiveness. If they are modified in any way, their Protection Factors may be voided. Usually one person in an organization is trained to inspect, clean, repair, and store respirators.

The program should be based on the number and types of respirators, working conditions, and hazards involved. In general, the program should include:

- Inspection
- Cleaning and Disinfection
- Repair
- Storage

II. INSPECTION

Inspect respirators after each use. Inspect a respirator that is kept ready for emergency use monthly to assure it will perform satisfactorily.

On air-purifying respirators, thoroughly check all connections for gaskets and "O" rings and for proper tightness. Check the condition of the face piece and all its parts, connecting air tube, and headbands. Inspect rubber or elastomer parts for pliability and signs of deterioration.

Maintain a record for each respirator inspection, including date, inspector, and any unusual conditions or findings.

III. CLEANING AND DISINFECTION

Collect respirators at a central location. Brief employees required to wear respirators on the respirator program and assure them that they will always receive a clean and sanitized respirator. Such assurances can boost morale. Clean and disinfect respirators as follows:

- Remove all cartridges, canisters, and filters, plus gaskets or seals not affixed to their seats.

- Remove elastic headbands.

- Remove exhalation cover.

- Remove speaking diaphragm or speaking diaphragm-exhalation valve assembly.

-Remove inhalation valves.

-Wash face piece and breathing tube in cleaner/sanitizer powder mixed with warm water, preferably at 120 to 140 degrees F. Wash components separately from the facemask, as necessary. Remove heavy soil from surfaces with a hand brush.

-Remove all parts from the wash water and rinse twice in clean warm water.

-Air dry parts in a designated clean area.

-Wipe face pieces, valves, and seats with a damp lint-free cloth to remove any remaining soap or other foreign materials.

NOTE: Most respirator manufacturers market their own cleaners/sanitizers as dry mixtures of a bactericidal agent and a mild detergent. One-ounce packets for individual use and bulk packages for quantity use are usually available.

IV. REPAIRS

Only a trained person with proper tools and replacement parts should work on respirators. No one should ever attempt to replace components or to make adjustments or repairs beyond the manufacturer's recommendations. It may be necessary to send high-pressure-side components of SCBA's to an authorized facility for repairs.

Make repairs as follows:

-Disassemble and hand clean the pressure-demand and exhalation valve assembly (SCBA's only). Exercise care to avoid damage to the rubber diaphragm.

-Replace all faulty or questionable parts or assemblies. Use parts only specifically designed for the particular respirator.

-Reassemble the entire respirator and visually inspect the completed assembly.

-Insert new filters, cartridges, or canisters, as required. Make sure that gaskets or seals are in place and tightly sealed.

V. STORAGE

Follow manufacturers' storage instructions, which are always

furnished with new respirators or affixed to the lid of the carrying case. In addition, these general instructions may be helpful:

- After respirators have been inspected, cleaned, and repaired, store them so to protect against dust, excessive moisture, damaging chemicals, extreme temperatures and direct sunlight.

- Do not store respirators in clothes lockers, bench drawers, or tool boxes. Place them in wall compartments at work stations or in a work area designated for emergency equipment. Store them in the original carton or carrying case.

- Draw clean respirators from storage for each use. Each unit can be sealed in a plastic bag, placed in a separate box, and tagged for immediate use.

Addendum C

J. M. HUBER, INC.

Industrial Hygiene Sample Plan

DIOXIN DESTRUCTION TESTS

INTRODUCTION

The industrial hygiene test plan is designed to give a representative, but thorough testing of both airborne concentrations of dioxin and any surface contamination which may occur during the testing.

SAMPLE PROCEDURES

Air samples will be collected on mixed Cellulose Ester filters using Hi Vol, and personal sampling pumps.

Samples will be extracted for MS/MS/GC analysis.

Pretest wipe samples will be collected on the day prior to the first Site Test.

The following indicates samples to be taken and their location.

INDUSTRIAL HYGIENE SAMPLES

TEST	BORGER	3" Reactor
SAMPLE	Air	Wipe
TYPE	HV-2	1D
	P-2	

HV = Hi-Vol P = Personal Sampling Pump

Air Samples	a.	1 Hivol at control panel
	b.	1 Hivol at building door/trailer door
	c.	1 Personal at Reactor Feed*
	d.	1 Personal at Reactor Discharge*
		*would not be analyzed if Hivol samples negative
Wipe Samples	a.	1 Feed hopper - after decon
	b.	1 Charge end of reactor - after cool
	c.	1 Discharge end of reactor - after cool (3)
	d.	1 Ash container - after decon
	e.	1 Air pollution control system - inside at first elbow
	f.	1 Air pollution control system - discharge (1)
	g.	1 Flat surface near reactor charge
	h.	1 Flat surface in discharge area (2)
	i.	1 Additional sample where observation may indicate

(1) only if stack test first elbow test positive

(2) only if wipe sample h. positive

(3) only ash is positive or wipe sample f. is positive

The process Engineer (Feed Operator's) respirator filter is to be analyzed for the presence of dioxin as he has the greatest potential of exposure.

Addendum C

J. M. HUBER, INC.

Medical Monitoring Program

Heat Stress Monitoring

For monitoring the body's recuperative ability to excess heat, one or more of the following techniques should be used as a screening mechanism. Monitoring of personnel wearing impervious clothing should commence when the ambient temperature is 70 degrees F or above. Frequency of monitoring should increase as the ambient temperature increases or as slow recovery rates are indicated. When temperatures exceed 85 degrees F, workers should be monitored for heat stress after every work period.

1. Heart rate (HR) should be measured by the radial pulse for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats per minute. If the HR is higher, the next work period should be shortened by 10 minutes (or 33%), while the length of the rest period stays the same. If the pulse rate is 100 beats per minute at the beginning of the next rest period, the following work cycle should be shortened by 33%.

2. Body temperature should be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature (OT) at the beginning of the rest period should not exceed 99 degrees F. If it does, the next work period should be shortened by 10 minutes (or 33%), while the length of the rest period stays the same. However, if the OT exceeds 99.7 degrees F at the beginning of the next period, the following work cycle should be further shortened by 33%. OT should be measured again at the end of the rest period to make sure that it has dropped below 99 degrees F.

3. Body water loss (BWL) due to sweating should be measured by weighing the worker in the morning and in the evening. The clothing worn should be similar at both weighings; preferably the worker should be nude. The scale should be accurate to plus or minus 1/4 lb. BWL should not exceed 1.5% of the total body weight. If it does, the worker should be instructed to increase his daily intake of fluids by the weight lost. Ideally, body fluids should be maintained at a constant level during the work day. This requires replacement of salt lost in sweat as well.

4. Good hygienic standards must be maintained by frequent change of clothing and daily showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel.

9. Effects of Heat Stress

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur ranging from mild (such as fatigue, irritability, anxiety, and decreased concentration, dexterity, or movement) to fatal. Standard reference books should be consulted for specific treatment.

CHAPTER 3: QUALITY ASSURANCE FOR THE PROCESS

Several deliberate measures are used during operation of the Toxbuster to maintain proper Quality Assurance and Quality Control. Attachment I contains the field data forms that were used to record process operations parameters during the Times Beach tests. These same forms will be used during the NCBC tests.

The information that will be documented using these forms includes:

- o Total amount of soil treated
- o Instantaneous soil feed rates
- o Reactor core temperatures (via optical pyrometer)
- o PRTZ temperature
- o Treated soil temperature
- o Reactor volts and amps
- o Nitrogen flow rates (rotometer)
- o Reactor power requirement
- o Reactor pressure
- o Total gas flow rate exiting process (dry gas meter)

Prior to the NCBC test, the entire AER process flow train will be leak tested using soapy water. This test is used to verify that all connections are secure and that the entire system is sealed. The following equipment will also be calibrated: dry gas flowmeter, optical pyrometer, weigh scales, screw feeder, reactor power readings and other miscellaneous gauges.

Redundancy is built into the AER design and data gathering to ensure proper AER operations. Proper operation of the reactor is verified by 1) optical pyrometer readings, 2) reactor power consumption, 3) volt and amp readings, and 4) temperature of the treated material. Also the nitrogen flowrate is metered at two separate points within the process.

The flow of soil into the reactor is set by the metered screw feeder which is calibrated prior to the test series. Instantaneous soil feed rates are verified by an in-line weigh scale which supports the feed bin.

To ensure that all process operating parameters are recorded, redundancy is built into process data gathering. All process parameter readings are taken by two seperate test participants. This procedure is used to guard against deficiencies in the recording of data which serves as a permanent record of each test.

ATTACHMENT I

FIELD DATA FORMS

DIOXIN DEMONSTRATION
DATA SHEET

CONTROL RECORDS

TEST NO: _____ TEAM: _____ DATE: _____

TIME	CORE TEMP	PRT2 TEMP	POT TEMP	TOTAL DTM	ROTOMETER %	ROTOMETER F	KW	FEED WEIGHT

SIGNATURE(S) _____ DATE _____

DIOXIN DEMONSTRATION
DATA SHEET

ANALYTICAL LOG

TEST NO: _____ TEAM: _____ DATE: _____

NEW FILTER BAGS WT: _____
FEED BIN EMPTY, WT: _____
PRETEST MIX-TOX SAMPLES: _____ CHECK
PRETEST FEEDSTOCK SAMPLES: _____ CHECK
COLLECTION POT WT: _____ TEST 1 _____ TEST 2 _____ TEST 3
COLLECTION POT SAMPLES: _____ CHECK _____ CHECK _____ CHECK
POST-TEST MIX-TOX SAMPLES: _____ CHECK
BAG FILTER BAGS WEIGHT: _____ #1 _____ #2 _____ #3 _____ #4
BAG FILTER SAMPLES: _____ CHECK _____ CHECK _____ CHECK _____ CHECK
FEED BIN WEIGHT: _____

TIME	COMMENTS

SIGNATURE(S) _____ DATE _____

DIOXIN DEMONSTRATION
DATA SHEET

PROCESS LOG

TEST NO: _____ TEAM: _____ DATE: _____

NEW FILTER BAGS WT: _____
FEED BIN EMPTY WT: _____
FEEDSTOCK COMPOSITION: _____ SOIL _____ TPE
FEED BIN FULL WT: _____
COLLECTION POT WT: _____ TEST 1 _____ TEST 2 _____ TEST 3
FINAL FILTER BAGS WEIGHT: _____ #1 _____ #2 _____ #3 _____ #4
FINAL FEED BIN WEIGHT: _____

TIME	COMMENTS

SIGNATURE(S) _____ DATE _____

VOLUME 3

THERMAL DESORPTION

WITH

ULTRAVIOLET LIGHT DESTRUCTION

E. Respiratory Protection

The respiratory protection to be used is outlined as follows:

1. For initial set-up of work activities, such as assembling the thermal desorber, a half-face air purifying respirator, with organic vapor/highly toxic particulate (HEPA) cartridges, shall be worn. Respirators with higher protective factors, such as a full-face, air-purifying respirator, powered air purifying respirators (PAPR), or air supplied respirators, may also be worn.

2. All operations involving soil handling, including the collection of soil, crushing of soil, placing the soil in the storage drums, transferring the soil to the thermal desorber, and the operation of the thermal desorber/UV photolysis operation, will require the use of air-supplied respirators.

3. For operation of the thermal desorption of UV photolysis systems, full-face air-purifying respirators or PAPR will be required. This assumes no soil-handling activity in the area.

4. For the AMPA process, treatment of the soil will require either air-supplied respirators or powered-air purifying respirators with organic vapor/HEPA cartridges.

5. An industrial hygienist will be on site during initial start-up activities. If monitoring results indicate potential exposures which are higher, or lower, than expected, or if the industrial hygienist observes operations which indicate that respiratory protection needs to be changed, then protection will be upgraded, or downgraded, as appropriate.

6. Cartridges for air-purifying respirators will be replaced at the end of each shift. The PAPR will be checked with the flow meter before each day's use to determine if filters need to be changed.

7. Only employees who have had pre-issue qualitative fit tests, and annual fit tests thereafter, shall be allowed to work in atmospheres where respirators are required.

8. If an employee has demonstrated difficulty in breathing during the fitting test or during use, he or she shall have a physical examination to determine whether the employee can wear a respirator while performing the required duty.

Scientific Support for Process Feasibility

A number of various laboratory bench-scale studies have been performed by ITC at its Environmental Research Laboratory in Knoxville, TN to demonstrate technical feasibility of the three primary unit operations and to investigate process variables effecting performance. The results of these studies serve as the primary basis for the design of the pilot-scale system to be used on site. Additional experiments are being conducted by ITC prior to mobilization to the initial site.

Test Data

Thermal Desorption - ITC has completed a series of laboratory treatability tests in which 30-gram samples of contaminated NCBC and JI soil were placed in a small furnace for various time periods and at various temperatures. A low-volume nitrogen purge was maintained on the furnace. The starting soil samples were air dried and screened to minus 2 mm prior to treatment. Analyses were performed for 2,3,7,8-TCDD, using prescribed standard EPA methods for the starting and thermally treated samples. In addition, for the starting soils and selected treated soil samples, analyses were performed for 2,4,-D, 2,4,5-T, chlorophenols, and total tetra, penta, hexa, hepta, and octa isomers of CDD and CDF.

The results demonstrate that the concentration of 2,3,7,8-TCDD can be reduced to less than 1 ppb if adequate residence time and temperature are employed. The treatment conditions required to achieve 1 ppb depend primarily on the starting concentration of 2,3,7,8-TCDD and to a relatively minor degree on soil characteristics. These same tests should find concentrations of 2,4-D and 2,4,5-T of less than 50 ppb.

Selected results showing the effect of time and temperature on treatment efficiency are given in Table 1. Test conditions will be selected for the pilot-scale process to achieve less than 1 ppb based on interpretation and translation of the time-temperature relationships determined in the lab, and considering the temperature profile (heat transfer characteristics) of the pilot rotating desorber.

Table 1: Thermal Descorption of TCDD Contaminated Johnston Island (JI) and Naval Construction Battalion Center (NCBC) soils.

Soil Source	Initial 2,3,7,8-TCDD Concentration (ppb)	Nominal Test Temperature (°C)	Time at Test Temperature (min)	Final 2,3,7,8-TCDD Concentration (ppb)
NCBC	494	430	30	27.4
		481	15	10.1
			30	4.6
		558	15	0.53
JI	106	430	20	30.5
		481	15	4.5
			30	1.6
		558	8	0.61

Off-Gas Scrubbing/Absorption of Contaminants

The literature indicates that the solubility of 2,3,7,8-TCDD in non-polar, water-insoluble hydrocarbon solvents is relatively high (e.g., 500 ppm) and that partition coefficient of 2,3,7,8-TCDD between such a solvent and air is expected to be on the order of 10^9. The vapor pressure of 2,3,7,8-TCDD at 40°C is about 10^{-6}mm Hg. The projected maximum concentration of 2,3,7,8-TCDD in the solvent which will be achieved during a pilot test, is 1 ppm. Soltrol 170®, a mixture of C_{12} aliphatics, was selected as a scrubber solvent for the following reasons (Reference Table 2):

- Very low solubility in water, therefore negligible loss into aqueous condensate collected during scrubbing
- High boiling point, low vapor pressure, to minimize vaporization into the purge gas
- High flash point to minimize fire and explosion hazard potential
- Low toxicity to facilitate handling
- Relatively low cost, commercially available refining product
- Low unsaturated hydrocarbon content and good color/clarity to minimize interference with efficiency of UV photolysis
- Low viscosity and good fluid flow characteristics.

IT is conducting laboratory confirmation testing to demonstrate the efficiency of removing volatilized 2,3,7,8-TCDD and 2,4-D and 2,4,5-T desorbed from RCBC and JI soils by performing a limited number of bench scale experiments. Preliminary test results indicate greater than 99% removal of 2,3,7,8-TCDD from the off-gas. Removal efficiency of the herbicide compounds is pending receipt of the data. A small static desorber and off-gas scrubbing apparatus were used, as shown in Figure 1. Another primary purpose of these experiments was to generate actual scrubber solution which could be subjected to UV photolysis tests, since the chemical components collected by the solvent from thermally treated soil might affect the photolysis efficiency and reactor by-products.

Preliminary lab test results indicate a removal efficiency of greater than 99% considering both scrubber stages, with concentrations of 2,3,7,8-TCDD of 100 ppb in the first scrubber solution.

Table 2: High Boiling Solvent Properties

	Soltrol 170*
Distillation range	
Initial B.P., °F	424
10%	433
50%	437
90%	448
Dry pt	462
API Gravity, 60°F	50.5
S.G. 60/60°F	0.778
Density lb/gal	6.48
Flash pt, °F	155
Kinematic Visc.	
CS at 32°F	5.65
CS at 100°F	2.47
Purity, %	99 + % iso
Automatic content - Total	nil (est.)
Sulfur	.0008
Br. No.	1.5
Odor	None
Color, Saybolt	+ 30
Acidity, Distill Resid.	Neutral
Cu Corrosion	1
Vn Sulfonated Resid.	98.5
Doctor test	Negative
Kauri Butanol	24
Aniline pt	192.6

* A product of Phillips Petroleum Co.

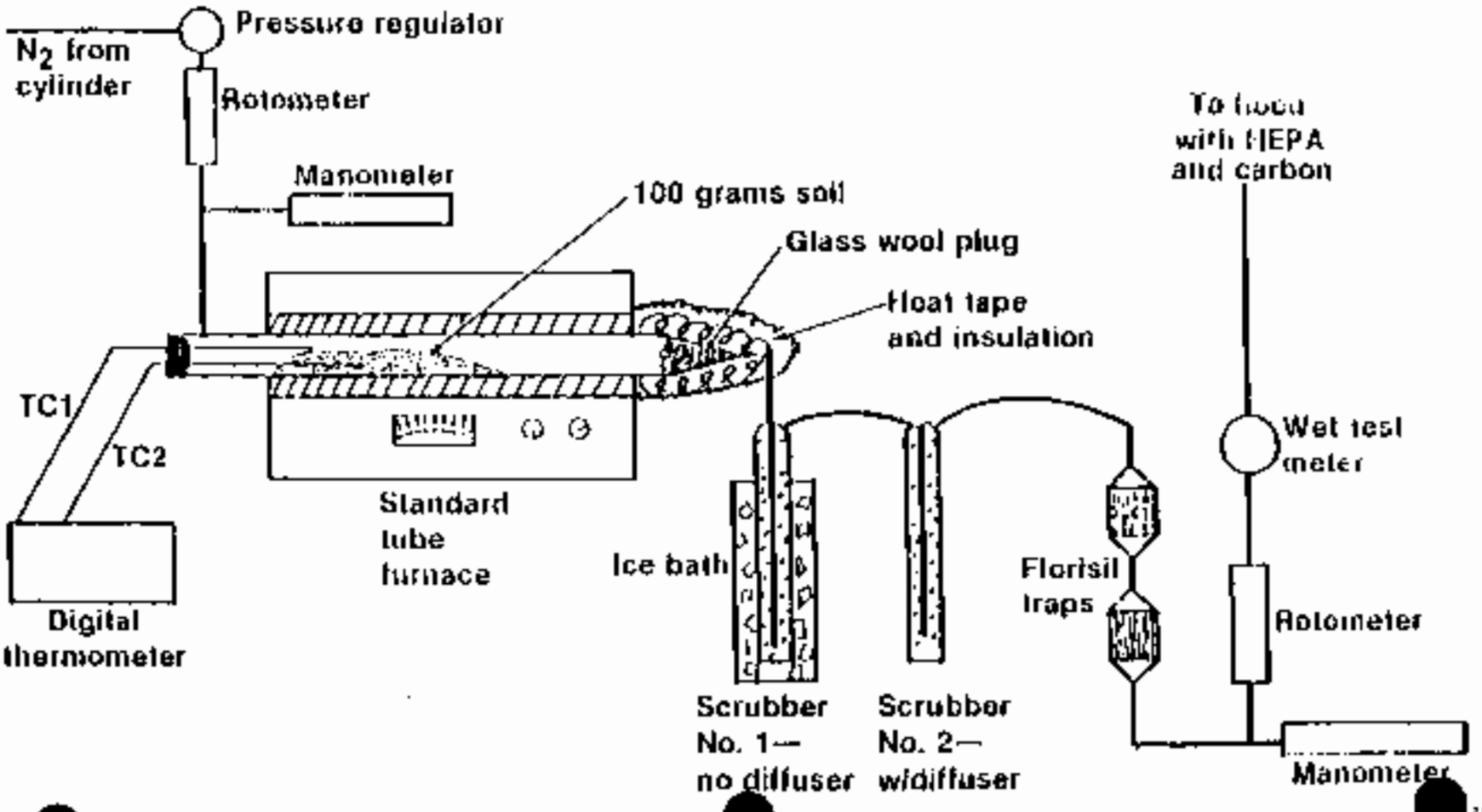
Photolysis with Ultraviolet Radiation

ITC has previously conducted photolysis studies of a waste solution containing dioxin, and designed and assisted in the operation of a full-scale treatment facility constructed by Syntex Agribusiness, Inc. in 1980. This technology development and demonstration program was described in an article entitled "Process for Destroying Tetrachlorodibenzo-p-dioxin in a Hazardous Waste" by J. H. Exner, et al published in Detoxification of Hazardous Waste, Ann Arbor Science Publishers, Inc. 1982. This program showed reduction of 2,3,7,8-TCDD in a hexane solution from greater than 10 ppm to less than 10 ppb.

Ongoing studies are confirming that 2,3,7,8-TCDD, and 2,4-D/2,4,5-T are effectively destroyed in Soltrol 170. Soltrol 170 spiked with 100 ppb 2,3,7,8-TCDD and irradiated using a 100 watt lamp for 4 hours, showed a nondetectible level. Actual scrubber solution, from the bench-scale desorption/scrubbing tests described above, containing 81 ppb 2,3,7,8-TCDD was irradiated using a 450 watt lamp with nondetectible concentration after 1.5 hours.

Figure 1

Schematic of Laboratory Test Apparatus for Desorption and Scrubbing Experiments



CHAPTER 1: PROCESS DESCRIPTION AND TEST PLAN

A. Process Description

1. Overview - Treatment Concept

This soil decontamination technology is based on separating, by volatilization, toxic organic contaminants, such as 2,4-D, 2,4,5-T and 2,3,7,8-TCDD from a natural soil matrix, and destroying the toxic chemicals using UV photolysis. The process is continuous, and normally all the unit operations of the process would be operated simultaneously.

Figure 0 is a block flow schematic of the complete process. Soil, after preparation and sampling, is continuously fed to the indirect fired rotary desorber unit. After sufficient residence time at the proper operating temperature, the treated soil is discharged into containers. The volatilized organics are continuously swept out of the desorber by a nitrogen purge. This off-gas is cooled and scrubbed with a high-boiling hydrocarbon solvent and the "clean" nitrogen stream is recirculated to the desorber. To allow for any influx of air, such as contained in the soil feed, nitrogen make-up is introduced to the recirculating gas stream, based on monitoring of the oxygen level. Gas displaced from the recirculation loop as a result of air influx is treated before discharge to ensure no emission of toxic chemicals.

The solvent from the scrubber is collected in a receiver which serves as a decanter to separate condensed water from the solvent and to allow solid particles to settle out. The solvent is recirculated to the scrubber through a heat exchanger to remove the heat absorbed from the off-gas. The entire solvent system is maintained at relatively low temperature (30-40°C) to reduce the vapor pressure of the solvent and the absorbed organic contaminants. The water from the receiver/decanter is withdrawn as it accumulates, and is treated by filtration followed by activated carbon adsorption. If carbon is used for treatment, it could be processed in the desorber unit with the soil feed to remove adsorbed chemicals.

The solvent containing 2,4-D, 2,4,5-T, 2,3,7,8-TCDD, and other scrubbed organics, is treated in a UV photolysis reactor system. The relative quantity of the "slip-stream" being photolyzed is dependent on the concentration of 2,3,7,8-TCDD, the kinetics of the actual stream, and the intensity and efficiency of the UV irradiation. The concentration of 2,3,7,8-TCDD in the recirculating scrubber solvent will be controlled below a maximum value to be

established based on concentration and quantity of 2,3,7,8-TCDD in the gas purge stream. A higher concentration will result in a lower "slip-stream" flow, since the mass rate of photodegradation increases with concentration.

At the conclusion of a run, the solvent inventory will be treated by recirculating the solvent through the photolysis reactor until treatment of the 2,3,7,8-TCDD is completed.

2. Pilot Test Facility Design

For the pilot-scale site testing, the three major steps of process-feed preparation, thermal desorption, and UV photolysis - will be carried out independently; they will not be directly coupled during this operation. This will facilitate the testing and ensure adequate data is obtained; however, no attempt will be made to assess continuous extended operation. The details of the process to be used for the on-site tests are described in this section. Figures 1 through 4 illustrate the process flows and instrumentation. Table 1 provides estimated quantities of materials that will be involved.

a. Thermal desorber unit (Figure 1 and 2)

Feed system - A hopper having sufficient capacity (approximately 100 lbs) for 2-3 hours of operation will be manually loaded. The hopper is isolated by a gasketed lid and a slide gate valve. A calibrated sight glass enables monitoring of the level and assurance of proper flow. The screw conveyor beneath the hopper is integral with the rotary desorber. It is constructed of 316 stainless steel and has a 2-inch diameter screw driven by a variable-speed gear reducer unit. Flows of 0.3-3.0 ft^3/hr are possible (25-250 lb/hr). The conveyor extends beyond the end of the rotating desorber chamber to ensure soil is properly forwarded toward the discharge.

Desorber - This unit consists of a continuously rotating tube (chamber), partially enclosed within a gas-fired (furnace) shell. The unit is termed a calciner by its manufacturer, CE Raymond Inc., since it is typically used for testing the processing of ores, limestone, etc. Figure 1 is a drawing of the unit. The inner chamber is 6½ in. internal diameter and 14 ft 7/8 in. long, with 6 ft 8 in. of this within the furnace zone. Flights are placed at intervals within this tube to provide increased mixing. A stationary pipe extends from the discharge into the unit, serving as a thermowell for six thermocouples to monitor the temperature of both solids and gas along the tube length. The chamber can be rotated at speeds from 1.16 to 11.6 rpm. The entire desorber unit can be inclined to further adjust the flow rate of solids.

The actual solids inventory will depend on the characteristics of the solids, the inclination, and rotational speed. The inventory can be increased by attaching a "dam" or retainer ring at the discharge end. The residence time of solids will be a function of the inventory volume and feed rate. Preliminary tests will be performed to define the residence time for various operating conditions.

The end sections of the desorber are not heated by the furnace and therefore provide considerable cooling effect. Electrical heaters have been placed on the solids feed end, the off-gas plenum, and transition section to the scrubber. Maintaining the temperature in these sections will minimize condensation of high boiling materials prior to the scrubber. The unheated, uninsulated portion of the solids discharge section is approximately 2 ft10 in.. The furnace is a single-refractory lined chamber with 14 equally spaced burners controlled by an automatic control system. Temperature measurements, which can be used for control or simply monitoring, are taken by 4 thermocouples attached at various locations at the inner metal wall beneath the refractory material. Natural gas or propane (LPG) can be used to fire the unit. The burner control system is a standard unit manufactured by GE Raymond, and has all appropriate safety features. The flue gas is discharged directly to the atmosphere through a remotely positioned exhaust pipe. The desorber is rated at 320,000 BTU/hr maximum heat duty. Maximum heat transferred to the inner rotary chamber is projected to be 100,000 BTU/hr depending primarily on the temperature gradient.

Soil exiting the rotary chamber drops through a gas plenum/transition section into a metal can. An outer stainless steel chamber contains the soil receiver can and provides a sealed system to prevent air leakage. A sight glass in the plenum section of the desorber unit allows the discharge to be visually monitored. Another sight glass in the top of the can enclosure allows the quantity collected in the can to be monitored. When a can is to be replaced, the valve in the discharge line is closed to isolate the chamber, and the ring clamp seal on the chamber is disconnected to allow the chamber bottom to be moved aside and the filled can withdrawn. Nitrogen connections are provided on the chamber to enable a flushing of oxygen from the chamber and can prior to reopening the discharge valve. Adequate inventory capacity is provided above this valve to allow the can replacement operation to be performed without interrupting the feed.

c. Solvent Scrubbing System (Reference Figure 3)

The desorber off-gas, containing nitrogen purge, volatilized moisture, desorbed organic contaminants, and thermal degradation products of soil organic matters is transferred through a short transition duct to the spray scrubber, where solvent removes these materials by cooling and condensation and/or absorption. If traces of fine particulates are carried from the desorber in the off-gas, they will likewise be removed. The superficial gas velocity in the scrubber will be less than 1 ft/sec.

The scrubber underflow flows to a receiver tank which overflows to the solvent hold tank. The stainless steel receiver has a normal liquid volume of approximately 5 gallons and serves as a separator for condensed water (and any particulates). The solvent enters through a dip pipe to prevent gas flow from the scrubber.

The temperature of the solvent and off-gas leaving the scrubber can be controlled to less than 40°C; the minimum temperature will be achieved when the heat load (i.e., soil feed rate and moisture content) is the lowest. The recirculated solvent flow is maintained at approximately 5 gpm to provide adequate cooling and proper functioning of the spray nozzle.

Solvent from the hold tank is recirculated through a stainless steel shell-and-tube heat exchanger which is cooled by a distilled water/glycol mixture from a packaged, air cooled refrigeration unit. This mode of cooling was required due to the unavailability of water at the test sites. The refrigeration unit has a capacity of about 30-40,000 BTU/hr depending on ambient air temperature and outlet coolant temperature.

The flow to the scrubber is controlled by adjusting the amount of cooled solvent diverted to the stainless steel holding tank, which has a nominal capacity of about 15 gallons. The flow, pressure, and temperature of the flow to the scrubber is measured, along with temperatures and pressures at strategic process locations. The scrubber nozzle will be selected to provide a high-intensity, full-coverage spray pattern based on the required flow and pressure drop. The fluid level in both the receiver and hold tank can be monitored by a sight glass. The level will be essentially constant in the receiver, but as condensed water accumulates, the level in the hold tank will increase. Condensed water can be drained periodically into glass sample containers. The amount of water is expected to vary from 1 to 10 pounds per hour; therefore only a few gallons are available from each test.

The solvent will be filtered using a fabric bag type filter unit to prevent accumulation of potential solids in the recirculating solvent.

The entire solvent system is piped to allow complete draining/pump-out to drums at the conclusion of a test. The vessels are designed to enable easy access for inspection and cleaning as necessary.

c. Solvent Photolysis System (Reference Figure 4)

The UV photolysis system consists of a solvent hold tank, recirculation pump, UV reactor unit and solvent cooler. The solvent hold tank has a capacity of about 15 gallons. A variable speed agitator mounted to the removable lid can be used to blend chemical additives prior to or after the reaction. All equipment and piping in the photolysis system is constructed of 316 stainless steel. The hold tank serves to separate heavy, insoluble materials which may be formed in small amounts during the reaction. The flow into the bottom and out of the top is intended to ensure all the solvent is recirculated uniformly. The entire system (e.g., piping and vessel locations) is designed to eliminate "dead spots" and ensure all solvent is recirculated and can be drained from the system following a batch.

The photolysis reactor consists of a section of pipe into which the immersion well assembly is inserted. The UV light source is a standard medium-pressure mercury lamp producing 200-300 watts/inch of 200-400 nm ultraviolet radiation. The exact radiation profile for the lamp was established by the manufacturer, Conrad-Havovia. The support equipment consists of immersion wells, well head assembly and well support equipment, which controls coolant flow and nitrogen purge. The immersion well consists of the lamp encased in a quartz tube which is sealed at one end. The immersion well assembly consists of two glass wells (inner and outer) telescoped one within the other. The wells are provided with long glass flanges which are secured and sealed into a stainless steel header assembly. This assembly includes the electrical junction box, a nitrogen cap, a coolant cap, and the mounting flange. Filtered water (or suitable coolant fluid) is circulated between the inner and outer wells to remove heat energy from the lamp. Nitrogen is maintained between the inner well and the lamp to avoid the potential for seepage of explosive (solvent) vapors into the inner well.

The well support system has as the pressure switches and solenoid valves which control the flow of coolant and nitrogen. Its components are "explosion proof" (Class I, groups C + D).

The lamp power supply is designed to provide constant wattage during start-up and extended operation. An electrical control cabinet and console provides appropriate power switches, circuit breakers, relays, etc.

The solvent recirculation pump provides sufficient flow to ensure highly turbulent condition in the reactor annulus, thereby minimizing potential deposition of any residue on the immersion well.

The solvent cooler is designed to control the solvent temperature in the system to yield reasonable reaction rates and minimize fouling and generation of undesirable by-products.

Solvent flow, temperatures and pressures are measured to enable proper system operation and detection of variation or malfunction.

An alternative thin film photolysis reactor unit constructed of borosilicate glass would operate with the same basic system elements. The flowrate of solvent would be much lower since turbulent conditions are not required to minimize potential fouling. In this unit the solvent does not come in contact with lamp cooling chamber; therefore, nitrogen is not required. The selection of the type of reactor unit to be used will depend on the laboratory confirmation tests and the final design evaluation.

B. Test Plan

1. Selection of Test Conditions

A series of independent test runs will be made at both NCBC and JI, with various operating conditions selected to demonstrate the affect of the key variables which effect treatment performance. Initial runs will utilize operating conditions which are sure to exceed the research objective of less than 1 ppb total of the tetra-, penta-, and hexa-, isomers of CDD and CDF in the treated soil. Later runs will utilize conditions of higher feed rates (lower residence times) and/or lower temperatures to confirm the effects on treatment performance. Also, the influence of particle size and moisture content will be demonstrated. This will provide important technical information for establishing the limitations of the process for the particular soil being treated, enable scale-up assessment of the system and provide the bases for evaluating cost effectivenss. ITC will analyze samples on a quick-response basis to monitor process performance during the field trials.

The principal process variables which will be evaluated are residence time and temperature of the soil in the rotary desorber unit. In addition, the ability of the process to effectively deal with gross differences in soil particle size and moisture will be demonstrated. Twelve proposed test conditions have been outlined below. The temperature-residence time values were selected based on laboratory test data discussed previously. The first two runs are duplicate experiments based on lab optimization data and will establish overall reproducibility in the field.

Site	Run	Residence Time	Temperature	Soil Condition
NCBC	1	30	550°C	1/2" maximum
NCBC	2	30	550°C	1/2" maximum
NCBC	3	20	550°C	1/2" maximum
NCBC	4	20	500°C	1/2" maximum
NCBC	5	20	500°C	1/4-1/2" fraction
JI	6	30	550°C	1/2" maximum
JI	7	20	550°C	1/2" maximum
JI	8	20	500°C	1/2" maximum
JI	9	15	500°C	1/2" maximum
JI	10	20	500°C	1/4-1/2" fraction
JI	11	20	500°C	increased moisture (e.g. 10% vs 3%)
JI	12	15	450°C	

Based on a complete review and evaluation of the test data from IT Corporation analysis, including the analytical results of the verification contractor, if available, target test conditions at JI will be optimized to yield the best information.

The final selection of time-temperature conditions for all runs will be based on (1) the actual measured concentration of 2,3,7,8-TCDD in the prepared test soil by IT Corporation analysis, (2) the results of preliminary "hot tests" using uncontaminated soil prior to transporting the pilot unit to NCBC, and (3) the results of initial runs (1, 2 and 6) at each site.

2. Test Strategy and Schedule

The on-site testing effort will be divided into three prin activities:

- Soil preparation (Volume 5)
- Thermal desorption of soil
- UV photolysis of scrubber solvent

It is intended at NCBC that two photolysis tests will be performe using scrubber solvent from two or three desorption tests. Al the scrubber solution will be treated and disposed of off sit per applicable regulations. The photolysis tests will be performe separately from the desorption tests. Considering five desorptio tests and three photolysis tests, ITC anticipates the testin period at NCBC to last two to three weeks, depending on weather the mechanical performance of the systems, and the results o sample analysis generated by ITC's analytical personnel in Knox ville.

Following each desorption test and each photolysis test, sample will be sent by package express and analyzed on a priority basis Anticipated total turn around time is three days and five day for analysis of 2,3,7,8-TCDD in solvent samples and soil sample respectively, and three days for analysis of 2,4-D and 2,4,5- (in solvent samples). Therefore, analytical results from first test of each process step will be available to enable co mation of a successful run and adjustment of any process condition for later tests.

At JI, the test schedule is impacted by shipping of samples of site to ITC's Knoxville analytical laboratory, with expected turn around times exceeding ten days. ITC will perform several o the tests prior to receiving preliminary analytical results, so as to ensure that the technical objectives of the test program at JI are met before the equipment is moved out. ITC expects the overall test period at JI to be approximately six weeks.

The test strategy is summarized in the following overview of the operating procedures.

a. Processing Soil

For each soil treatment test, the rotary desorber system, including gas recirculation and solvent scrubber, will be brought on line to the appropriate target test condition by following written step-by-step start-up procedures. The desorber unit must be allowed to reach steady-state (completed

heat-up cycle), and the gas and solvent recirculation systems must be performing at the prescribed process control conditions defined in the Standard Operating Procedures (SOP's) and the test conditions.

Soil will be weighed and loaded into the feed hopper. Feeding will commence at time zero on the run timer. As soil fills the rotary desorber and begins to discharge into the treated soil collection containers, minor adjustments will be made to set the desorber temperature profile to the target value. After steady-state conditions have been achieved with soil being fed (approximately 1 hour), the treated soil collection containers will be replaced and test start time will be noted. The test will be continued approximately four hours at steady-state, with additional soil being added to the feed hopper and replacement of the treated-soil collection containers as necessary (approximately once every 1½-2½ hours). During this time, process monitoring data will be recorded. A treated-soil collection container will be placed on line and a sufficient quantity collected to provide for all samples to be taken by ITC or the verification contractor. This container will be replaced, and the standard process shut down procedures will be implemented once visual inspection determines that no soil is remaining in the feed hopper or rotary desorber unit.

After the desorber unit has been cooled and turned off, the solvent and gas recirculation systems will be shut down according to standard written procedures. The solvent (scrubber solution) which is collected during the entire run will be drained from the solvent system and tranferred to a metal drum for temporary storage. Prior to this draining operation, the water condensate collected in the scrubber receiver/decanter will be separated into containers. This water will be sampled by the verification contractor. ITC will composite the remaining water collected from all the runs at each site and treat it using a small high-retention filter and activated carbon unit. The verification contractor will sample the treated water. The filter element, and the demister pad from the scrubber will be removed and placed in sealed containers, and new media will be placed in the equipment. The solvent vessels will be inspected and flushed with small, known quantities of S-170 if necessary to remove residues. This flush will be collected in appropriate containers.

b. UV Photolysis of Scrubber Solution

The photolysis process will be operated independen treat scrubber solution generated during particular desorpt tests. The scrubber solution will be transferred from temporary storage drums into the solvent inventory ta A measured dosage of isopropyl alcohol or substitute addit will be transferred to the same tank and the contents w be blended for several minutes using the agitation unit. solvent recirculation system will be started initially with the UV reactor on line. All operating conditions will set according to the SOP's and the test conditions.

After all systems are lined out, a sample wil be taken the initial solution to establish the starting concentrat of 2,3,7,8TCDD and other parameters of interest. The po will be turned on to the UV light unit and time zero marke The process will be operated and data recorded intermitten until the prescribed initial sampling time. Several sampl will be taken during the later phase of the reaction cyc Normally only the sample of the final treated (photolyze solvent and one other sample will be analyzed by ITC to demo strate treatment efficiency and enable comparison with labo atory kinetic data.

At the completion of the photolysis, the recirculation syst will be shut off, and any insoluble material collecte the bottom of the solvent inventory tank will be ca drained into sample containers for ITC and the verifi contractor. The entire system will be drained/transferr to a metal drum for temporary storage on site. At the compl tion of testing on site, this material will be disposed per applicable regulations. Following this operation, t tank will be inspected and flushed/cleaned as necessary pri to the next run. The cleaning solution will be collect and stored. The UV reactor unit will be opened and the lig well inspected and manually cleaned if appropriate (i.e if sigificant fouling has occurred).

TABLE 1

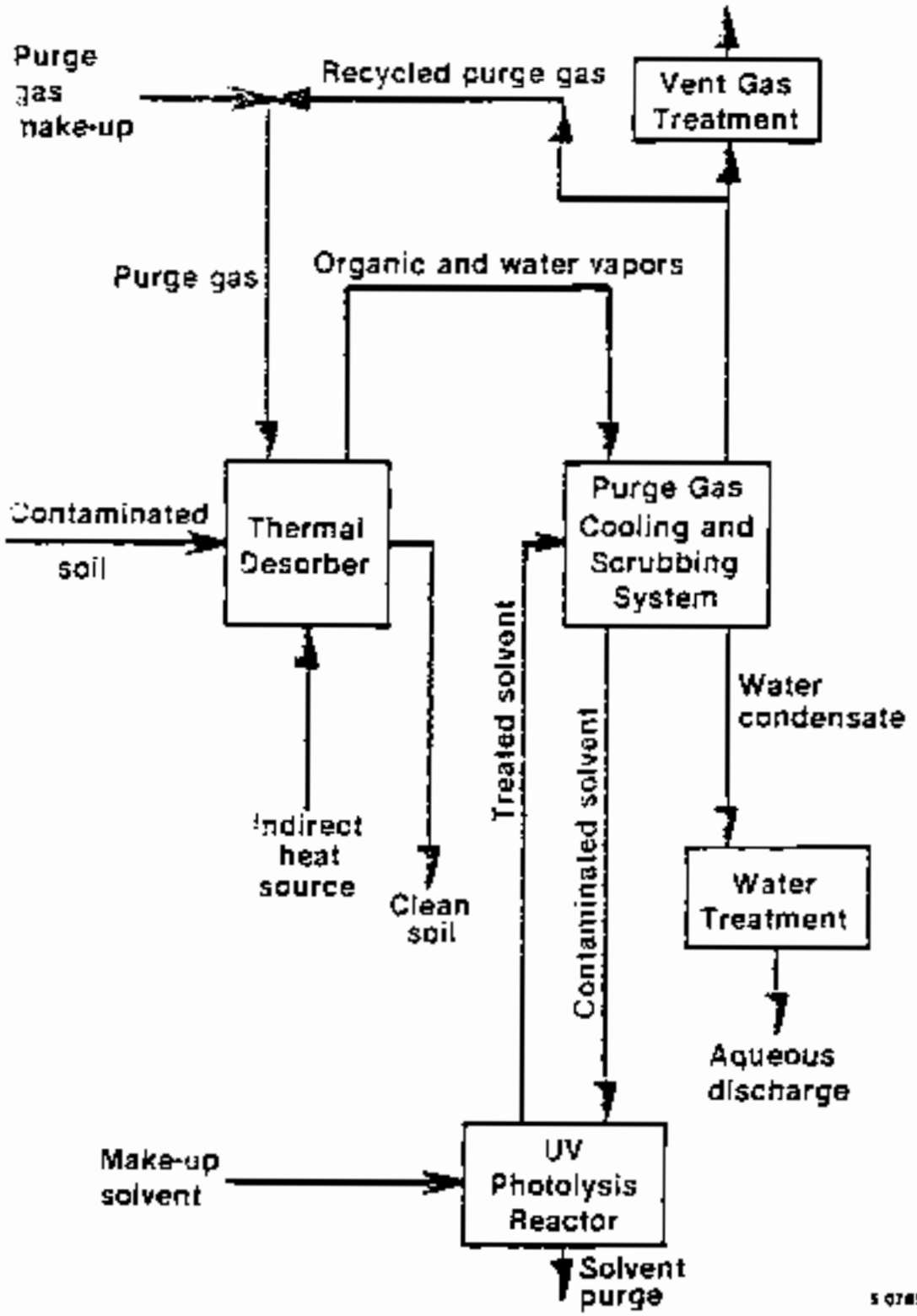
Estimated Quantities of Principal Process Feed and Effluent Streams for Thermal Desorption/UV Photolysis On-Site Tests

Stream Description	Quantity (per test)[6]
Soil Feed	150 - 300 lb
Nitrogen Make-up	1 - 5 cfm
Solvent	15 gallons
Treated Soil	150 - 300 lb
Desorber Off-Gas Purge (after treatment)	1 - 5 cfm
Scrubber Solution Aqueous Phase	½ - 4 gallons
Photolyzed Solvent	15 gallons

[6] Assumes total test time = 6 hours including one hour start-up and one hour shut-down.

FIGURE 6

IT Confidential
Thermal Desorption/UV Photolysis Process Schematic



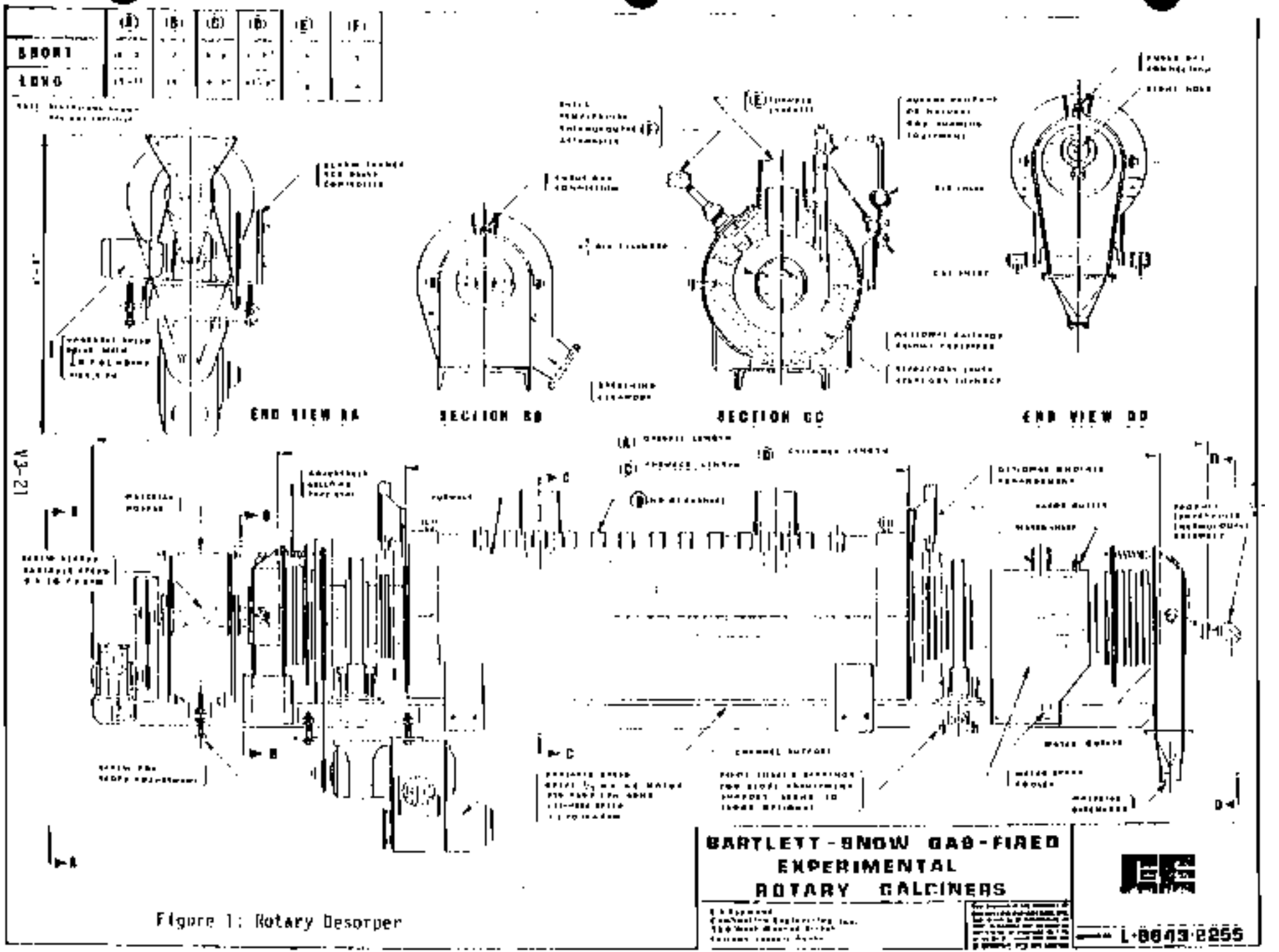
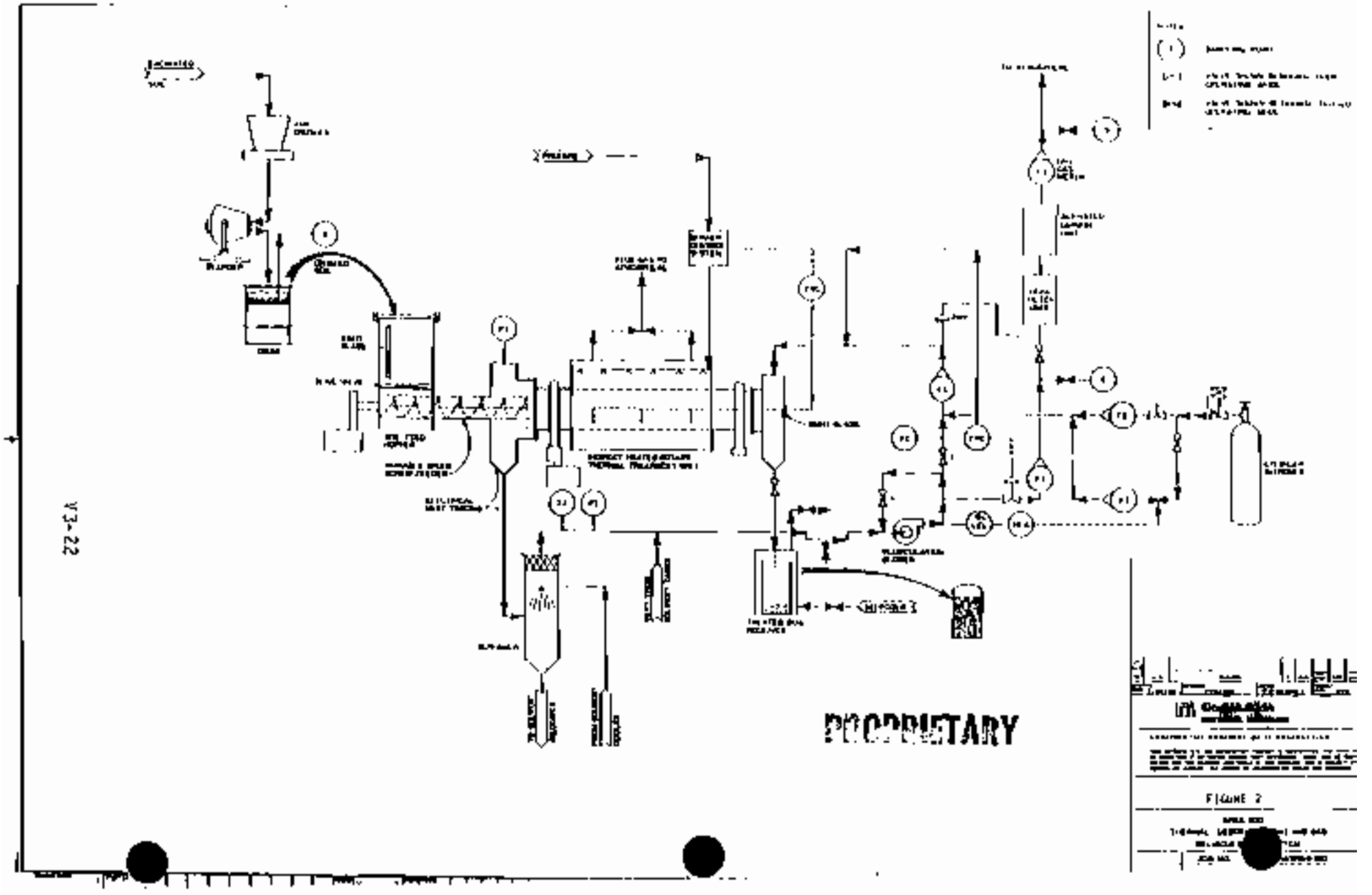
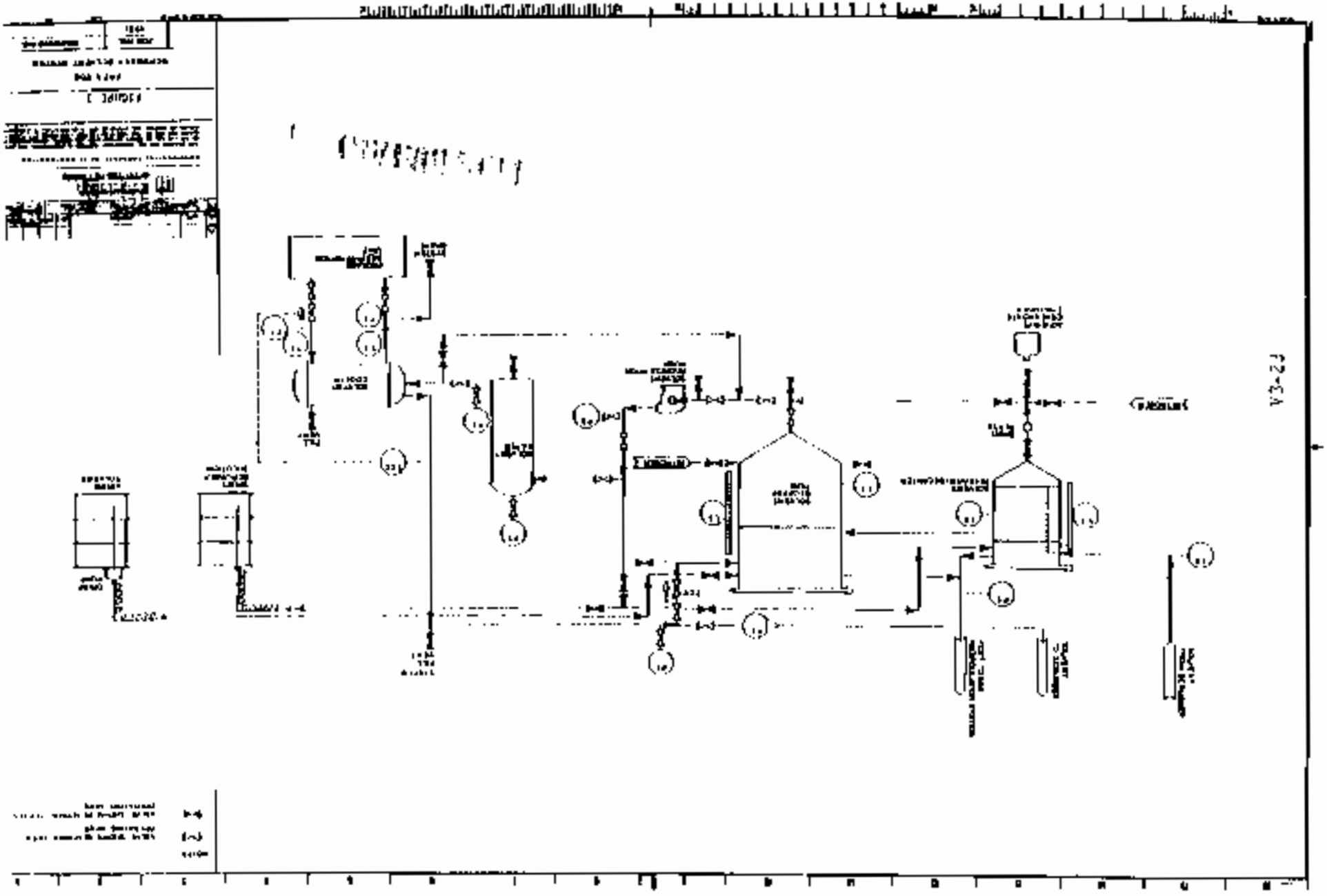
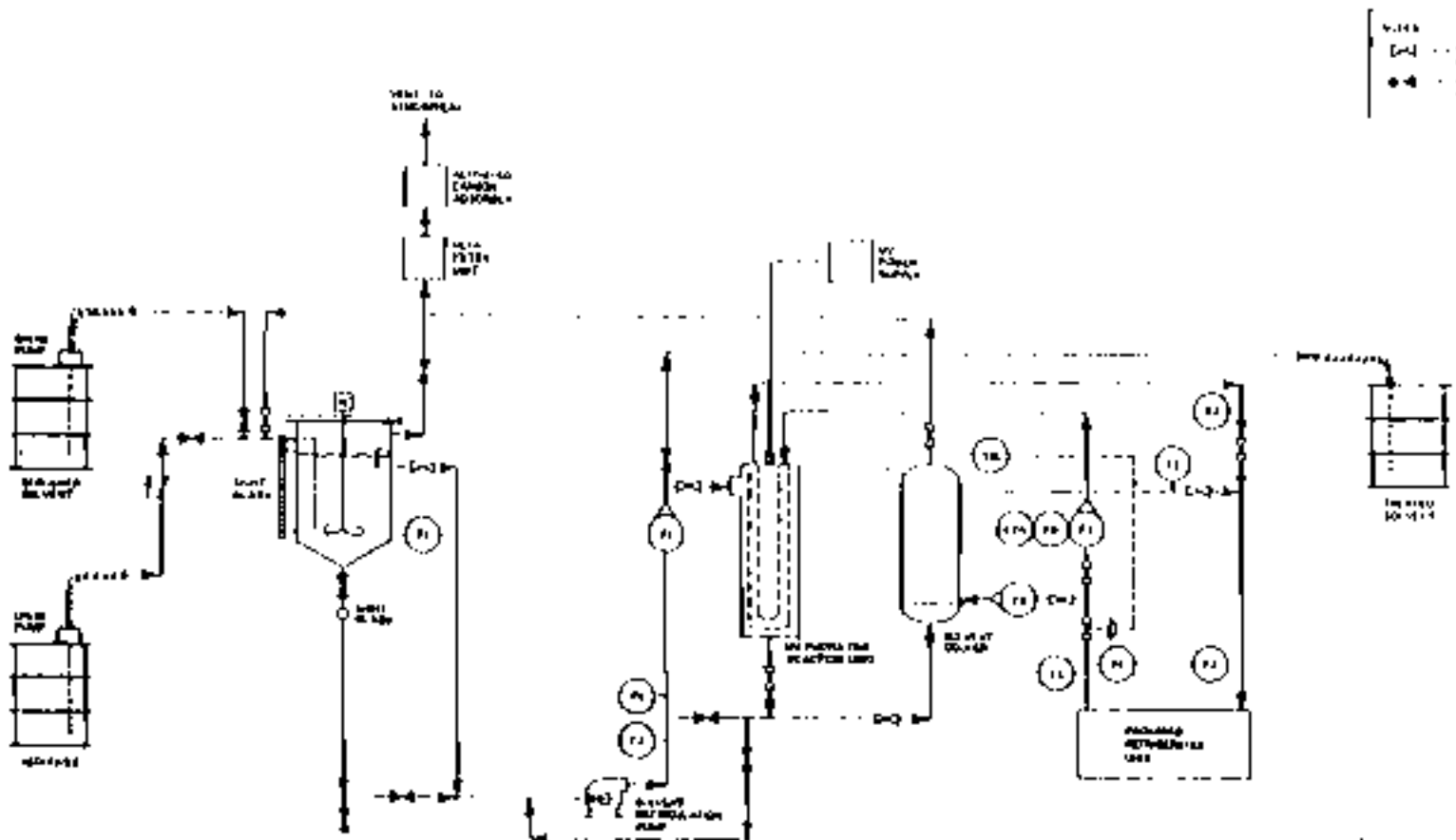


Figure 1: Rotary Desorper


PROPRIETARY
FIGURE 2





PROPRIETARY

FIGURE 4

2. Hazard Assessment to Surrounding Area and Population

The primary factor to consider in determining the potential impact of the operation of the thermal desorption/UV photolysis process on the surrounding area and population is the small quantity of contaminated material which will be involved. As described previously under the Technical Work Plan, the maximum total quantity of soil to be handled and processed over a two- to three-week period is estimated to be about 2000 lbs. Considering a concentration in the soil of 200 ppb 2,3,7,8-TCDD and 1000 ppm 2,4-D and 2,4,5-T, the total quantity of these chemicals involved is 0.18 grams of 2,3,7,8-TCDD and 2 lbs. of 2,4-D and 2,4,5-T. The vapor pressure of these chemicals is extremely low, and the primary means of migration from the immediate site is airborne particles. Therefore, all appropriate provisions will be taken to avoid fugitive dust emissions during soil loading. Provisions to minimize release of contaminated soil during loading of the feed hopper include:

- Keeping the soil in closed containers until actual removal of a feed batch
- Working with small quantities
- Transferring the soil minimum distance in open containers
- Placing the soil carefully in the hopper
- Constructing a wind break or curtain as part of the temporary weather protection enclosure over the entire process area
- Not performing transfers in conditions of high wind, if it is deemed that uncontrolled release of fugitive dust toward the nearest population (office trailer) is unavoidable.

Good housekeeping practices will be enforced to clean up loose soil from external equipment surfaces and hard floor surfaces where minor spillage might occur.

Once loaded, the soil and associated chemicals are contained within a closed system except for the small-volume vent gas stream, which is treated through both HEPA (particulate entrapment) and activated carbon (organic vapor retention). The gas system is kept under negative pressure in case of minor leakage. The temperature of the solvent system is kept low to minimize the volatility of any potential leakage or release.

To contain any accidental release of solvent, (containing dioxi the entire pressurized portion of the solvent piping is wrapped a covering to avoid uncontrolled spraying of solvent in the of a leak or failure. All portions of the process in which solve is handled are within the perimeter of a metal spill-control t which can contain more than the volume of the entire systems. entire process area is also covered by a tent to protect against ra fall. The vent gas flow and projected concentration of TCDD and constituents represent an extremely small potential emission e if the control devices were not employed. Considering a worst ca of 10 cfm vent-gas flow for a normal test duration of six hours, t estimated maximum emission even without HEPA and carbon is 1 microgra Water (condensate) and spent solvent generated from each test wi be transferred into closed containers and treated or shipped off s to appropriate permitted disposal facilities at the conclusion the site activity.

Treated condensate (10-20 gal) from all runs will be returned to t contaminated area. The solvent remaining at NCBC after all tes are completed will be properly packaged, labeled, and, with necessa approvals, will be shipped off site for incineration. Rollins Enviro mental Services at Deer Park, Texas, is permitted and has receiv such waste solvent. At DI, the solvent will either be held for t EPA-EERV mobile incinerator or will be photolyzed sufficiently ensure non-detectable limits of dioxin and removed from the site.

The potential for fire or explosion which could conceivably resu in release of chemicals or toxic combustion products is pre by:

- Use of a high boiling solvent
- Control and monitoring of solvent temperatures
- Containment of all solvent in closed systems or containers
- Separation of the solvent from the high-temperature desorpt unit
- Use of containment trays to control potential solvent spills
- Use of nitrogen as an inert gas and monitoring of the oxyge concentration in the desorber purge-gas system
- Small volumes of solvent used
- Emergency pressure relief to a contained area
- Local fire extinguishers.

All equipment will be properly decontaminated by washing with wate or steam to avoid transporting contamination off site.

A final factor in evaluating the potential risk to the population is the relative location of the test area. At NCBC, this distance is normally at least 150 feet, depending on prevailing wind. The closest population source is considered the contractor personnel working without protective gear in or near the office trailer southeast of the test site. At JI, the normal prevailing winds eliminate any population at risk.

B. Hazard Assessment to the Immediate Area and Workers

Other than the obvious sources of hazard already identified above (such as fire and release of contaminated solvent), several aspects of the thermal desorption/UV photolysis pilot testing must be addressed in design and operating provisions and safeguards to prevent hazards to the immediate vicinity and workers. ITC's Health and Safety Plan, described in the next section, deals with all these matters:

- Handling hot containers and working near high temperature surfaces
- Ultraviolet radiation
- Worker protective clothing to avoid exposure to chemicals
- Heat stress (both on-site tests will be done in summer in hot climates)
- Rotating machinery.

All ITC employees working with the pilot unit will be trained prior to arriving on site. Standard Operating Procedures (SOPs) will be written covering all normal activities, including start-up and shutdown, and defining proper procedures for dealing with abnormal situations, such as equipment malfunction, leaks, power failure, etc. These SOPs will be reviewed and approved by the ITC's Project Manager, Project Leader, Quality Assurance Officer, and Health and Safety Officer and EG&G Idaho, Inc. The entire process will be operated in Knoxville's Environmental Research Laboratory, using uncontaminated soils to shake down all mechanical and instrument systems and to develop experience in the operating and data recording procedures.

The process will undergo a thorough safety review prior to completion of construction, based on detailed piping and instrument drawings and preliminary SOPs. A safety inspection of the completed system will be conducted prior to start-up.

The process is designed with many instruments and valves to enable close monitoring and control of all process functions. An operator will be on duty at all times during operation in the field. Modifications to the physical system or SOPs in the field must be done only by the Project Leader in coordination with the Project Manager and Health and Safety Officer, and with the cognizance of EG&G Idaho, Inc. and the USAF.

C. Health and Safety

1. Purpose

This health and safety plan prescribes workplace procedures wni must be followed in order to protect the employees who are worki with 2,3,7,8 tetrachloridibenzodioxin and other hazardous materia which may be present at the Naval Construction Battalion Cent and Johnston Island. The requirements listed may change as wo progresses due to changing conditions, but no changes will . made without prior approval by the ITC Regional Manager, Heal and Safety Division. The program outlined is for both ITC employe and ITC's subcontractor personnel.

2. Discussion

2,3,7,8 tetrachloridibenzodioxin can be found as a contaminar of chemicals such as 2,4,5-trichlorophenoxyacetic acid (a herb cide), 2,4,5-trichlorophenol (used in the production of pesticide or herbicides), or hexachlorophene (a skin cleaner). It co also be a breakdown product resulting from the exposure of chlorin ated hydrocarbons, such as PCBs, to intense heat. Like othe organochlorine compounds, such as DDT and PCBs, dioxin is persister in the environment and accumulates in living tissues.

3. Program Structure

The Project Occupational Safety and Health Officer will be resp ible for the coordination of this plan. He, or one or more c his representatives, will be on site for the duration of the job Liaison with officers or representatives of USAF or EG&G on matter relating to safety and health will be handled by the health an safety representative.

The Project Leader is responsible for field implementations c the health and safety plan. This includes communicating the speci fic requirements to all personnel, conducting audits, and consultin with the health and safety representative regarding appropriat changes in safety and health requirements.

All on-site personnel are responsible for understanding and complying with the requirements of this plan, and must sign a statemen that they have read, understood, and will abide by the plan (Attachment 1). Failure to comply with this plan will result in disciplinary action, which could lead to termination.

4. Worker Health Protection

All employees on this job shall have completed a preemployment medical examination and/or a periodic/update physical examination within two months of assignment. The follow-up examination must be repeated within one month of project completion. The medical examination must be reviewed by a physician specializing in occupational medicine and a report must be submitted to ITC which medically approves the employee for work with hazardous materials. Examples of a "medical examination report" and a "physical activity restriction" report are attached, Attachments 2 and 3, respectively.

The preemployment examinations must include at least the information included on the IT Preemployment Medical Examination form, Attachment 4. The periodic/update physical examination must include at least the information included on the Periodic/Update Physical Examination form, Attachment 5.

In the event of any injury or accident a "Supervisor Employee Injury Report" (Attachment 6) shall be completed by a supervisor as soon as practical after the event. This shall be reviewed by the senior manager and the health and safety coordinator on site. If an employee has been absent due to a work-related injury or illness, a "Return to Work Authorization Following Medical Absence" form (Attachment 7) must be completed prior to returning to the job assignment. This form shall have a medical release from a physician attached. If appropriate, a "physical activity restriction" report shall be included.

5. Procedures

A. Permissible Exposure Limits

1. 2,3,7,8 TCDD

Review of 2,3,7,8 TCDD risk assessments (performed by regulatory agencies and related to PCB Transformer Fires at Binghamton, NY and One Market Plaza, CA) indicates that a limit of 18 picograms per cubic meter (pg/m^3) is appropriate. Therefore, until further research is done, the limit will be 18 pg/m^3 for 2,3,7,8 TCDD.

2. Other Materials

The permissible exposure limits for other materials are:

- Soltrol 170 - 14 parts per million parts of air
- Polyethylene glycols - None established
- Sodium Hydroxide - 2 mg/m^3 air

- Sodium Peroxide - None established, will use mg/m³ air

- Potassium Carbonate - None established - literatu indicates a PEL of 2 mg/m³ air may be appropriate.

3. Engineering controls and operational procedures sha be used to maintain levels of hazardous materials with the limits set forth above. This may be accomplishe by the use of dust-suppression techniques with 2,3,7. TCDD and closed systems and ventilation controls. Thes controls will be coupled with protective equipmer of the appropriate level for exposures encountered.

B. Employee Training and Information

All employees who work on site shall have completed a forma training program which shall include, as a minimum, th following:

1. Basic Safety Training - This course stresses fundamental such as the cause and prevention of slip, trip, an fall hazards, safe drum handling and opening, saf lifting techniques, heat stress illnesses and thei prevention, etc.

2. Hazards and Protection - This course deals with th identification, recognition, and safe work proce involving toxic materials. Understanding the use an limitations of applicable protective clothing, respira tors, and decontamination procedures is an importan part of this course. Respirator fit testing is give to each attendee.

3. First Aid and Cardiopulmonary Resuscitation - At leas one ITC employee at the site will have completed thes standard Red Cross First Aid and CPR courses.

4. 2,3,7,8 TCDD Hazard Awareness - This course discusse the specific nature of the operations which could resul in exposure to 2,3,7,8 TCDD, a description of the medica surveillance program, the specific protective clothing and respirators to be worn on the job, the adverse health effects associated with exposure to 2,3,7,8 TCDD, the routes of exposure (skin penetration, inhalation, ingestion), and the safe work procedures associatec with the employee's job assignment.

5. Other Hazard Awareness - Information will be given concerning other materials to which the employee may be exposed. Information will include routes of exposure, toxic effects, appropriate protective equipment, medical surveillance, and the specific nature of the job wh could result in exposure.

6. The following training sessions and informational materials will be provided on site:

   a. Tailgate Safety Meeting - A tailgate safety meeting will be conducted at the beginning of each shift or whenever new employees arrive at the job site once the job commences. This meeting discusses the health and safety considerations for that day's activities, and outlines protective equipment necessary. Attachment 8 shows a copy of a Tailgate Safety Meeting form.

   b. Material Safety Data Sheets (MSDS) - Completed MSDS for the toxic materials present at the site shall be posted at the job site. An example of an MSDS for 2,3,7,8 TCDD is attached (Attachment 9).

C. Regulated Areas

1. Delineated Zones - The site shall be divided into three well-delineated zones, as follows:

   a. Contaminated Zone - This zone includes the actual areas of contamination. This zone has the highest inhalation exposure potential and/or presents a high probability of skin contact with cutaneous- or percutaneous-effecting chemicals.

   b. Contamination Reduction Zone - This zone includes the areas immediately surrounding the Contamination Zone. This zone has the next highest inhalation hazard, but does not have a high probability of skin contact with cutaneous- or percutaneous-effecting chemicals.

   c. Clean Zone - This zone covers all areas outside the contamination-reduction zone. Adverse exposure to chemicals is unlikely.

2. Access - Access to 2,3,7,8 TCDD-contamination work areas (contaminated and contamination reduction zones) shall be regulated and limited to authorized persons. A daily roster shall be kept of all persons entering such areas.

3. Posting - Warning signs shall be affixed in readily visible locations in or near 2,3,7,8 TCDD (Dioxin) work areas. The information contained thereon shall be arranged as in the following example:

CAUTION

DIOXIN CONTAMINATED AREA

AUTHORIZED PERSONNEL ONLY

D. Employee Decontamination

1. A decontamination unit shall be positioned at the entrance to the contamination-reduction zone with a step-off area just inside the contamination-reduction zone. All persons entering the contamination zones shall pass through the decontamination unit to change from street clothing to protective clothing. All persons leaving the contamination zones shall pass through the unit to remove the protective clothing and shower before donning their street clothing. An example of a decontamination unit is shown as Attachment 10.

2. All employees shall be required to shower in the decontamination unit at the end of the work shift.

3. The decontamination unit shall have clean change rooms equipped with separate storage facilities which prevent cross-contamination for protective clothing and equipment and street clothing

4. An area shall be designated as the break area. Employees shall wash their faces and hands before eating, drinking or smoking.

5. An eyewash and shower shall be provided in the immediate work area for employees who may come into contact with contaminated materials

6. If there is a rip or tear in an employee's protective clothing and if there was contact with potentially contaminated material, the employee shall return to the decontamination unit immediately, wash the affected skin area, and report the incident to the on-site health and safety officer. The officer will then determine and authorize, if appropriate, the employee to don new protective clothing and return to the work area.

7. The decontamination procedure is outlined in Appendix A.

E. Respiratory Protection

The respiratory protection to be used is outlined as follows:

1. For initial set-up of work activities, such as assembling the thermal desorber, a half-face air purifying respirator, with organic vapor/highly toxic particulate (HEPA) cartridges, shall be worn. Respirators with higher protective factors, such as a full-face, air-purifying respirator, powered air purifying respirators (PAPR), or air supplied respirators, may also be worn.

2. All operations involving soil handling, including the collection of soil, crushing of soil, placing the soil in the storage drums, transferring the soil to the thermal desorber, and the operation of the thermal desorber/UV photolysis operation, will require the use of air-supplied respirators.

3. For operation of the thermal desorption of UV photolysis systems, full-face air-purifying respirators or PAPR will be required. This assumes no soil-handling activity in the area.

4. For the AMPA process, treatment of the soil will require either air-supplied respirators or powered-air purifying respirators with organic vapor/HEPA cartridges.

5. An industrial hygienist will be on site during initial start-up activities. If monitoring results indicate potential exposures which are higher, or lower, than expected, or if the industrial hygienist observes operations which indicate that respiratory protection needs to be changed, then protection will be upgraded, or downgraded, as appropriate.

6. Cartridges for air-purifying respirators will be replaced at the end of each shift. The PAPR will be checked with the flow meter before each day's use to determine if filters need to be changed.

7. Only employees who have had pre-issue qualitative fit tests, and annual fit tests thereafter, shall be allowed to work in atmospheres where respirators are required.

8. If an employee has demonstrated difficulty in breathing during the fitting test or during use, he or she shall have a physical examination to determine whether the employee can wear a respirator while performing the required duty.

9. No employee shall be assigned to tasks requiring t use of respirators if, based on the most recent examin tion, a physician determines that the employee be unable to function normally wearing a respir or that the health or safety of the employee or oth employees will be impaired by use of a respirator.

10. The employee shall be permitted to change cartridg whenever an increase in breathing resistance is detected

F. Protective Clothing

1. The protective clothing to be worn during initial set will be:

   a. Polyethylene coated tyvek coveralls with hoods
   b. Nitrile gloves
   c. Polyvinyl chloride (PVC) boots
   d. Hard hat

2. The protective clothing to be worn during dirt-loadir activities, such as loading the dirt into drums, wil be:

   a. Medium to heavy weight PVC coveralls with hood
   b. PVC outer gloves with surgical undergloves
   c. PVC boots
   d. Hard hat

3. The protective clothing to be worn during operatic of the thermal desorber/UV photolysis process and th AMPA process will be:

   a. Polyethylene coated tyvek coveralls with hoods
   b. White tyvek or cotton coveralls as an undergarment
   c. Viton gloves with surgical undergloves for th thermal desorber/UV photolysis process
   d. Nitrile gloves with surgical undergloves for th AMPA process. Leather outer gloves may be wor to protect the nitrile gloves where appropriate These leather gloves can be used, but must be lef on site and disposed of at the end of the job Leather gloves must be worn during handling o hot treated soil containers or when in proximit of the desorber furnace.
   e. PVC boots
   f. Hard hat

4. The protective clothing sleeves will be taped to the gloves, the legs taped to the boots, and the hood to the respirator (if appropriate). All openings shall be sealed.

5. The protective coveralls shall be removed in the inside out fashion.

E. Monitoring

Industrial hygiene monitoring will be conducted at the beginning of the job and periodically thereafter to determine the employee's exposures to 2,3,7,8 TCDD and other materials. The results of the monitoring will dictate the selection of the personal protective equipment.

The industrial hygiene dioxin samples will be collected by using a personal pump sampling air at a rate of 3.0 liters per minute. The dioxin will be collected on a mixed cellulose ester filter (0.8 u pore size) in a three-piece cassette, operated in the open-face mode. A minimum sampling time of 420 minutes (1260 liters) will be necessary. Appropriate analytical methods can detect a level of 0.5 nanograms per sample; therefore, the lower detection limit will be 0.4 nanograms per cubic meter for 1260 liters of air collected. Note that this level is above the PEL established, but, since full-face, air-purifying respirators are minimal protection required when working with 2,3,7,8 TCDD, this level is below the exposure level when applying the respiratory protection factor. Any measure concentration above 0.5 mg/m^3 requires the use of air-supplied respirators.

Since TCDD has a low vapor pressure, very little gaseous phase TCDD is expected to be present. Therefore, sorbent tube samples will be taken only during the early phases of the job. If no TCDD is detected, this sampling method will be discontinued. To obtain these samples, XAD-2 sorbent tubes will be used as a back-up to the filters described previously. Therefore, the same volume of air will be sampled and the same detection limits will be used. Also, the analytical procedures will be the same.

The dioxin samples taken will be prepared for analysis by extraction of the filters (or sorbent tubes) with subsequent cleanup by liquid chromatography. Analysis will be high-resolution gas chromatography/low-resolution mass spectrometry operating in a selected ion mode. Turnaround time for analyses will be no greater than 48 hours.

The NIOSH Sampling and Analytical Methods will be followed when evaluating other chemical hazards (outlined in Section B) at the site. The amount of sampling activity will vary according to the location of work crews. The Regional Manager for Health and Safety will coordinate the sampling for these chemicals.

The quality assurance/quality control will be as follows:

- The personal sampling pumps will be calibrated before and after each use with the standard bubble meter. All volumes will be adjusted to standard temperature and pressure, if necessary.

- A chain-of-custody form will be kept for each sample. The form will be signed by the person taking the sample, the person(s) transferring the sample to the laboratory, and by the laboratory receiving the sample.

- There will be one blank filter and one blank spike with 0.5-2.5 nanograms of dioxin included with each set of dioxin samples sent to the laboratory. The blanks and spikes will be labeled in such a way as to be indistinguishable from the field sample. The blanks and spikes will be utilized to determine precision and accuracy of the laboratory.

H. General Work Practices

1. At least one copy of this procedure shall be available at each 2,3,7,8 TCDD job work site.

2. Contaminated protective equipment, such as respirators, hoses, boots, etc., shall not be removed from the regulated area until it has been cleaned, or properly packaged and labeled.

3. Legible and understandable precautionary labels shall be affixed prominently to containers of contaminated scrap, waste, debris, and clothing.

4. Removal of dioxin-contaminated soil from protective clothing or equipment by blowing, shaking, or any other means which disperses contaminated material into the air is <u>prohibited</u>.

5. No food or beverages shall be present or consumed in the regulated area.

6. No tobacco products shall be present or used, and cosmetics shall not be applied in the regulated area.

7. 2,3,7,8 TCDD-contaminated materials shall be stored in tightly closed containers in well ventilated areas.

8. Containers shall be moved only with the proper equipment and shall be secured to prevent dropping or loss of control during transport.

9. Emergency equipment shall be located outside storage areas in readily accessible locations which will remain minimally contaminated with 2,3,7,8 TCDD.

10. All areas that have been determined as uncontaminated inside the regulated area will be clearly marked as such. No personnel, equipment, etc. shall be in these areas until they have been decontaminated.

11. It may be necessary to mix chemicals which are reactive at the job site. If laboratory studies indicate that chemicals mixed are reactive, the following procedures shall be followed:

    a. The mixing will take place in a reaction vessel with proper venting, relief valves, temperature and pressure controls, and cooling coils, if necessary.

    b. The chemical will be combined in small quantities with good continuous mixing.

    c. The chemical mixture will be used as soon as possible after mixing. If there is a time delay between mixing and use, a stabilizer will be added, if necessary.

12. The ultraviolet process shall be controlled as follows:

    a. Shielding of the lamp is necessary to prevent burns to the skin and eyes. The shields must be fireproof, opaque, and not degenerate under the UV.

    b. There shall be no direct light visible to the operators.

    c. The exposure to reflected light shall be avoided. This may be accomplished by coating reflective surfaces with black UV-adsorbing paint.

    d. Protective lenses on the respirators shall be utilized if shielding is not complete.

    e. Since the UV light operates at a very high temperature, exposed hot surfaces shall have guards.

    f. Signs shall be affixed in the UV area warning of UV radiation and potential hot surfaces.

11. For operation of rotating equipment, such as grinders, rotary desorber, and screw feeder, appropriate guards must be in place. Standard lock-out/red tag procedures must be followed for any maintenance or inspection.

L. Heat Stress

The heat stress of employees on site will be monitored by the Wet Bulb Globe Temperature Index (WBGT) technique. This method will require the use of a heat stress monitoring device, such as the Wibget Heat Stress Monitor (Renter Stokes).

The WGBT shall be compared to the Threshold Limit Values (TLV) outlined in the ACGIH TLV's Manual, and a work-rest regimen established, as necessary, according to the WBGT obtained. Note that 3°C must be subtracted from the TLVs for heat stress listed to compensate for the wearing of impermeable protective clothing.

One or more of the following control measures can be used to help control heat stress:

1. Provision of adequate liquids to replace lost body fluids. Employees must replace water and salt lost from sweating. Employees must be encouraged to drink more than the amount required to satisfy thirst. Thirst satisfaction is not an accurate indicator of adequate salt and fluid replacement.

2. Replacement fluids can be a 0.1% salt water solution, commercial mixes such as Gatorade or Quick Kick, or a combination of these with fresh water. Employees should be encouraged to salt their foods more heavily.

3. Establishment of a work regimen that will provide adequate rest periods for cooling down. This may require additional shifts of workers.

4. Cooling devices such as vortex tubes or cooling vests can be worn beneath protective garments.

5. All breaks are to be taken in a cool rest area (77°F is best).

6. Employees shall remove impermeable protective garments during rest periods.

7. Employees shall not be assigned other tasks during rest periods.

8. All employees shall be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress.

9. Since the UV process can generate radiant heat, employees should avoid this area as much as practical.

4. Emergency Actions

In the event of an emergency, the following procedures will be followed:

A. All employees on site will become familiar with the emergency procedures of the facility. These procedures will be followed in case of an incident.

B. Facilities will be located in the work area to enable employees to immediately wash any affected skin area or the eyes if they come into contact with contaminated materials.

C. If an injury/illness is the result of a chemical exposure, steps shall be made to identify the chemical, and this information will be given to the attending physician. Data on the chemicals involved will be distributed to the nearest medical facilities at both sites. At NCBC, a community hospital is located immediately outside the base, and at CI, a dispensary with two doctors is available.

D. At least two fire extinguishers shall be located in the thermal desorber/UV photolysis area. These extinguishers shall have a minimal rating of 10B:C.

APPENDIX A

DECONTAMINATION AREA PROTOCOLS

A. Personnel Decontamination Layout (Station Index Numbers)

B. Decon Area Diagram

C. Personnel Decontamination Sequence (Step by Step)

D. Potential For Modification

A. PERSONNEL DECONTAMINATION LAYOUT (STATION INDEX NUMBERS)

(Note: heavily contaminated workers should be helped by decon assistant)

EXCLUSION ZONE

Station 1 Segregated Equipment Drop (to table or decon pad)

----X----X----Hotline Perimeter Boundary----X----X----X----X----X----

Station 2 Total Wash (submersible pump/drums)

Station 3 Total Rinse (submersible pump/drums)

Station 4 Tape Removal (face, wrist, ankle, etc.)

Station 5 Outer Glove Removal (into bucket)

Station 6 Suit/Boot Removal (disposal of Tyvek into bucket)

Station 7 Tyvek Bootie Donning

Station 8 Respirator Removal (into bucket)

Station 9 Inner Glove Removal (in bucket for disposal)

Station 10 Underclothing Removal (if necessary) and Bootie Removal for disposal)

Station 11 Shower

Station 12 Locker Room

Out

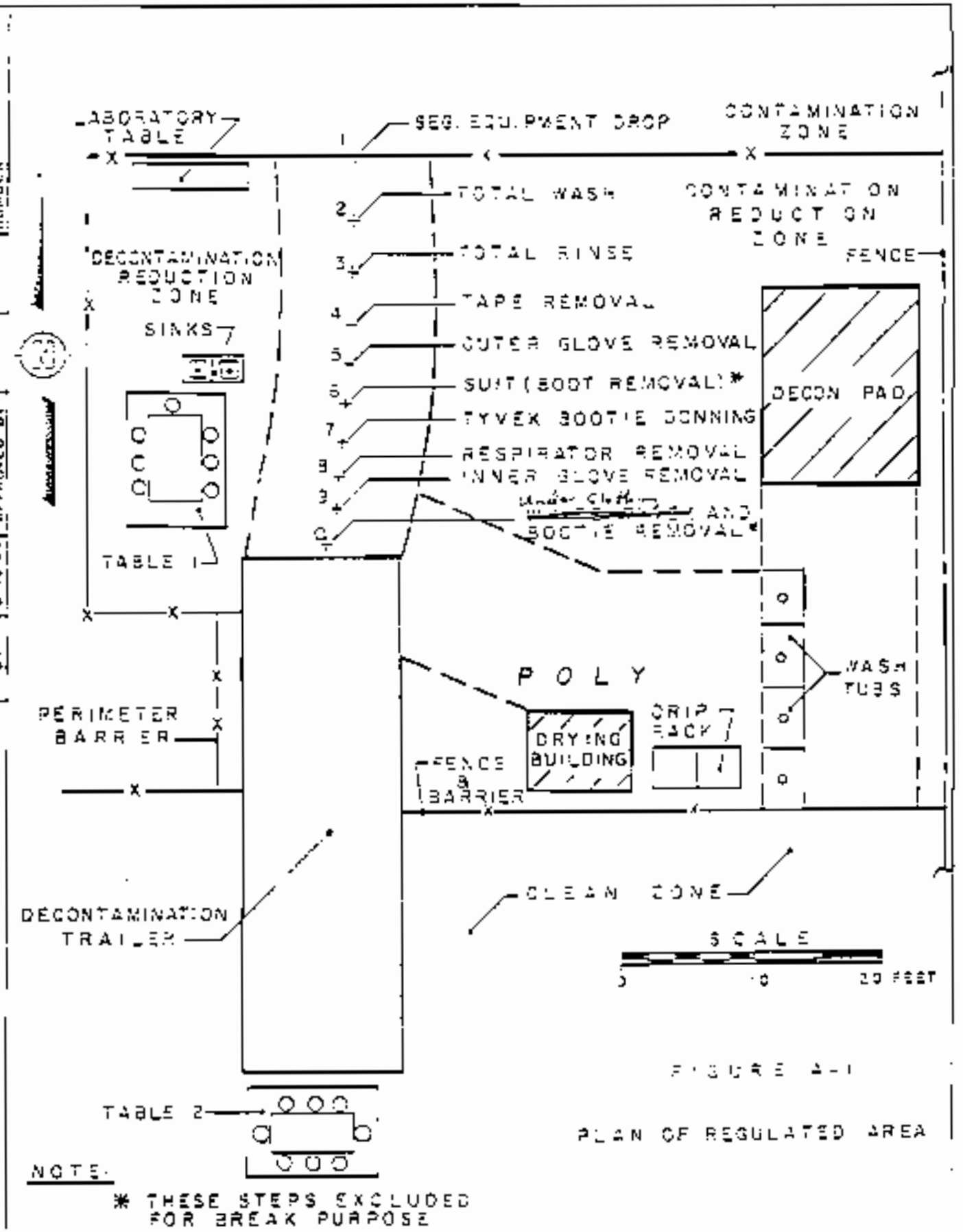


FIGURE A-1

PLAN OF REGULATED AREA

C. PERSONNEL DECONTAMINATION SEQUENCE (STEP BY STEP)

Station 1: Segregated Equipment Drop

Task: Deposit all equipment used on site onto/into poly sheeting or poly lined containers. Place on table or pass to decon line personnel.

Equipment:
1. Various sized containers
2. Poly drum liners (4 to 6 mil)
3. Poly sheeting

Station 2: Total Outer Protective Clothing Wash

Task: Scrub suits, boots, and gloves thoroughly with solution and soft bristle scrub brushes.

Equipment:
1. Wash tubs
2. Decon solution or detergent/water (example: trisodium phosphate)
3. Hudson Sprayers
4. Garden hose and pressure reducing nozzles (minimize overspray contamination)
5. Long handled soft bristle scrub brushes
6. Submersible pump
7. Recovery drums (17C)

Station 3: Total Outer Protective Clothing Rinse

Task: Total rinse with large amounts of water. Repeat as necessary.

Equipment:
1. Wash tubs
2. Rinse water (garden hose and pressure reducing nozzles)
3. Hudson Sprayers
4. Submersible pump
5. Recovery drums (17C)

Station 4: Tape Removal

Task: Remove tape around boots, gloves, and face pieces and deposit in plastic-lined bucket.

Equipment:
1. Buckets
2. Poly drum liners (4 to 6 mil)

Station 7: Outer Glove Removal

Task: Remove outer gloves and deposit in container with plastic liner.

Equipment:
1. Buckets
2. Poly drum liners (4 to 6 mil)

Station 8: Suit/Boot Removal and/or Disposal (Tyvex)

Task: Remove suit inside out and deposit into a plastic-lined container. Remove pants and boots as one. Place in separate containers. Use bootjack to aid in boot removal. Keep liner while tyvex on.

Equipment
1. Buckets
2. Small aluminum ladders (seats)
3. Poly drum liners (4 to 6 mil)
4. Bootjack

Station 9: Tyvek Bootie Donning

Task: Put on white Tyvek booties over socks.

Equipment:
1. Same aluminum ladder as in 8
2. Supply of Tyvek booties

Station 10: Respirator Removal

Task: Remove respirator and place in a plastic-lined container.

Equipment:
1. Buckets
2. Poly drum liners (4 to 6 mil)

Station 11: Inner Glove Removal

Task: Remove inner gloves (inside out) and dispose of in a plastic-lined container.

Equipment:
1. Buckets
2. Poly drum liners (4 to 6 mil)

Station 12: Underclothing Removal (if necessary) and Tyvek Bootie Removal

Task: Removal of Tyvek suit (inside out) and disposable booties.

Equipment:
1. Buckets
2. Poly drum liners (4 to 6 mil)

Station 11: Shower in Decon Trailer

Task: Thoroughly shower with soap.

Equipment:
1. Soap
2. Disposable and washable towels
3. Buckets
4. Poly drum liners (4 to 6 mil)

Station 12: Locker Room

Task: Don street clothes.

--Bagged disposal material will be trash compacted, drummed, and remain on site.

--Bagged reusable equipment will be taken to the decon pad where it will be washed, rinsed and hung on metal clothes hangers to drip-dry.

--Boots and gloves shall be washed, rinsed, the insides sprayed with disinfectant and hung on drying prong racks to drip-dry.

--After all protective equipment has been deconned, it will be brought to the drying building. Boots and gloves will be transferred to the drying racks within and the suits hung on poles.

--Cleaned respirators will be laid out neatly on the screen shelving to dry.

--During breaks all protective equipment other than outer/inner suits and boots will be removed. Suits will be unzipped to aid the cooling process.

D. POTENTIAL FOR MODIFICATION

It must be understood that the decontamination system be flexible. Changes occur on site which can easily be overlooked during planning stages. Always be prepared to alter (add or delete a step or process) the decontamination sequence or equipment. Extra decon equipment (spares) as well as a local supplier need to be readily available for items such as brushes, rags, soap, buckets, hoses, etc.

The main thing to remember concerning modification of the decon sequence is to thoroughly and safely decontaminate regardless of the changes. Actions must be taken to minimize the contamination in the contamination reduction zone and eliminate any contamination in the clean zone and off-site areas. At all times, minimize contact between potentially contaminated material and clean material (e.g., do not touch yourself without thoroughly washing at the break area).

Attachment 1

EMPLOYEE HEALTH AND SAFETY PLAN CERTIFICATION

Employee:

I have read and do understand the Health and Safety Plan for the _____ Project. I will abide by this plan.

_____ _____
Signature

_____
Date

Attachment 2

CORPORATION

MEDICAL EXAMINATION REPORT

_____
Date

To: _____

Company: _____

Location: _____

_____ has received the appropriate:

- ☐ preemployment examination
- ☐ baseline examination
- ☐ periodic examination
- ☐ DOT examination
- ☐ Other _____ .

and has been found to be:

- ☐ acceptable, without restriction
- ☐ acceptable, subject to the attached "Physical Activity Restriction"*
- ☐ not acceptable

as a:

- ☐ casual employee
- ☐ permanent employee

_____
Occupational Safety & Health

* For "Physical Activity Restriction":
1. Have employee read and sign restriction
2. Provide manager signature
3. Retain a copy
4. Return to the Occupational Safety & Health Department

Distribution: Occupational Safety & Health
Regional Administration
Corporate Personnel
Manager

Form 10-125 (rev. 10/79)

Attachment 3

ITT CORPORATION

Physical Activity Restriction

EMPLOYEE'S NAME _____ DATE _____

DIVISION _____ LOCATION _____

DATE OF INJURY/EXAM _____ JOB TITLE _____

Employee is subject to the following physical activity restriction(s):

_____

_____

_____

_____

_____

_____

_____

☐ Acceptable for work under restriction stated above	By _____
☐ Not acceptable for work under restriction stated above	Date _____

Duration: ☐ Permanent

☐ Temporary

From: _____

To: _____

Employee _____ Date _____

Manager _____ Date _____

Health & Safety _____ Date _____

Distribution: Occupational Safety & Health
Regional Administration
Manager

ITC Form 9410B
(rev. 8/83)

Attachment 4

JT CORPORATION

☐ ANALYTICAL SERVICES
☐ CORPORATION
☐ ENVIROSCIENCE
☐ ENVIRONMENTAL

☐ OIL
☐ SERVICES
☐ TRANSPORTATION
☐ NUCLEAR SERVICES

☐ DAYTON HUDGE
☐ DENSON HUDGE
☐ CINCINNATI
☐ EDISON

☐ HOUSTON
☐ IMPERIAL VALLEY
☐ KNOXVILLE
☐ LOS ANGELES
☐ MARTINEZ

☐ [illegible]
☐ SAN [illegible]
☐ SAN JOSE
☐ [illegible]
☐ [illegible]

PERSONAL HISTORY RECORD

NAME _____ SEX _____ AGE _____ BIRTH DATE _____ SOC. SEC. NO. _____

ADDRESS _____ CITY _____ STATE _____ ZIP _____ TELEPHONE NO. ( ) _____

APPLICANT NOTE - READ CAREFULLY

THIS INFORMATION IS TO HELP PLACE YOU IN A JOB SAFE TO YOURSELF AND TO OTHERS ACCORDING TO YOUR PHYSICAL ABILITY. ANSWER EVERY QUESTION (✓).

DO YOU OR HAVE YOU EVER HAD: (CHECK EVERY ITEM)

	YES	PRES	NO
1 GLASSES FOR READING			
2 GLASSES FOR DISTANCE			
3 EYE TROUBLE. Other than glasses			
4 EYE IRRITATION			
5 NOSE TROUBLE			
6 BROKEN NOSE			
7 SINUS INFECTION			
8 HAY FEVER			
9 MOUTH TROUBLE			
10 CONSIDERABLE TEETH TROUBLE			
11			
12 BAD HEARING			
13 EAR TROUBLE			
14 RUNNING EAR			
15 RINGING IN THE EAR			
16 RUPTURED EAR DRUM			
17 SORE THROAT			
18 FATIGUE			
19 FREQUENT HEADACHES			
20 HEAD INJURY			
21 SKULL FRACTURE			
22 BRAIN CONCUSSION			
23 DIZZY SPELLS			
24 FAINTING SPELLS			
25 CONVULSIONS			
26 ERUPTIONS			
27 LIGHT HEADED			

	YES	PRES	NO
28 RHEUMATISM			
29 A "STROKE"			
30 PARALYSIS			
31 NERVOUS ATTACKS			
32 MENTAL TROUBLE			
33 SHOCK TREATMENT			
34			
35 ALLERGIES			
36			
37 SKIN TROUBLE OR RASHES			
38 CHANGE IN SKIN COLOR			
39 A GOITER			
40 CHEST PAIN			
41 BREAST TROUBLE			
42 CHRONIC CHEST CONDITION			
43 LUNG DISEASE			
44 SHORTNESS OF BREATH			
45 A RECENT OR TIGHTNESS IN CHEST			
46 ASTHMA			
47 NIGHT SWEATS			
48 TUBERCULOSIS			
49 BRONCHITIS			
50 CHRONIC COUGH			
51 COUGHING UP OF BLOOD			
52 HEART TROUBLE OR A HEART ATTACK			
53 FREQUENT COLDS			

	YES	PRES	NO
55 HIGH BLOOD PRESSURE			
56 GAINED OR LOST WEIGHT LAST YEAR			
57 HEARING OR DRINKING DEFICIENCY			
58 FREQUENT NAUSEA			
59 FREQUENT VOMITING			
60 ULCERS			
61 STOMACH TROUBLE			
62 CHRONIC INDIGESTION			
63 ABDOMINAL PAIN			
64 APPENDICITIS			
65 GALL BLADDER TROUBLE			
66 JAUNDICE			
67 RECTAL TROUBLES			
68 CONSTIPATION			
69 PILES			
70 DARK URINE			
71 DO YOU SMOKE			
72 HAVE YOU EVER SMOKED			
73 MORNING COUGH			
74 KIDNEY TROUBLE			
75 URINARY BLADDER TROUBLE			
76 VENEREAL DISEASE			
77 SWOLLEN FACE OR ANKLES			
78 HERNIA OR HERNIA			
79			
80 RECENT WEIGHT GAIN OR DIMINISHING			

	YES	PRES	NO
81 PAINFUL OR SWOLLEN JOINTS			
82 RHEUMATISM			
83 ARTHRITIS			
84 A KIDNEY INJURY			
85 SWOLLEN ANKLES			
86 FOOT TROUBLE OR PAINFUL FEET			
87 BACK TROUBLE			
88 SPINE TROUBLE			
89 OSTEOMYELITIS (BONE INFECTION)			
90 ALCOHOLISM			
91 DIABETES			
92 MALARIA			
93 ANEMIA OR OTHER BLOOD CONDITION			
94 CANCER			
95 GROWTHS OR TUMORS			
96 ANY CHRONIC AILMENT			
97 BLOOD DISORDERS IN FAMILY			
98 TETANUS SHOT LAST 10 YEARS			
FOR ENGINEER OR SPOUSE ONLY			
99 NUMBER OF PREGNANCIES			
100 NUMBER OF MISCARRIAGES			
101 TUBAL LIGATION			
102 DATE LAST DELIVERY			
103 CONTROLLED ABORTIONS			
104 ARE YOUR BLOOD BROTHER			
105 DATE LAST PAPSMEAR			

EXPLAIN FULLY ITEMS CHECKED YES: _____

WHAT ILLNESS HAVE YOU HAD IN THE PAST 5 YEARS: _____

WHEN DID YOU LAST SEE A DOCTOR? _____ FOR WHAT? _____

NAME AND ADDRESS OF PERSONAL PHYSICIAN _____ DATE OF LAST VISIT _____ REASON _____

WHAT MEDICINES ARE YOU NOW TAKING? _____

Attachment 4

OCCUPATIONAL HISTORY

BEST KINDS OF WORK DONE	WHAT MACHINES AND INSTRUMENTS HAVE YOU HANDLED	HOW SO LEARNED

ALL OCCUPATIONAL ILLNESS & INJURIES

DATE	NATURE OF ILLNESS OR INJURIES	NAME OF COMPANY & CITY

MILITARY SERVICE - CONNECTED DISABILITIES

NATURE OF DISABILITY	%	AMT. REC. PER MT.	BRANCH OF SERVICE	SERIAL NO.	CLAIM NO.	V.A. REGIONAL OFFICE

HOSPITALIZATION _____ WHEN _____ WHERE _____ WHERE _____

ALL HOSPITALIZATIONS - ACCIDENTS - SICKNESS - (EXCEPT OCCUPATIONAL)

DATE	NATURE	DATE	NATURE
1.		3.	
2.		4.	

ALL PHYSICAL DEFECTS OR ABNORMALITIES AT THIS TIME

PARTS OF BODY	EXTENT OF DEFECT

I HEREBY CERTIFY THAT TO THE BEST OF MY KNOWLEDGE THE FOREGOING ANSWERS ARE COMPLETE AND CORRECT AND I UNDERSTAND THAT ANY FALSIFICATION OF THIS RECORD IS CAUSE FOR TERMINATION. I FURTHER UNDERSTAND THAT THIS PHYSICAL EXAMINATION IS CONDUCTED FOR THE EMPLOYER AS A PREREQUISITE TO EMPLOYMENT. I AGREE THAT THIS FORM AND ANY INFORMATION ACQUIRED AS A RESULT OF THIS EXAMINATION WILL BECOME THE PROPERTY OF THE EMPLOYER. I HEREBY GRANT PERMISSION TO OBTAIN RECORDS FROM MY PREVIOUS PHYSICIAN(S) OR HOSPITAL(S) WHERE I HAVE BEEN TREATED. UPON MY TERMINATION OR EMPLOYMENT I AGREE TO PARTICIPATE IN A COMPANY MEDICAL EXAMINATION.

JOB POSITION _____ DATE _____ SIGNATURE _____

PHYSICIAN'S REVIEW OF THE ABOVE HISTORY _____

ETC Form 9410-1 (10/80)

IT CORPORATION

☐ CORPORATION
☐ ENVIROSCIENCE
☐ ENVIRONMENTAL

☐ SERVICES
☐ TRANSPORTATION
☐ NUCLEAR SERVICES

☐ DENSON RIDGE
☐ CINCINNATI
☐ EDISON

☐ IMPERIAL VALLEY
☐ KNOXVILLE
☐ LOS ANGELES
☐ MARTINEZ

☐ SAN DIEGO
☐ SAN JOSE
☐ TAFT
☐ TORLAND

PERSONAL HISTORY RECORD

Attachment 4

NAME _____ SEX _____ AGE _____ BIRTH DATE _____ SOC. SEC. NO. _____

ADDRESS _____ CITY _____ STATE _____ ZIP _____ TELEPHONE NO. ( ) _____

APPLICANT NOTE - READ CAREFULLY

THIS INFORMATION IS TO HELP PLACE YOU IN A JOB SAFE TO YOURSELF AND TO OTHERS ACCORDING TO YOUR PHYSICAL ABILITY. ANSWER EVERY QUESTION (✓).

DO YOU OR HAVE YOU EVER HAD: (CHECK EVERY ITEM)

	YES	NO
1 GLASSES FOR READING		
2 GLASSES FOR DISTANCE		
3 EYE TROUBLE, other than glasses		
4 EYE IRRITATION		
5 NOSE TROUBLE		
6 BROKEN NOSE		
7 SINUS INFECTION		
8 HAY FEVER		
9 MOUTH TROUBLES		
10 CONSIDERABLE TEETH TROUBLE		
11		
12 BAD HEARING		
13 EAR TROUBLE		
14 RUNNING EAR		
15 RINGING IN THE EAR		
16 PUNCTURED EAR DRUM		
17 SORE THROAT		
18 FATIGUE		
19 FREQUENT HEADACHES		
20 HEAD INJURY		
21 SKULL FRACTURE		
22 BRAIN CONCUSSION		
23 DIZZY SPELLS		
24 FAINTING SPELLS		
25 CONVULSIONS		
26 DEAFNESS		
27 LIGHT HEADED		

	YES	NO
28 HEMIPLEGIA		
29 A "STROKE"		
30 PARALYSIS		
31 NERVOUS ATTACKS		
32 MENTAL TROUBLE		
33 SHOCK TREATMENT		
34		
35 ALLERGIES		
36		
37 SKIN TROUBLE OR BOILS		
38 CHANGE IN SKIN COLOR		
39 A GOITER		
40 CHEST PAIN		
41 BREAST TROUBLE		
42 CHRONIC CHEST CONDITION		
43 LUNG DISEASE		
44 SHORTNESS OF BREATH		
45 A FEELING OF TIGHTNESS IN CHEST		
46 ASTHMA		
47 NIGHT SWEATS		
48 TUBERCULOSIS		
49 SILICOSIS		
50 CHRONIC COUGH		
51 COUGHING UP OF BLOOD		
52 DISEASE TROUBLE OF A HEART ATTACK		
53 REPEATED COLDS		

	YES	NO
54 HIGH BLOOD PRESSURE		
55 FAINTED OR LOST MEMORY PAST YEAR		
56 BLEEDING OR BRUISING TENDENCY		
57 THROUGHOUT NAUSEA		
58 THROUGHOUT VOMITING		
59 HICCUPS		
60 STOMACH TROUBLE		
61 CHRONIC INDIGESTION		
62 ABDOMINAL PAIN		
63 APPENDICITIS		
64 GALL BLADDER TROUBLE		
65 JAUNDICE		
66 HERNIA		
67 RECTAL TROUBLES		
68 COLITIS		
69 PILES		
70 PAIN URINE		
71 DO YOU SMOKE		
72 HAVE YOU EVER SMOKED		
73 BREATHING COUGH		
74 KIDNEY TROUBLE		
75 URINARY BLADDER TROUBLE		
76 VENEREAL DISEASE		
77 SWOLLEN FACE OR ANKLES		
78 RUPTURE OR HERNIA		
79		
80 BROKEN BONES OR DISLOCATIONS		

	YES	NO
81 FAILURE OF SPRAINED JOINTS		
82 RHEUMATISM		
83 ARTHRITIS		
84 A BACK INJURY		
85 SWOLLEN ANKLES		
86 FOOT TROUBLE OR PAINFUL FEET		
87 BACK TROUBLE		
88 SPINE TROUBLE		
89 OSTEOMYELITIS (BONE INFECTION)		
90 ALCOHOLISM		
91 DIABETES		
92 MALARIA		
93 ANEMIA OR OTHER BLOOD CONDITION		
94 CANCER		
95 GROWTHS OR TUMORS		
96 ANY CHRONIC AILMENT		
97 BLOOD DISORDERS IN FAMILY		
98 TETANUS SHOT LAST 10 YEARS (FOR EMPLOYEE ON OFFSHORE JOB)		
99 NUMBER OF PREGNANCIES		
100 NUMBER OF MISCARRIAGES		
101 FEMALE SURGERY		
102 DATE LAST PREGNANCY (FOR FEMALE APPLICANTS)		
103 ABNORMAL PERIODS		
104 DATE LAST PERIOD		

EXPLAIN FULLY ITEMS CHECKED YES: _____

WHAT ILLNESS HAVE YOU HAD IN THE PAST 5 YEARS: _____

WHEN DID YOU LAST SEE A DOCTOR? _____ FOR WHAT? _____

NAME AND ADDRESS OF PERSONAL PHYSICIAN _____ DATE OF LAST VISIT _____ REASON _____

WHAT MEDICINES ARE YOU NOW TAKING? _____

V3-50

PORATION

Attachment 5

UPDATE/PERIODIC PHYSICAL EXAMINATION

DATE _____

NAME _____ WORK POSITION _____ SEX _____ AGE _____

ADDRESS _____ CITY _____ STATE _____

BIRTH DATE _____ SSN _____ PHONE NO. _____

IT IS IMPORTANT TO BRING TO THE ATTENTION OF THE DOCTOR ANY CHANGES IN YOUR HEALTH STATUS OCCURRING SINCE YOUR LAST HEALTH EXAMINATION. THEREFORE PLEASE CAREFULLY ANSWER THE FOLLOWING QUESTIONS. EXPLAIN ALL ITEMS CHECKED YES.

	YES	NO
1. Have you had any injury or illness other than colds?		
2. Have you been hospitalized for any reason?		
3. Have you had any surgery (in or out of the hospital)?		
4. Have you been under the care of a physician or other medical practitioner?		
5. Have you had any abnormal x-rays or electrocardiograms; any abnormal blood, urine, or laboratory tests?		
6. Have you been nervous, depressed, or tense or had any emotional trouble?		
7. Have you had headaches, dizzy spells or black-outs?		
8. Have you had trouble with your eyes - change in vision, blurring, seeing double, pain or glaucoma?		
9. Have you had trouble with nose and throat - persistent hoarseness, voice change?		
10. Have you had trouble with ears - pain, change in hearing, noise exposure?		
11. Have you had chronic cough; any sputum that was bloody, excessive or colored; any pain on breathing?		
12. Have you had shortness of breath, difficulty breathing, any swelling of the ankles?		
13. Have you had any chest pain, or history of heart trouble or high blood pressure?		
14. Have you had abdominal pain (or distress) or persistent vomiting?		
15. Have you had any change in bowel habits; any bloody or tarry black stools?		
16. Have you had trouble starting, stopping, or holding urine, any bloody or very dark urine; any discharge?		
17. Are you now taking any medication?		
18. Have you had skin rashes, sores, new or growing lumps, or changing moles?		
19. Have you gained or lost 10 pounds or more?		
20. Have you had any pain, swelling or stiffness of back or joints?		
21. Have you been bleeding or bruising more than at time of last examination?		
22. Has there been any change in the family medical history, such as appearance of diabetes, heart disease, strokes, blood problems or conditions that you think may be inherited?		
23. Are you a Diabetic?		
24. Are you pregnant?		
25. Have you had a Tetanus Immunization within the last 10 years?		

26. If you still smoke, how much?_____ How many years have you smoked?_____

27. Present use of alcohol: social____ moderate____ heavy____

28. If you have any medical problems you wish to discuss, please list them in.

EXPLAIN ITEMS CHECKED YES

_____

_____

_____

_____

_____

I HEREBY CERTIFY THAT TO THE BEST OF MY KNOWLEDGE THE FOREGOING ANSWERS ARE COMPLETE AND CORRECT AND I UNDERSTAND THAT ANY FALSIFICATION OF THIS RECORD IS CAUSE FOR TERMINATION. I AGREE THAT THIS FORM AND ANY INFORMATION ACQUIRED AS A RESULT OF THIS EXAMINATION WILL BECOME THE PROPERTY OF THE EMPLOYER. I HEREBY GRANT PERMISSION TO OBTAIN RECORDS FROM MY PREVIOUS PHYSICIAN(S) OR HOSPITAL(S) WHERE I HAVE BEEN TREATED.

Attachment 5

☐ State Compensation
☐ Federal L & H

Date Received

Date Employer's Sig

SUPERVISORS EMPLOYEE INJURY REPORT

This is an official document to be initiated by the Supervisor. Be thorough and accurate. Answer all questions.

Injured's Name _____ Sex ____ SS # _____ Birthdate _____

Home Address _____ City _____ Phone _____

Classification _____ Hourly Wage _____ Hire Date _____

IT Division _____ Location _____

Who work was being performed for? _____ Address _____

Exact location of incident _____

Date of Injury _____ Time Shift Began _____ Time Injured _____

Time Reported _____ Did employee leave work? _____ Left When? _____

Date & Time Employee Returned To Work _____

Supervisor/foreman _____ Leadman _____

Nature of Injury _____ Exact Body Part Affected _____

☐ NEAR MISS ☐ FIRST AID ☐ DOCTOR CASE ☐ HOSPITALIZED

SUPERVISOR

Doctor's Name _____ Address _____ City _____

Hospital _____ Address _____ City _____

What was employee doing at time of incident? _____

How did incident occur? _____

Incident witnesses _____ Statement Attached ☐ Yes ☐ No Did you witness incident? ☐ Y ☐ N

Why did incident occur? _____

Had corrective action been initiated to prevent recurrence? ☐ Yes ☐ No Explain _____

Supervisor's Signature | Date Report Prepared | Injured's Signature | Date

MANAGER

MANAGER

What unsafe condition or act caused incident? _____

Your recommendation? _____

Signature

OCCUPATIONAL SAFETY & HEALTH

OSH

Concur with action taken? ☐ Yes ☐ No Remarks _____

Signature

Distribution: Insurance
Medical
Safety
Manager

ITC FORM 9300.1-T (August 1980)

Attachment 7

IT CORPORATION

RETURN TO WORK AUTHORIZATION
FOLLOWING MEDICAL ABSENCE

_____ Date

To: _____

Company: _____

Location: _____

_____ has been absent from work due to a:

- ☐ work related illness or injury _____ (Date of injury)
- ☐ nonindustrial illness or injury
- ☐ other

and has provided a satisfactory medical release certificate for:

- ☐ return to work, without restriction
- ☐ return to work subject to the attached "Physical Activity Restriction"*

_____
Occupational Safety and Health

*For "Physical Activity Restriction":
1. Have employee read and sign restriction
2. Provide manager signature
3. Retain a copy
4. Return to the Occupational Safety & Health Department

Distribution: Occupational Safety & Health
Regional Administration
Corporate Personnel
Manager

IMC 8001-T (replaces 10-244)

Attachment 3

TAILGATE SAFETY MEETING

Division/Subsidiary _____ Facility _____

Date: _____ Time: _____ Job Number: _____

Customer _____ Address: _____

Specific Location: _____

Type of Work: _____

Chemicals Used: _____

SAFETY TOPICS PRESENTED

Protective Clothing/Equipment: _____

Chemical Hazards: _____

Physical Hazards: _____

Emergency Procedures: _____

Hospital / Clinic: _____ Phone:( ) _____ Paramedic Phone:( ) _____

Hospital Address _____

Special Equipment _____

Other _____

ATTENDEES

NAME PRINTED	SIGNATURE

Meeting conducted by: _____ _____

NAME PRINTED SIGNATURE

SUPERVISOR _____ MANAGER _____

Occupational Safety and Health Administration

Attachment 9

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME: N/A	EMERGENCY TELEPHONE NO.: N/A
ADDRESS (Number, Street, City, State, and ZIP Code): N/A	
CHEMICAL NAME AND SYNONYMS: Dioxin, 2,3,7,8-tetrachlorodibenzo-p-dioxin	TRADE NAME AND SYNONYMS: 2,3,7,8-TCDD, TCDBD
CHEMICAL FAMILY: Chlorinated hydrocarbon	FORMULA: $C_{12}H_4Cl_4O_2$

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%
PIGMENTS			BASE METAL	
CATALYST			ALLOYS	
VEHICLE N/A			METALLIC COATINGS N/A	
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX	
ADDITIVES			OTHERS	
OTHERS				

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%
An impurity in herbicide 2,4,5-T	
CAS Number 1746-01-6	
RTECS NR 3500000	

SECTION III - PHYSICAL DATA

BOILING POINT (°F) @ 1ATM >1292F	Decomposes	SPECIFIC GRAVITY (H_2O=1)	N/A
VAPOR PRESSURE (mm Hg) @ 77°F	1.7×10^{-6} mm Hg	PERCENT, VOLATILE BY VOLUME (%)	Unknown
VAPOR DENSITY (AIR=1)		EVAPORATION RATE (_____=1)	Unknown
SOLUBILITY IN WATER G/100 G water at 20°C	200ppm	Melting point	581°
APPEARANCE AND ODOR Colorless, crystalline solid. Decomposes when exposed to UV			

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used): N/A	FLAMMABLE LIMITS: LEL N/A; UEL

EXTINGUISHING MEDIA
Use alcohol foam, CO_2, dry chemical, or water fog on surrounding areas

SPECIAL FIRE FIGHTING PROCEDURES
Wear SCBA and full protective clothing

UNUSUAL FIRE AND EXPLOSION HAZARDS N/A

EFFECTS OF OVEREXPOSURE

Chloracne, kidney/liver damage, skin/eye irritation, fatigue, cough, CNS depression, cancer (lab animals)

EMERGENCY AND FIRST AID PROCEDURES

Wash eyes 15 minutes with copious amounts of water and skin with water and soap. After exposure by inhalation remove to fresh air immediately. Upon ingestion seek medical attention immediately. Seek medical attention after any exposure

SECTION VI - REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
	UNSTABLE		N/A
	STABLE	X	

INCOMPATABILITY (Materials to avoid)
Unknown

HAZARDOUS DECOMPOSITION PRODUCTS
None

HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID
	MAY OCCUR		
	WILL NOT OCCUR	X	

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Contain dry or liquid material and keep from spreading poisonous solid N.O.S. or Poison B, Solid, N.O.S.

Reportable Quantities 2 lb

WASTE DISPOSAL METHOD

HW 2011

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)

Fullface air purifying respirator with organic vapor cartridges with dust, fume, mist

VENTILATION			
	LOCAL EXHAUST: Use wherever possible	*	SPECIAL: Supplied air or SCBA
	MECHANICAL (General)		OTHER

PROTECTIVE GLOVES: Viton gloves with PVC or Neoprene (OG) Outer Glove

EYE PROTECTION: Faceshield, goggles or FF Respirator

OTHER PROTECTIVE EQUIPMENT

PVC suit/poly Tyvek depending on the situation; PVC or Neoprene boots with disposable shoe coverlets. Tape necessary

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Eyewash and shower in vicinity. Eating, smoking, drinking, etc prohibitied in the work area. Minimize contact at all times

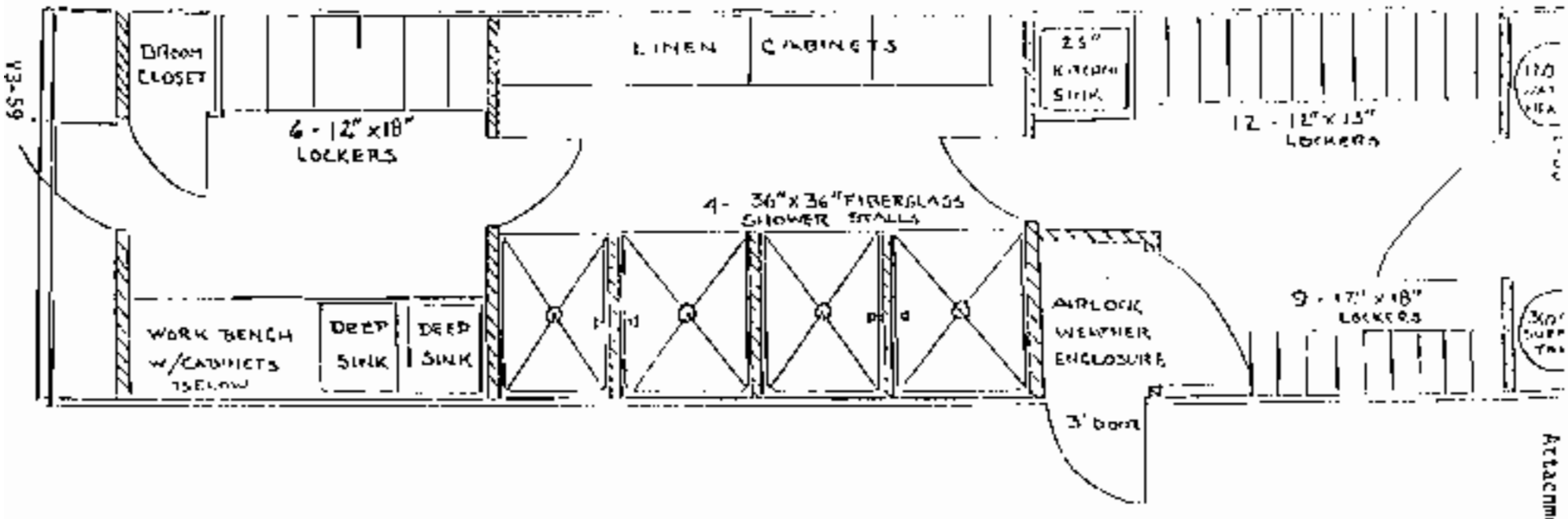
OTHER PRECAUTIONS

Material is very persistent in the environment. Highly toxic. Carcinogen, mutagen, teratogen in animals

PAGE (2)

*with higher concentrations or greater potential per exposure

DECONTAMINATION UNIT (CATEGORY [illegible])



Attachment 10

CHAPTER 3: QUALITY ASSURANCE OF THE PROCESS: THERMAL DESORPTION/UV PHOTOLYSIS

Project Organization and Responsibilities

The ITC project personnel and their reporting relationships are shown in Figure 1. ITC will have responsibility for all operational data and process sample results for thermal desorption/UV photolysis and AMPA. Quality assurance responsibilities for other program activities such as verification sampling and analysis and the Huber technology demonstration are not included.

The key individual responsible for quality assurance will be V. Kalcevic. He will be responsible for:

- Approving the project QA plan
- Directing the overall QA program and ensuring the quality of data and reports generated by the programs
- Auditing all program activities
- Initiating, reviewing, and followup on corrective actions.

Mr. Kalcevic reports directly to the Director of IT Technology Development (ITTD), Mr. R. Fox. On IT Corporation contracts with government and commercial clients, Mr. Kalcevic has served as the QA officer. As part of EPA contracts with IERL/CI and EERU/Edison, he has been responsible for several comprehensive QA programs.

The project manager, R. W. Helsel, is responsible for:

- Preparing, obtaining approval, and distributing the QA Project Plan and other related plans such as the Test Plan and final Sampling and Analysis Plan.
- Managing overall technical and operational activities for all phases of the project.
- Interfacing with EG&G Idaho, the Air Force and other contractors as necessary on QA/QC matters.
- Calling to the attention of the quality assurance officer and others, as appropriate, any problems arising during the project that affect this QA Project Plan and documenting and communicating any modifications.

- Issuing a final technical report, including QA/QC results to EG&G Idaho.

The field QC coordinator, E. S. Alperin, also serves as project leader, and is responsible for:

- Managing the day-to-day process operations and sampling on-site
- Deciding when test run sampling will be performed
- Assuring that samples and process operating data are taken according to the QA Project Plan and Sampling and Analysis Plan
- Assuring that equipment and instrument calibrations are performed and recorded
- Reviewing operating logs and analytical reports for completeness and transferring all test data and reports to the project manager
- Coordinating with the verification contractor regarding sampling
- Directing and assisting in sample collection, preservations, documentation and shipping
- Reporting to the project manager any problems in conducting the field activities related to the QA Project Plan and implementing any modifications specified by the project manager and QA officer
- Assuring that process conditions (temperatures, rates, etc.) prescribed for each test are set and maintained.

The analytical QC coordinator, M. Wass, will be responsible for:

- Training and qualifying as necessary the specific laboratory personnel in the prescribed analytical procedures prior to receiving process samples
- Coordinating the distribution and prioritization of sample analysis
- Monitoring and verifying that the specified analytical and QC procedures are being followed
- Reviewing the analytical data and QC data as it is developed and notifying the project manager if data quality warrants repeat analysis
- Entering QC samples into the sample stream.

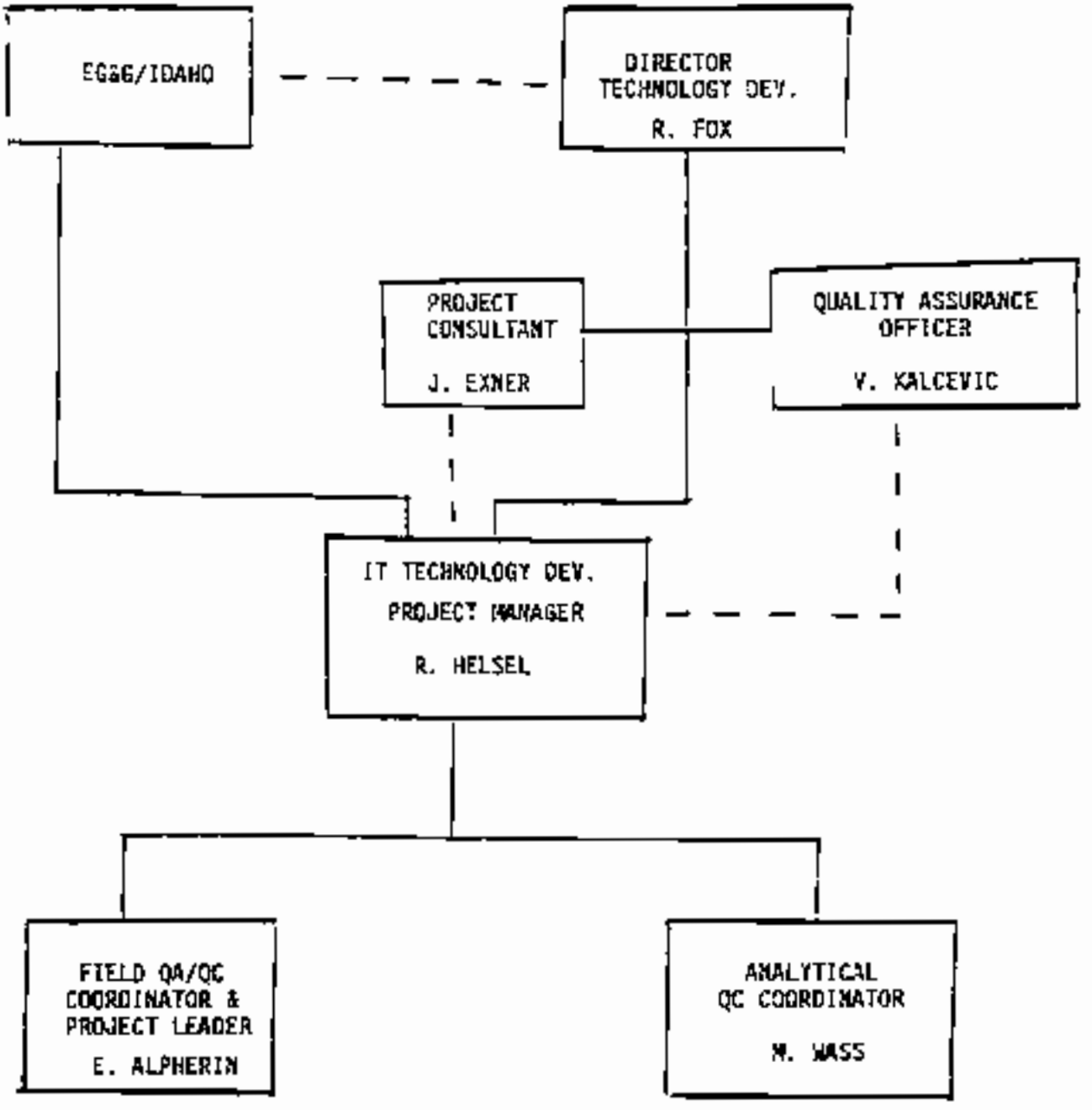


Figure 1: Quality Assurance Organizational Structure

The ITC QA/QC plan for operations and sampling is divided into two sections. The following section refers to thermal desorption/UV photolysis. The particular QA/QC aspects of the AMPS test program are identified in Volume 4, Chapter 3.

Quality Assurance Objectives - Operations and Sampling

As part of the overall objectives of the field testing program, the thermal desorption/UV photolysis pilot process unit will be evaluated for the capability of:

- Achieving less than the research objective (1 ppb 2,3,7,8-TCDD and affiliated DDD and DDF's) as defined in Volume 6..
- Producing no significant discharge to the surroundings during the test.
- Destroying dioxins collected in the solvent to a concentration less than 1 ppb.

To adequately determine if these objectives are met, samples must be taken of the treated soil, the vent gas, and the photolyzed solvent. In addition, certain key process parameters which most significantly influence treatment performance will be measured. These include the soil feed rate and desorption temperature, the vent gas flow rate, and the quantity of photolyzed solvent. The objectives for accuracy, precision and completeness of these measurements are given in Table 1.

Representativeness

The temperature of the soil within the desorber will be measured by thermowells positioned so as to be in contact with the soil as it moves forward along the bottom and side of the rotating tube. This positioning will be visually inspected through the sight glass during preliminary system trials prior to planned test runs.

Sampling by the verification contractor of the vent gas will be done by passing the complete stream through the gas sampling system. This is possible due to the anticipated low flow.

Sampling of the treated soil and photolyzed solvent will be done according to the final Sampling and Analysis Plan developed by ITC to ensure representativeness.

Table 1:
Quality Assurance Objectives for Precision, Accuracy, and Completeness for Thermal Desorption/UV Photolysis Operations

Parameter	Method of Measurement	Precision (%)[a]	Accuracy (%)[b]	Completeness (%)[c]
Soil Feed Rate	Scale (electronic/ weigh cell)	5	5	90
	Quartz timer	5	5	90
Desorption Temperature	Thermocouple	5	5	90
Vent gas flow rate	Dry gas meter	5	5	90
Solvent quantity	Scale (electronic/ weigh cell)	5	5	90

[a] Expressed in terms of the relative standard deviation.

[b] Expressed as the percentage difference from the true (standard) value.

[c] Expressed as the amount of valid data obtained compared to the total amount expected.

Comparability

Duplicate desorption tests will be made on the first two runs at NCBC to demonstrate comparability of overall system performance. In addition, duplicate samples will be taken of the treated soil and the photolyzed solvent from one test at each site to demonstrate the comparability of samples from the same source.

Sampling and Data Collection Procedures

Procedures are described below for the key parameters for which quality assurance objectives are established. In addition, other process streams will be sampled and operating data recorded to define the condition of the process during the designated treatment. A process data log to be defined in the Standard Operating Procedures (SOPs) will be used for recording the process parameters.

Soil Feed Rate

The soil feed rate corresponds to a specific residence time (or treatment period) for the soil within the rotary desorber. The screw feeder will be calibrated using both NCBC and JI soil to establish the relationship between rotational speed and mass flow rate. This will serve as a guide for adjusting and monitoring the soil feed rate. The actual feed rate will be measured by weighing the soil as it is added to the feed hopper and recording the time at the start and conclusion of the test. The screw conveyor speed will not be adjusted during a test.

The soil temperature within the desorber will be measured continuously using an electronic strip chart recorder having readable range of 0-1000°C.

Soil and gas temperatures will be measured at three known locations along the length of the desorber.

The time will be measured using a digital quartz clock mounted on the process control panel. All data will be recorded with the appropriate time.

The quantity of solvent will be measured using a digital electronic scale. The vent gas flow will be measured using a calibrated dry gas meter.

Samples will be taken for two purposes. Verification samples will be taken and analyzed by the analytical verification contractor. Process samples will be either splits of these samples or they will be taken by the ITC operators according to the prescribed Sampling and Analysis Plan.

Sampling of the soil after (and before) treatment will be performed by compositing several aliquots removed from the soil container from different random locations, both vertically and horizontally. The detailed Sampling and Analysis Plan will specify the exact sampling protocol.

Sampling of the vent gas will be done by the verification contractor using a method to be specified by the Sampling and Analysis Plan implemented by that contractor.

Sampling of the solvent after (and prior to) photolysis will be done by draining sufficient liquid through the designated sampling connection after first flushing the connection with at least three volumes of fluid. The solvent within the photolysis system will be thoroughly blended by recirculation and agitation prior to acquiring the sample. Additional sampling protocol will be given in the Sampling and Analysis Plan.

Sampling of the treated soil, solvent and vent gas will be done at the time specified by the ITC Project Leader and agreed to by the EG&G Idaho, Inc. site manager.

Sample Custody

After verification samples are taken from the thermal desorption/UV photolysis pilot unit, the verification contractor is responsible for sample documentation, preservation, chain of custody, and transfer of custody to the verification analytical laboratory. For process monitoring samples, ITC's quality assurance coordinator will be responsible for these activities, interfacing with ITC's Knoxville analytical laboratory and the project analytical QA/QC coordinator.

Calibration Procedures and Frequency

The scale used to weigh soil feed (and treated soil) and photolyzed (and unphotolyzed) solvent will be calibrated on site prior to the initial test using standard weights according to the manufacturers specifications. The calibration will be checked after several tests and again prior to the first test at JI. The timer will be checked prior to the initial test against standardized time over a period of at least 24 hours.

The dry gas meter used to measure vent gas flow will be calibrated prior to the initial test using a standardized wet test meter over the expected range of interest.

The temperature monitoring system for the desorber unit (and other recorded process temperatures will be calibrated by inputting a millivolt signal to the thermocouple convertor and recorder which corresponds to a given temperature signal according to ANSI Standard Thermocouple Tables. The output signal is then adjusted to a proper temperature reading. Calibration of the temperature recorder will be checked after transport to JI. Thermocouples will be calibrated initially against an NBS traceable termocouple over the temperature range of interest.

Analytical Procedures

No on-stream process analysis will be performed. EPA standard analytical procedures and associated QA/QC will be used for quantitative determination of 2,3,7,8-TCDD (CLP) and 2,4-D/2,4,5-T (SW846-8150) in process samples of soil.

Data Analysis, Validation, and Reporting

Performance evaluation of the process is determined by the concentration of dioxin remaining in the treated soil and secondly by the concentration of 2,3,7,8-TCDD and quantity of photolyzed solvent and vent gas. Treatment or removal efficiencies will not be calculated by ITC from this data except as an immediate aid in evaluating and understanding the process operation on site.

As indicated in Volume 6, the verification contractor is responsible for validation of process performance, and a seperate QA/QC plan will be prepared to define data analysis and validation. Verification contractor data will be analyzed and used by EG&G Idaho, Inc. to determine overall technology performance.

Validation of soil processing rates (and respective residence times) will be provided by comparison of feed soil mass versus treated soil mass, allowing for expected weight loss due to moisture and other volatile materials as determined in laboratory studies with the same soil. The feed rates calcuated from the screw feeder calibration curves will serve as another comparison.

Desorber temperatures will be validated by comparison and evaluation of the six thermocouple readings inside the desorber and the several thermocouple readings in the furnace section.

Vent gas flow measured by the dry gas meter will be compared to instantaneous flow readings of the calibrated gas rotometer upstream which is used for process control. This flow will also be validated during the official verification contractor gas sampling period when a second calibrated gas flow meter will be on-line.

Validation of photolyzed solvent volume will be done by comparison with the initial solvent charge to the final volume. Losses in the vent gas are projected to be negligible and allowance will be made for sample quantities removed from the system during the run.

VOLUME 4

SOIL PREPARATION

CHAPTER 1: WORK PLAN

For the thermal desorption/UV photolysis and the Advanced Electric Reactor (AER) pilot units, soil excavated from selected site "hot spots" (selected by USAF and EG&G Idaho, Inc.) will be processed prior to being treated. The thermal desorber feed screw conveyor cannot pass soil lumps larger than 1/2 in. due to mechanical clearances. The AER requires finely ground soil to properly operate. The sequence of preparing the soil is illustrated in Figure 1.

A. At MCBC, about 2,500 lbs of soil will be prepared for thermal desorption and 1,200 lbs for the AER, to enable the designated number and duration of tests to be made. The soil will be transferred manually between each step (e.g., shovel, bucket, wheelbarrow, drum).

An existing roofed, concrete pad located on the contaminated area will be temporarily modified to serve as a suitable processing area. Temporary walls will be fabricated from lumber and plastic sheeting to prevent wind and rain from entering the sides of the structure. The walls will have sufficient, appropriately spaced openings to provide flow-through ventilation. A door will enable passage of materials and personnel. The interior concrete floor (34 ft x 41 ft) will be laid out to accommodate the jaw crusher and pulverizer, various empty or full containers of soil, and an isolated drying area. Access to the building will be restricted to those employees involved in the soil processing. The building will not be used for storage of any chemicals or solvents used for the process testing. Electrical power will be supplied to the building by a temporary 110-volt cable from a power pole adjacent to the SE corner of the site.

Soil from the designated test pile adjacent to the building will be transferred into the building and processed through the jaw crusher. This 3-HP unit can accept up to 2-3/4 in. x 4 in. soil lumps and will produce material having a maximum particle size of 1/8 in. to 1/2 in. depending on machine setting.

The jaw crusher is mounted on a platform which allows drums to be placed underneath the discharge. A "sock" will be used to direct the material into the drum, and a "skirt" will be put in place around the drum to further control fugitive dust. Each drum will be partially filled with 400-600 lbs of soil, for a total of 2,700 lbs. or 8 drums.

Two drums (1,200 lbs) of the crushed soil will be transferred to the drying area (approximately 13 x 13 ft), where it will be carefully spread out to a depth of about one inch. This material will be allowed to air dry for several days, with periodic gentle raking to achieve a low moisture level (e.g., <2%). (This step would not be required if the crushed soil was determined to be sufficiently dry.) The dried soil will be carefully placed in containers and taken to the pulverizer where it will be reduced to less than 35 mesh. The pulverizer operation

will be similar to that described above for the crusher. The pulverized soil will be collected in small containers which will be carefully transferred and emptied into the AER feed hopper. Each container will be weighed before transfer and a cumulative weight recorded. The hopper will then be sealed, the exterior surfaces decontaminated, and the entire hopper lifted and transported to the AER facility using a portable crane. Samples of the soil representing the feed to the AER will be taken during or after the hopper is filled according to the sampling and analysis plan of the verification contractor.

The 5-6 drums of crushed soil to be used for the thermal desorber will be transferred into a small cement mixer or blender to achieve a uniform feed mixture for each test run. The blended soil will be placed back in the drums, sealed and transported to the thermal desorber.

After all soil preparation has been completed, the floor of the building and the equipment will be cleaned to remove dust. At the conclusion of the on-site activity, the equipment will be moved out of the building and thoroughly decontaminated. The plastic sheeting and lumber will be disassembled, properly containerized, and labeled, and shipped off site for disposal in accordance with all regulatory requirements.

B. At JI, only soil (coral) for the thermal desorption/UV photolysis pilot unit is required, or about 3,000 lbs. This preparation will be performed in an enclosed area by the jaw crusher and handled as described above. Following soil preparation, the equipment will be decontaminated and the enclosure removed as stated above.

Soil preparation has the potential for generating fugitive dust. To minimize dust generation and to prevent airborne transport from the work area, a number of provisions have been made, most of which have been identified above, but are summarized as:

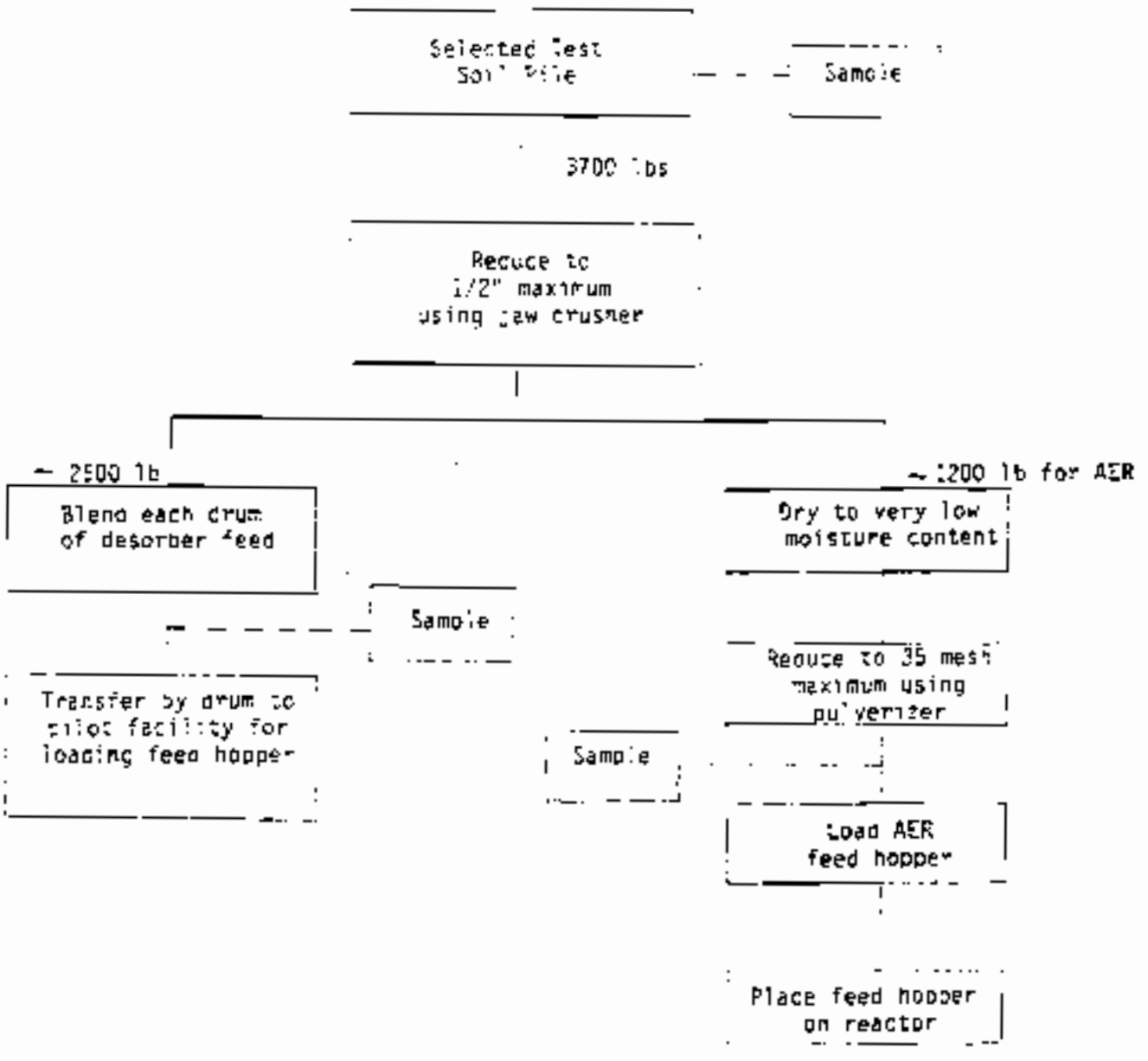
- Enclosure of the processing activities
- Careful transfer of soil in containers
- Secondary enclosure/isolation of the jaw crusher and pulverizer
- Cleaning of materials prior to removing from enclosed area.

Safety precautions to be used during soil preparation to protect the workers are identified in the Health and Safety Plan, Volume 2, Chapter 2, and are summarized as:

- Air-supplied respirators required
- Guards on machinery
- Lock-out/red tag procedures during maintenance or inspection of machinery
- Well laid out work area and limited worker access
- Use of hearing protection if deemed necessary during machinery operation.

Figure 1

SOIL PROCESSING BLOCK FLOW DIAGRAM



VOLUME I

SCOPE OF WORK

for

USAF SITE DEMONSTRATION:
ENVIRONMENTAL RESTORATION TECHNOLOGY

THIRD PARTY VERIFICATION

by

EG&G Idaho, Inc., Prime Contractor
Idaho National Engineering Laboratory

SCOPE OF WORK

for

USAF SITE DEMONSTRATION:
ENVIRONMENTAL RESTORATION TECHNOLOGY

SAMPLING AND ANALYSIS

I. INTRODUCTION

EG&G Idaho, Inc., is responsible for conducting a "USAF Site Demonstration: Environmental Restoration Program." The purpose of the program is to determine the most appropriate and available technology to reduce Herbicide Orange derived tetra, penta, and hexachlorodibenzo-p-dioxins and dibenzofuran soil contamination to less than 1 ppb at former United States Air Force storage sites. The demonstrations (more than one is contracted) will be conducted at two sites: Johnston Island (JI), in the Pacific Ocean and the Naval Construction Battalion Center (NCBC) at Gulfport, MS.

The major components of the program are selecting a technology(ies), obtaining permits/approvals, site demonstration, third party verification, and reporting of the results. EG&G will subcontract the site demonstration(s) and a third party verification. This scope of work covers only the third party verification; which includes sampling and analysis to provide the data for evaluation of the technology meeting the restoration criteria.

II. BACKGROUND

Johnston Island

Johnston Atoll, a coral reef surrounding the land masses of JI and three small islets, lies approximately 717 nautical miles southwest of Honolulu. It is a possession of the United States and is controlled by the Field Command of the Defense Nuclear Agency. As such, the atoll is normally closed to the public. All visiting personnel must be cleared by security prior to arrival. This is coordinated with the U. S. Air Force by EG&G.

JI is rectangular in shape, about two miles long and one-half mile wide with an average elevation of seven feet above sea level. Most of the coastline of the island is artificial, consisting of stone and concrete facings built to form a low sea wall. In 1942, the island occupied an area of 60 acres and has been expanded to its present 626 acres using local dredged materials.

Four acres of JI served as a storage area for 1.27 million gallons of herbicide orange returned from South Vietnam. The 4-acre storage site has been sampled several times, with the highest level of dioxin detected in soil being 450 ppb. Three, of approximately 30 soil sampling locations, exceeded 100 ppb. The six acres surrounding the storage area are also contaminated, but only one of approximately 25 soil samples exceeded 1 ppb. The storage site material is crushed coral. Therefore soil samples can be expected to be coral, Herbicide Orange, its derivatives, and dioxins, and furans.

JI is serviced by Continental Airlines with Monday, Wednesday and Friday departures from Honolulu. There is one return flight weekly leaving on Wednesdays.

Weather conditions at Johnston Island include temperature ranges of 85-100°F for the daily high and 65-80°F for the daily low. Humidity varies from approximately 50 to 90 percent. Mean wind speed is approximately 15 mph. A fall rainy season will average 50-65 percent of possible sunshine, with about 2-2.5 inches of rain each month.

The island houses over 300 military and civilian personnel, and all normal services are provided by a site services contractor.

Naval Construction Battalion Center

The NCBC is located near Gulfport, MS, approximately 2 miles from the Gulf of Mexico and occupies a land area of several square miles. The NCBC is approximately 20 feet above sea level. The soil is sand to sandy loam, intermixed with some clay.

Approximately 12 acres at the NCBC served as a storage site for 0.85 million gallons of Herbicide Orange. The "old" storage site was stabilized with portland cement approximately 20 years ago. The stabilized soil provided a hardened storage area for heavy supplies and equipment. Over the years, additional fill material (shell, rock, asphalt, road oil, and soil) was added to the storage area, creating a diverse soil matrix. Soil samples can be expected to contain all of these components in addition to Herbicide Orange, dioxins, furans and other Herbicide orange components.

During 1980, retention basins were constructed on the storage site to prevent the migration of dioxin-contaminated soils off-site. Currently, the Herbicide Orange storage site is a restricted area and is not used. All soil samples collected on the storage area have been contaminated with dioxin in excess of 1 ppb and levels to 263 ppb.

The average daily maximum and minimum temperatures are 85°F and 45°F. The wind speed average is 12-15 mph and humidity ranges from 35 to 85 percent.

III. SAMPLING AND ANALYSIS PLAN

The technology demonstrations will be performed at test plots selected by EG&G Idaho. These test plots will be located at Johnston Island, in the Pacific Ocean, and the NCBC base at Gulfport, MS. Depending on the technology demonstrated, the test plot size will vary but is not expected to exceed an area of sixteen hundred square feet (40 x 40 foot area). Since more than one technology will be demonstrated, test plots will be appropriately selected to provide non-interference between the demonstration subcontractors.

The technologies to be demonstrated are:

1. Thermal desorption followed by ultra-violet light destruction. (For sample requirements see Appendix A.)

   A. Thermal desorption in a heated chamber with the organic vapors purged by an inert gas.

   B. Gas scrubbing with an organic solvent.

   C. Ultraviolet light destruction of the chlorinated compounds in the solvent stream.

2. In-situ treatment with an alkali metal polyglycoxide reagent with additives (AMPA). There will be four plots approximately 10 x 10 feet as follows: (For sample requirements see Appendix A.)

   A. Control plot - no treatment.

   B. AMPA application plot: Surface treatment with reagent.

   C. Excess AMPA application (Penetration Test).

3. Surface AMPA application and subsurface injection.

2. Treatment of soil material in an electric arc reactor. (For sample requirements see Appendix A.)

   Soil and an inert gas are fed to an electrical arc furnace operating in excess of 4000°F. Treated soil is cooled and discharged, while the gas stream passes through a particulate removal unit, scrubber, and activated carbon prior to exhaust.

The demonstration subcontractors will provide EG&G Idaho detailed procedures that will govern the performance of the demonstration including equipment operation, materials handling, personnel and equipment safety, protection of the environment and the data to be obtained. EG&G Idaho will coordinate these procedures with the sampling subcontractor prior to performing the demonstration to obtain the necessary samples and determine equipment interfaces. However, it can be noted from the technologies that air and gaseous effluent samples, in-place soil sampling, soil prepared for feed stock samples, treated soil samples, water and chemical samples will be required. It is anticipated that less than one-hundred (100) verification samples will be required; however, the number of analyses, and their identification can be determined by referencing Appendix A.

As presently scheduled, the demonstrations will begin at NCBC on or about June 3, 1985 and will be complete by July 12, 1985. The demonstrations at JI will start on or before August 15, 1985 and will be complete by September 30, 1985. Before treatment samples would be the week prior to demonstration and the after treatment samples would not be later than the week following completion. In all cases sample analysis is estimated to be complete and the data provided to EG&G Idaho, six (6) weeks after the sample is obtained. This estimate allows up to two (2) weeks for shipping.

The goal of each technology is to treat or clean the soil such that the following criteria are met:

1. Total isomers of tetra-, penta-, and hexachloro-dibenzo-p-dioxin and dibenzofuran equal to, or less than, 1ppb.

2. Carcinogenous organics (CAG list) equal to, or less than, 10ppb.

3. All other organics (Priority Pollutant List) equal to, or less than, 1ppm.

4. Heavy metals, with particular emphasis on those listed in Table 1 of 40 CFR 261 and Priority Pollutant List and reported in mg/kg.

5. EPA Toxicity Test as required by analysis in No. 4 (Ref. 40 CFR 261).

The soil sample analysis must provide data for assessment in meeting the above criteria. This is clarified as follows for each criterion:

1. <u>Dioxins and Furans</u>

   The protocol for these components will be as follows:

   Sample pretreatment with dilute HCL, followed by Soxhlet extraction. High resolution GC/MS equipment is required. If further details of this procedure are required, contact EG&G Idaho.

2. CAG List

Composite "before" and one "after" sample will be scanned for those compounds listed in the modified CAG List (Appendix B). (If the materials are not present in the "before" sample, they will not be analyzed in the "after" sample for thermally treated soils.) This modified CAG list includes those compounds that are expected, such as creosote, but has deleted those compounds that are for practical purposes, not present, such as certain pharmaceuticals. Analysis will be according to existing, EPA approved procedures where available.

3. Priority Pollutant List

Composite "before" and one "after" sample will be scanned for those compounds listed in the modified Priority Pollutant List (PPL), Appendix C. (If the materials are not present in the "before" sample, they will not be analyzed in the "after" sample for thermally treated soils.) This modified list includes those compounds expected (such as those indigenous to Herbicide Orange, Appendix D). Analysis will be according to existing, EPA approved procedures.

4. Heavy Metals

Composite "before" and one "after" sample will be scanned for heavy metals indentified in Table 1 of 40 CFR 261 or the Priority Pollutant List. Results are to be reported in mg/kg for solids and mg/L for liquids. (If the materials are not present in the "before" sample, they will not be analyzed in the "after" sample for thermally treated soils.)

5. EPA Toxicity Test

EP Toxicity Test will be performed as for 2,4-D and 2,4,5T on all "before" samples and all "after" samples that have results exceeding Table 1, 40 CFR values as analyzed (Reference Appendix D). In addition, the EP Toxicity Test will be performed for those components that exceed the listed value in Table 1, 40 CFR 261 as determined in the analysis performed in No. 3 and 4 above.

A separate analytical subcontractor will provide quality assurance and validation; however, the proposer should include in-house quality assurance plans associated with these analyses.

In addition to the soil analysis, the analysis of gaseous and liquid effluents will be required and existing approved procedures will be utilized. The proposer can expect to be requested to rerun some samples or analyze QA samples provided by the QA/validation subcontractor (less than 10% total samples).

IV. PROVIDED EQUIPMENT AND SERVICE

Lodging, cafeteria meals, and vehicles will be provided by EG&G Idaho via Holmes and Narver at Johnston Island. Water, 110 to 480 V power, and a "decon" trailer are available at the demonstration site at Johnston Island and NCBC. Lodging, meals, and vehicles at NCBC will have to be obtained by the subcontractor and are available in the local community of Gulfport, MS.

EG&G Idaho will have one person on site for the duration of the field efforts and that person will observe, direct, and insure procedural compliance of the demonstration and sampling effort. The EG&G Idaho representative will not, however, supervise subcontractor personnel. One Air Force representative will be on the site for the whole demonstration period and will provide all liason with the USAF, DNA, and NCBC, as applicable.

V. SUBCONTRACTOR-SUPPLIED EQUIPMENT AND SERVICE

The subcontractor shall provide trained sampling personnel to perform the sampling in accordance with the approved procedures. All necessary safety equipment, sampling equipment, materials, etc., are to be provided by the subcontractor. The subcontractor will also cover all costs of personnel travel, equipment, and shipping. The sampling subcontractor will cover the cost of providing appropriate sample shipping containers and the cost of shipping samples to the analytical laboratory. All samples are to be shipped Federal Express or equivalent.

At both locations, the subcontractor will identify hazardous wastes generated and the volume anticipated as a result of sampling. The subcontractor will provide approved containers for the hazardous waste, containerize it, label, remove from the case, and dispose of the hazardous waste by an identified, approved method.

VI. HEALTH AND SAFETY

The subcontractor shall be responsible for the health and safety of all their personnel and all related expenses. At all sites, Level C personnel protection is required for all activities that generate dust. All applicable EPA, OSHA, NIOSH, and DOA (for JI) safety procedures must be adhered to by the subcontractor. Permeable suits may be used on JI, but coated suits will be used at the NCBC.

The subcontractor will comply with the safety measures outlined in the approved procedures which will incorporate safety procedures at the Federal, State, and local level. The subcontractor will assure compliance with its safety and emergency procedures, and EG&G Idaho will monitor the subcontractor's compliance with same.

All subcontractor personnel involved in sampling activity must document attendance in a training program for hazardous material handling and safety procedures. The same individuals must also be given a physical examination by a qualified physician during the two-month period prior to initiation of field work and within one month after completion of field work. The subcontractor shall obtain EG&G Idaho approval in advance concerning the tests to be conducted in the physical examination. A final medical examination report covering the same tests, will be provided by the subcontractor to EG&G Idaho within two months of field work completion on all personnel involved in the field sampling effort.

VII. PUBLIC RELEASE OF PROJECT INFORMATION

Neither the subcontractor nor any personnel in the employ of the subcontractor shall release any information concerning this project to the public or the media. All requests for information are to be directed to the on-site EG&G Idaho representative. That representative will refer all requests to Mr Peter Wygatt, Director, Office of External Affairs, DOE-ID. Mr Wygatt will coordinate all releases with the USAF.

SAMPLING/ANALYSIS MATRIX

SAMPLE/ANALYSIS MATRIX

Process: Pre-Demo Feedstock Soil Preparation

Sample Matrix	Required Analyses
Ambient Air	Amount of Fugitive Dust

NOTE: Soil conditions may be such that this sample is not required.

SAMPLE/ANALYSIS MATRIX

Process: In-Situ Treatment

SAMPLE MATRIX	REQUIRED ANALYSES	DECTECTION LIMIT[a]
Soil, before treatment (4 samples each site, 8 total)	1. 2,3,7,8-TCDD; total isomers of tetra-, penta-, and hexa-chlorodibenzo-p-dioxin and chlorodibenzofuran	≤ 0.1 ppb
	2. Modified CAG List (App. B)	≤ 10 ppb
	3. Modified Priority Pollutants List (App. C)	≤ 1 ppm
	4. Organics indigenous to Herbicide Orange (App. D)	≤ 10 ppb
Soil, after treatment (4 samples each site, 8 total)	1. 2,3,7,8-TCDD and isomers of CDD and CDF as before.	≤ 0.1 ppb
	2. Modified CAG List (App. B)	≤ 10 ppb
	3. Modified Priority Pollutants List (App. C)	≤ 1 ppm
	4. Organics indigenous to Herbicide Orange (App. D)	≤ 10 ppb
	5. Process byproducts (to be identified later and only analyzed from plot D)	≤ 10 ppb
Ambient Air (3 samples each site, 6 total)	1. Fugitive Dust (obtained during soil handling - may be N/A)	amount generated
	2. Organics of the modified PPL (App. C)	≤ 1 ppm

SAMPLE/ANALYSIS MATRIX

Process: Thermal Desorb/UV Destruct

SAMPLE MATRIX	REQUIRED ANALYSES	DETECTION LIMIT[a]
Soil, before treatment (5 samples - NCBC, 7 samples - JI, 12 total)	1. 2,3,7,8-TCDD; total isomers of tetra-, penta-, and hexa-chlorodibenzo-p-dioxin and chlorodibenzofuran	≤ 0.1 ppb
	2. Modified CAG List (App. B)	≤ 10 ppb
	3. Modified PPL (App. C)	≤ 1 ppm
	4. Organics indigenous to Herbicide Orange (App. D)	≤ 10 ppb
Soil, after treatment (5 samples - NCBC, 7 samples - JI, 12 total)	1. 2,3,7,8-TCDD and isomers of CDD and CDF as before	≤ 0.1 ppb
	2. Modified CAG List (App. B)	≤ 10 ppb
	3. Modified PPL (App. C)	≤ 1 ppm
	4. Organics indigenous to Herbicide Orange (App. D)	≤ 10 ppb
	5. Process byproduct (to be identified later)	≤ 1 ppm
Scrubber/Quench Liquid (5 samples - NCBC, 7 samples - JI, 12 total)[b]	1. 2,3,7,8-TCDD and isomers of CDD and CDF as above	≤ 0.1 ppb
	2. Modified CAG List (App. B)	≤ 10 ppb
	3. Modified PPL (App. C)	≤ 1 ppm
	4. Organics indigenous to Herbicide Orange (App. D)	≤ 10 ppb
	5. Suspended solids content	Amount present

Process: Thermal Desorb/UV Destruct (continued)

SAMPLE MATRIX	REQUIRED ANALYSES	DETECTION LIMIT[a]
Effluent Water (5 samples - NCBC, 7 samples - JI, 12 total)[b]	1. 2,3,7,8-TCDD and isomers of CDD and CDF as above	≤ 0.1 ppb
	2. Modified PPL (App. C)	≤ 1 ppm
	3. Hydrocarbon used as Scrubber/Quench Liquid	≤ 1 ppm
	4. Suspended solids content	Amount present
	5. Total amount of water	Amount present
Solids from Scrubber Liquid and/or Water Phase (5 samples - NCBC, 7 samples - JI, 12 total)[b]	1. 2,3,7,8-TCDD and isomers of CDD and CDF as above	≤ 0.1 ppb
	2. Modified PPL (App. C)	≤ 1 ppm
	3. Hydrocarbon used as Scrubber/Quench Liquid	≤ 1 ppm
	4. Total amount	Amount present
	NOTE: Depending upon the total amount of solids recovered and the method of disposal, they may have to be considered as treated soil and analyzed accordingly.	
Carbon from Water Filter Bed (5 samples - NCBC, 7 samples - JI, 12 total)[b]	1. 2,3,7,8-TCDD and isomers of CDD and CDF as above	≤ 0.1 ppb
	2. Modified PPL (App. C)	≤ 1 ppm
	3. Hydrocarbon used as Scrubber/Quench Liquid	≤ 1 ppm
	4. Total amount of carbon	Amount present
	NOTE: If significant levels of organics are found more extensive analysis of the sample will be required.	

Process: Thermal Desorb/UV Destruct (continued)

SAMPLE MATRIX	REQUIRED ANALYSES	DETECTION LIMITS
Vent Gas(5 samples - NCBC, 7 samples - JI, 12 total)	1. 2,3,7,8-TCDD and isomers of CDD and CDF as above	≤ 0.1 ppb
	2. Volatile organics	≤ 1 ppm
	3. Gas composition and molecular weight	N/A
	4. Flow rate	N/A
	5. Hydrogen chloride	≤ 1 ppm
	6. Particulate loading	0.0001 gr/scf
Carbon from Gas Filter Bed (5 samples - NCBC, 7 samples - JI, 12 total)[2]	1. 2,3,7,8-TCDD and isomers of CDD and CDF as above	≤ 0.1 ppb
	2. Modified CAG List (App. B)	≤ 10 ppb
	3. Modified PPL (App. C)	≤ 1 ppm
	4. Organics indigenous to Herbicide Orange (App. D)	≤ 10 ppb
	5. Hydrocarbon used as Scrubber/Quench Liquid	≤ 1 ppm
	6. Total amount of carbon	Amount present
Carrier Gas	NOTE: It is assumed that the system will be purged at the end of the trial to vent the potentially contaminated carrier gas. Otherwise, the gas will have to be sampled and analyzed as is the vent gas above.	

SAMPLE/ANALYSIS MATRIX

Process: Electric Arc Reactor

SAMPLE MATRIX	REQUIRED ANALYSES	DETECTION LIMIT[a]
Soil, before treatment (3 samples total)	1. 2,3,7,8-TCDD; total isomers of tetra-, penta-, and hexa- chlorodibenzo-p-dioxin and chlorodibenzo-furan	≤ 0.1 ppb
	2. Modified CAG List (App. B)	≤ 10 ppb
	3. Modified PPL (App. C)	≤ 1 ppm
	4. Organics indigenous to Herbicide Orange (App. D)	≤ 10 ppb
Soil, after treatment (3 samples total)	1. 2,3,7,8-TCDD and isomers of CDD and CDF as before	≤ 0.1 ppb
	2. Modified CAG List (App. B)	≤ 10 ppb
	3. Modified PPL (App. C)	≤ 1 ppm
	4. Organics indigenous to Herbicide Orange (App. D)	≤ 10 ppb
Baghouse Particulate (3 samples total)	1. Treated as soil, after treatment, and analyzed accordingly	
Off-Gas (3 samples total)	1. 2,3,7,8-TCDD and isomers of CDD and CDF as above	≤ 0.1 ppb
	2. Volatile organics	≤ [illegible] ppm
	3. Gas composition and molecular weight.	N/A
	4. Flow rate	N/A

Process: Electric Reactor (continued)

SAMPLE MATRIX	REQUIRED ANALYSES	DETECTION LIMIT
Off-Gas (continued)	6. Hydrogen chloride	≤ 1 ppm
	7. Carbon and Nitrogen oxides	≤ 1 ppm
	8. Particulate loading	.0001 gr/scf
Carbon from Gas Filter Bed (2 samples total)	1. 2,3,7,8-TCDD and isomers of CDD and CDF as above	≤ 0.1 ppb
	2. Modified PPL (App. C)	≤ 1 ppm
	3. Organics indigenous to Herbicide Orange (App. D)	≤ 10 ppb
	4. Hydrogen chloride	≤ 1 ppm
	5. Carbon and Nitrogen oxides	≤ 1 ppm
	6. Modified CAG List (App. B)	≤ 10 ppb
Scrubber Liquid (2-3 samples total)	1. 2,3,7,8-TCDD and isomers of CDD and CDF as above	≤ 0.1 ppb
	2. Modified PPL (App. C)	≤ 1 ppm
	3. Suspended Solids	Amount present

NOTES: a) Detection limit for each component analyzed.

b) Estimated totals; may change with process parameter changes.

MODIFIED
CARCINOGEN ASSESSMENT GROUP'S (CAG) LIST
FOR
HERBICIDE ORANGE CONTAMINATION

PERTINENT COMPOUNDS EXCERPTED FROM
THE CARCINOGEN ASSESSMENT GROUP'S (CAG)
LIST OF CARCINOGENS

1. Creosote

2. Polychlorinated Biphenyls (PCBs)*

3. 2, 3, 7, 8-Tetrachlorodibenzo-p-dioxin (TCDD)**

* Also listed in the Priority Pollutant List (PPL).

** Analyzed for independently as the compound of primary interest.

MODIFIED

PRIORITY POLLUTANT LIST

FOR

HERBICIDE ORANGE CONTAMINATION

MODIFIED PRIORITY POLLUTANT LIST

28 are purgeable organics

Acrolein
Acrylonitrile
Benzene
Toluene
Ethylbenzene
Carbon tetrachloride
Chlorobenzene
1,2-Dichloroethane
1,1,1-Trichloroethane
1,1-Dichloroethane
1,1-Dichloroethylene
1,1,2-Trichloroethane
1,1,2,2-Tetrachloroethane
2-Chloroethyl vinyl ether
1,2-Dichloropropane
1,3-Dichloropropene
Methylene chloride
Methyl chloride
Methyl bromide
Bromoform
Dichlorobromomethane
Chlorodibromomethane
Tetrachloroethylene
Trichloroethylene
Vinyl chloride
1,2-trans-Dichloroethylene
Chloroethane
Chloroform

45 are base/neutral extractable organic compounds

1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Hexachloroethane
Hexachlorobutadiene
Hexachlorobenzene
1,2,4-Trichlorobenzene
bis(2-Chloroethoxy) methane
Naphthalene
2-Chloronaphthalene
Isophorone
Nitrobenzene
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Fluorene
Fluoranthene
Chrysene
Pyrene
Phenanthrene
Anthracene
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Indeno(1,2,3-c,d)pyrene
Dibenzo(a,h)anthracene
Benzo(g,h,i)perylene
4-Chlorophenyl phenyl ether

4-Bromophenyl phenyl ether
bis(2-Ethylhexyl) phthalate
Di-n-octyl phthalate
Dimethyl phthalate
Diethyl phthalate
Di-n-butyl phthalate
Acenaphthylene
Acenaphthene
Butyl benzyl phthalate
3,3'-Dichlorobenzidine
Benzidine
bis(2-Chloroethyl) ether
Hexachlorocyclopentadiene
N-Nitrosodiphenylamine
N-Nitrosodimethylamine
N-Nitrosodi-n-propylamine
bis(2-Chloroisopropyl) ether

11 are acid extractable organic compounds

Phenol
2-Nitrophenol
4-Nitrophenol
2,4-Dinitrophenol
4,6-Dinitro-o-cresol
Pentachlorophenol
p-Chloro-m-cresol
2-Chlorophenol
2,4-Dichlorophenol
2,4,6-Trichlorophenol
2,4-Dimethylphenol

26 are pesticides/PCB's

α-Endosulfan
β-Endosulfan
Endosulfan sulfate
α-BHC
β-BHC
δ-BHC
γ-BHC (Lindane)
Aldrin
Dieldrin
4,4'-DDE
4,4'-DDD
4,4'-DDT
Endrin
Heptachlor
Heptachlor epoxide
Chlordane
Toxaphene
Aroclor 1016
Aroclor 1221
Aroclor 1232
Aroclor 1242
Aroclor 1248
Aroclor 1254
Aroclor 1260
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
Endrin aldehyde

13 are metals

Antimony
Arsenic
Beryllium
Cadmium
Chromium
Copper
Lead
Mercury
Nickel
Selenium
Silver
Thallium
Zinc

Miscellaneous

Total cyanides

MODIFIED LIST OF COMPOUNDS INDIGENOUS TO HERBICIDE ORANGE

MODIFIED SUMMARY OF COMPOSITION OF HERBICIDE ORANGE

COMPOUND

Dichlorophenol
Trichlorophenol
Trichlorganisole
Dichloro-Methoxyanisole
Butoxydichlorophenol
Butoxytrichlorophenol
Butyl-monochlorophenoxyacetate
Butyl-dichlorophenoxyacetate
Butyl-tricalorophenoxyacetate
Butyl-methoxy-dichlorophenoxyacetate
Octyl-dichlorophenoxyacetate
Octyl-dichlorophenoxypropionate
Octyl-trichlorophenoxyacetate
1,1-Dibutoxy-2-trichlorophenoxyethane
Octyl-methoxy-dichlorophenoxyacetate
Butyl-bis-dichlorophenoxyacetate
Butyl ester of bis Trichlorophenoxyacetic acid
Butyl ester of Trichlorophenoxy- (methoxy-dichlorophenoxy) -acetic acid
2,4-Dichlorochenoxyacetic acid (free acid)
2,4,5-Trichlorophenoxyacetic acid (free acid)

CHAPTER 1: QA/QC PLAN OUTLINE

The QA activities for the USAF Agent Orange Remedial Action Program can be broken down into two broad areas as follows: There are those activities grouped as "External QA" which refers to those activities which occur external to the analytical laboratory. In addition, there are those activities which are grouped as "Internal QA" which refers to those activities which occur within the analytical laboratory; i.e., they are the responsibility of the analytical laboratory. External QA activities can additionally be broken down or grouped according to those which are specific to the sampling effort and those which are specific to the analytical effort. The specific QA activities planned for the subject program can be outlined as follows:

External QA

A. Sampling Related

1. Sampling will be performed according to approved protocols where such are available; such protocols typically contain specific QA requirements.
2. Sampling will be performed in a manner to produce representative samples.

B. Analytical Related

1. Blank samples will be included on a selected basis and submitted for analysis.
2. Replicate samples will be taken on a selected basis and submitted for analysis.
3. A limited number of sample splits will be taken and submitted to the on-call laboratory for analysis.
4. All analytical data will be reviewed and validated for completeness, consistency and accuracy.

Internal QA

1. Approved analytical procedures will be used where applicable; such procedures typically contain specific QA requirements.
2. Internal standards and surrogate standards will be used where appropriate to provide checks on recoveries and method accuracy.
3. Duplicate analyses will be performed on selected samples for specific components.
4. Method blanks will be analyzed as appropriate.
5. Matrix spike samples will be prepared and analyzed on a selected basis.
6. All analytical data will be reviewed for completeness, consistency and accuracy before release by the laboratory.

VOLUME 6

FOLLOWUP AND REPORTING

The EG&G Idaho on-site representative will maintain a hardbound log book of all activities associated with the testing of the technologies. All routine operations will be logged in addition to anomalies, operational problems, and any incidents. All approvals obtained for changes or problem resolution will be noted as well as any notifications made for changes or emergency response actions.

Each of the subcontractors, IT Corporation and J. M. Huber Company, will provide daily information and a report following completion of the testing. These reports will be compiled with the analytical data and evaluations to provide the final report. Evaluations will include:

1. Evaluation of technologies and statistical analysis of test results

2. Scale-up factors of successful technology(ies) and cost estimates

3. Evaluation of environmental impacts from technology

4. Risk/benefit analysis

5. Conclusions.

A preliminary, or quick-look, report will be made based on preliminary estimates of the testing and available data. Monthly reports are submmitted describing the project activities during the past thirty (30) days, funds expended, milestones achieved, or variances (if any).

All reports are prepared by EG&G Idaho and submitted to Captain T. L. Stoddart, USAF Engineering Services Center. Copies of the preliminary report and the final report will be provided to the DOAG by the USAF. In addition, the DOAG will be informed of any emergency response activities that involve personnel injury, property damage, or unplanned releases to the environment.

The schedule of reporting is shown in Figure 1.

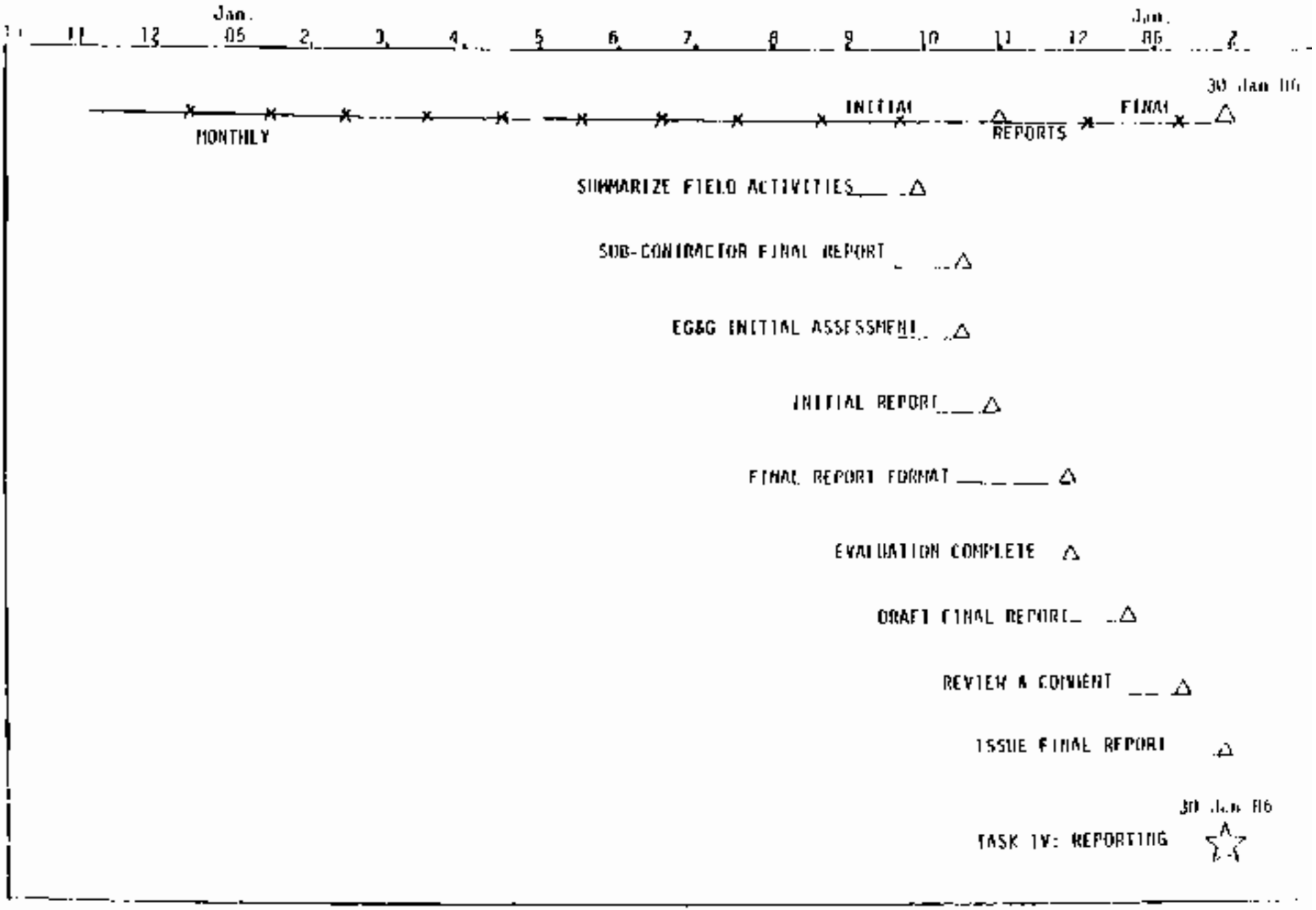



FIGURE 1: SITE SUMMARY - REPORTING