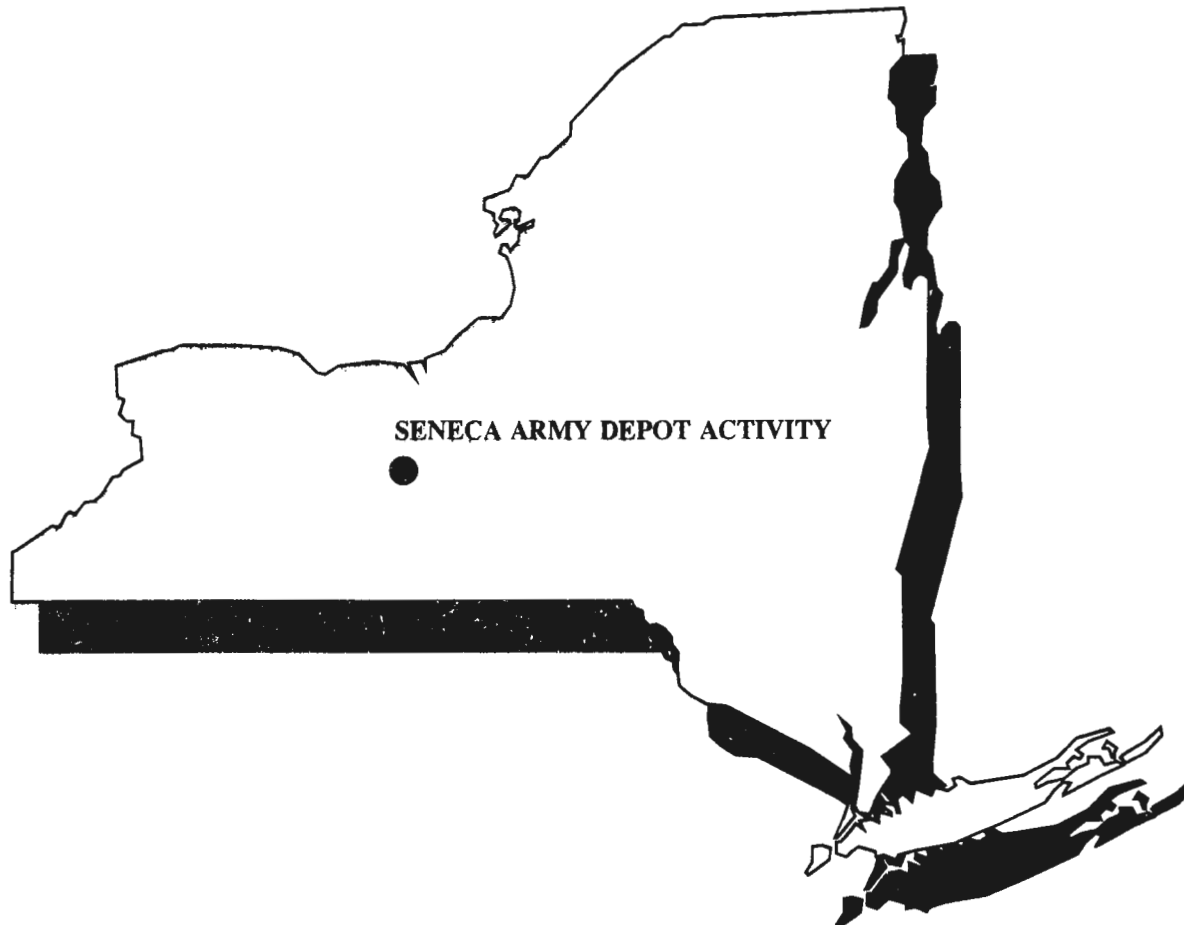
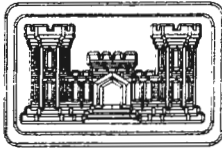


U.S. ARMY ENGINEER DIVISION  
HUNTSVILLE, ALABAMA

00698



**FINAL**

LOW TEMPERATURE THERMAL  
DESORPTION (LTTD) DEMONSTRATION STUDY WORK PLAN  
SENECA ARMY DEPOT ACTIVITY

CONTRACT # DACA87-95-D-0031  
DELIVERY ORDER #0013

JUNE 2000

**LOW TEMPERATURE THERMAL DESORPTION (LTTD)  
TREATABILITY STUDY WORK PLAN**

**SENECA ARMY DEPOT ACTIVITY  
ROMULUS, NEW YORK**

**LOW TEMPERATURE THERMAL DESORPTION  
TREATABILITY STUDY WORK PLAN  
FOR THE  
SENECA ARMY DEPOT ACTIVITY**

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- Appendix B Sample Calculations**
- Appendix C Laboratory Certifications**
- Appendix D ASTM Method C702-87 “Standard Practice for Reducing Field Samples of Aggregate to Testing Size”**
- Appendix E Response to Comments**



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## ACRONYMS AND ABBREVIATIONS

acfm	Actual cubic feet per minute
ACGIH	American Conference of Governmental Industrial Hygienists
AGC	Annual Guideline Concentration
APC	Air Pollution Control
APCD	Air Pollution Control Device
APE	Ammunition Peculiar Equipment
ASTM	American Society of Testing Materials
AWFMS	Automatic Waste Feed Monitoring System
AWFSO	Automatic Waste Feed Shut-off
Btu	British thermal unit
CD	Calibration Drift
CEM	Continuous Emissions Monitoring
cfm	Cubic Feet Minute
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CO <sub>2</sub>	Carbon Dioxide
DAS	Data Acquisition System
DF	Deactivation Furnace
DRE	Destruction and Removal Efficiency
dscf	dry standard cubic foot
dscfm	dry standard cubic foot per minute
DP	Differential Pressure
EC	Calibrator Error
EPA	Environmental Protection Agency
FID	Flame Ionization Detector
FM	Factory Mutual
FSG	Flame Safeguard Panel
GFC	Gas Filter Correlation
° C	degrees Celsius
° F	degrees Fahrenheit
hp	horsepower
hr	hour
HT	High Temperature
ID	Induced Draft
IR	Infrared
IRIS	Integrated Risk Information Service

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**ACRONYMS AND ABBREVIATIONS**

(Continued)

ITRC	Interstate Technology and Regulatory Cooperation
i/o	Input/output
LDL	Lower Detectable Limit
LD <sub>50</sub>	Lethal Dose – 50
Lpm	Liters per minute
LT	Low Temperature
LTTD	Low Temperature Thermal Desorption
MM5	Modified Method 5
NDIR	Non-Dispersive Infrared
NIOSH	National Institute of Occupational Safety and Health
NYSDEC	New York State Department of Environmental Conservation
O <sub>2</sub>	Oxygen
PAI	Predicted Annual Impact
PC	Personnel Computer
PCDD	Polychlorinated Dibenzo-p-Dioxins
PCDF	Polychlorinated Dibenzofurans
PCOS	Personal Computer Operatives Station
PEP	Propellant/explosive/pyrotechnic
PIC	Product of Incomplete Combustion
PLC	Programmable Logic Controller
POHC	Principal Organic Hazardous Constituent
ppm	Parts per million
PSM	Point Source Method
PST	Performance Specification Test
PV	Process Variable
PVC	Polyvinyl chloride
QAC	Quality Assurance Coordinator
QA/QC	Quality Assurance/Quality Control
RA	Relative Accuracy
RAC	Reference Air Concentrators
RCRA	Resource Conservation and Recovery Act
REC	Recommended Exposure Limit
RFD	Reference Dose
RPM	Revolutions Per Minute
RSD	Risk Specific Doses
RT	Response Time

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**ACRONYMS AND ABBREVIATIONS**

(Continued)

RTECS	Registry of Toxic Effects of Chemical Substances
scfm	Standard cubic feet per minute
SEAD	Seneca Army Depot
SGC	Short Term Guideline Concentration
SOP	Standing Operating Procedures
SP	Set Point
STEM	Sampling Train for Energetic Materials
TB	Trial Burn
TBP	Trial Burn Plan
TCE	Trichloro Ethylene
THC	Total Hydrocarbons
TLV	Threshold Limit Value
TSLoO <sub>2</sub>	Thermal Stability Low Oxygen
TSI	Thermal Stability Index
TWA	Time Weighted Average
UDRI	University of Dayton Research Institute
UHP	Ultra High Purity
USATHAMA	United States Army Toxic and Hazardous Material Agency
USGS	United States Geographic Service
VOST	Volatile Organic Sampling Train

## SECTION 1

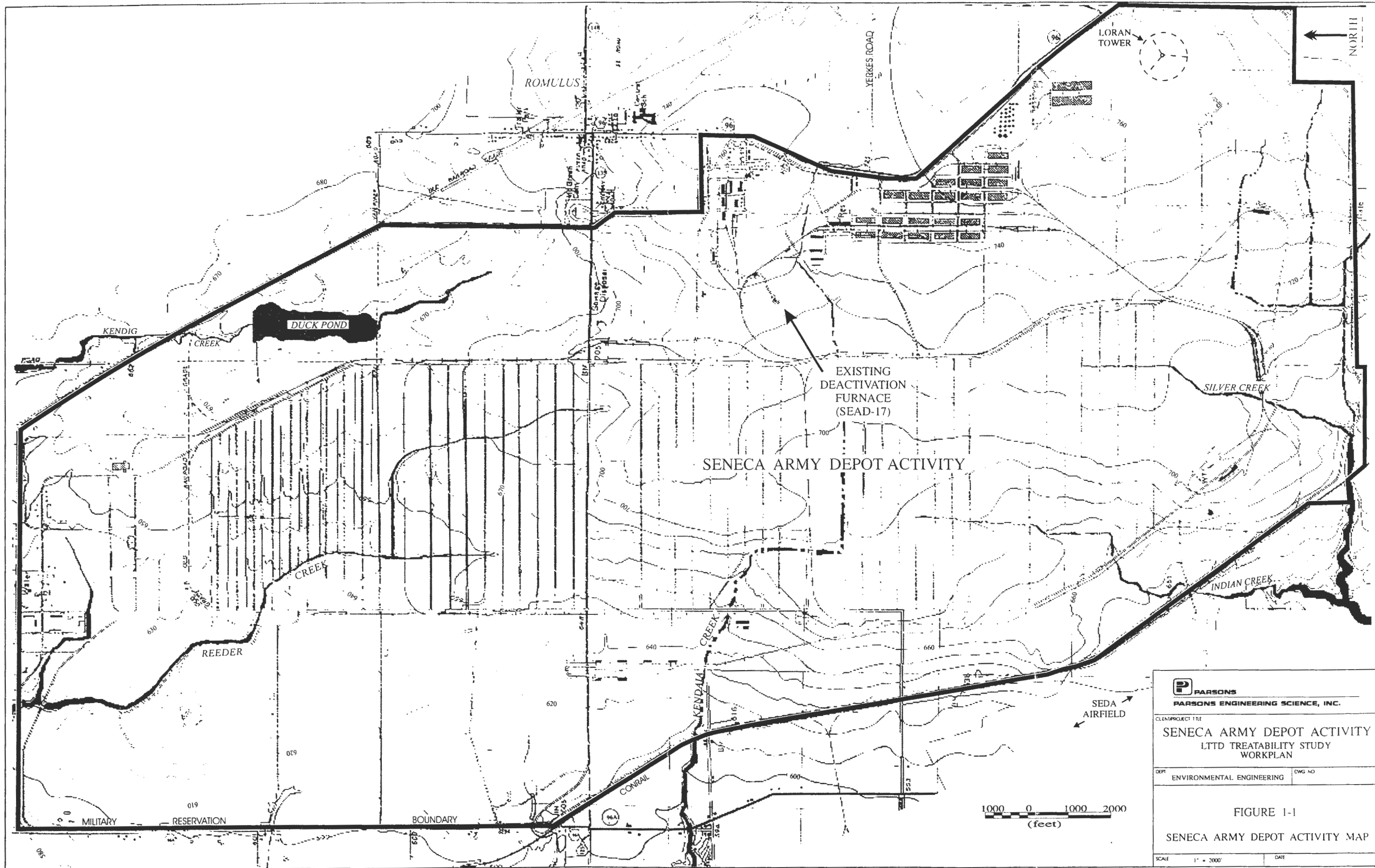
### INTRODUCTION

The US Army is proposing to conduct a treatability study to assess the potential of using an Army Peculiar Equipment (APE) 1236 deactivation furnace as a low temperature thermal desorption (LTTD) system for treating soil contaminated with volatile and semi-volatile organic compounds. The proposed treatability study will be conducted using the APE 1236 deactivation furnace located in SEAD-17 at the Seneca Army Depot Activity (SEDA). **Figure 1-1** shows the location of the deactivation furnace at SEAD-17 at SEDA.

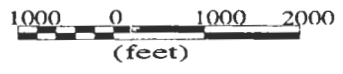
The existing APE 1236 furnace's waste feed system will be modified to permit soil to allow soil contaminated with volatile organic, semi-volatile organic, and low levels of organochlorine pesticides and polychlorinated biphenyl compounds to be fed to the LTTD system for thermal treatment. Sampling and analysis will be conducted on the system's solid waste feed and residue streams to document the system's ability to thermally remove the contaminants from the soil via volatilization. The system's ability to remove the organic contaminants will be determined by comparing the concentrations of contaminants found in the soil after treatment to those recorded for the waste feed input. Additionally, the composition of the waste gases and particulate matter liberated during the thermal treatment process (i.e., initial thermal desorption and subsequent combustion in the afterburner) and processed within the system's air pollution control train will also be documented via sampling and analysis of the waste gases and captured flyash. The system's destruction and removal efficiency will be evaluated by comparing the volatile and semi-volatile organic compound stack emissions with the material contained in the waste feed. Operational data will also be collected to define the economics of the treatment process.

The APE 1236 deactivation furnace was initially designed and intended for demilitarization of small-to-moderate sized munitions. As designed and constructed, the APE 1236 system included:

- a waste ordnance feed system to safely deliver unexploded ordnance to the rotary kiln for controlled processing (i.e., detonation),
- a rotary kiln or "popping" furnace where the aged ordnance was heated until they detonated,
- an afterburner where exhaust gases and fumes resulting from the detonation of the ordnance in the rotary kiln were re-combusted to render them inert and harmless,
- a train of air pollution control devices (APCDs) to capture and contain generated particulate and to cool combustion process exhaust gases prior to their discharge to the atmosphere, and
- a rotary kiln ash handling system to recover non-volatile or non-mobile residues remaining in the kiln subsequent to ordnance detonation.



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DEPT	DWG NO
ENVIRONMENTAL ENGINEERING	
<b>FIGURE 1-1</b> <b>SENECA ARMY DEPOT ACTIVITY MAP</b>	
SCALE	DATE
1" = 2000'	



The APE 1236 system located at SEDA is no longer being used to treat aged ordnance, as this mission is no longer conducted at the depot. This equipment is considered excess equipment. Additional consideration may be given to upgrade the APE 1236 system to expand the types of materials thermally processed in the unit if the proposed tests demonstrate that the system can be modified and used to successfully desorb and treat volatile organic, semi-volatile organic, organochlorine pesticide and polychlorinated biphenyl compounds from soil, and the economics of the treatment process are favorable.

The Army's preferred alternative for soil found at SEDA that contains chemicals at concentrations above regulatory limits is to treat the soil and to then reuse the treated soil as fill material. A less desirable alternative is to partially treat the soil to reduce the concentration of contaminants and transport (under appropriate manifests) it off-site for further treatment or disposal.

Specific goals of the proposed tests sequence include:

- LTTD treated soils are shown to contain concentrations of volatile organic, semi-volatile organic, organochlorine pesticide, and polychlorinated biphenyl constituents of concern lower than State of New York Technical and Administrative Guidance Memorandum (TAGM) levels;
- LTTD treated processed soils are proven to contain concentrations of Total Petroleum Hydrocarbons below 100 parts per million;
- exhaust gases from the APE 1236 system contain less than 100 parts per million by volume (100 ppm<sub>v</sub>) of carbon monoxide, corrected to a level of 7 percent (%) oxygen on a rolling hourly-average basis;
- exhaust gases from the APE 1236 system contain less than 0.05 grains per dry standard cubic foot (dscf) of particulate matter at 7% oxygen;
- exhaust gases contain less than 0.2 nanograms per dry standard cubic meter of Polychlorinated Dibenzo-p-dioxin and Polychlorinated Dibenzofuran (dioxin/furan) compounds corrected to 7% oxygen;
- Destruction and removal efficiency (DRE) determinations indicate that either a 99.99 percent efficiency is achieved in the process or that no organic compounds are detected at levels above detection limits in the stack gas released from the system;
- Operation of the APE 1236 does not result in excessive fugitive emissions from the process or from associated waste feed or waste residue handling operations;
- The APE 1236 system's Automatic Waste Feed Shutoff (AWFSO) system is fully functional and effectively works in the event of operating system upsets; and
- The APE 1236 system is shown to pose an economically viable alternative to treat soils containing TPH and semi-volatile organic compounds.

Based on a review of available literature, removals of greater than 60 to 70 percent can be achieved for

volatile, semi-volatile, organochlorine pesticide and PCB compounds and petroleum hydrocarbons in properly designed and operated LTDD systems. Since the APE 1236 was not initially designed specifically as a LTDD system, removal efficiencies of 60 – 70 % may not be achieved without further modification. One of the goals of these tests are to evaluate several operating conditions that will assist in determining how greater removal efficiencies can be achieved via operational changes or equipment modification.

This work plan describes the tests that will be conducted to demonstrate the performance of the APE 1236 system as an LTDD unit. The proposed work plan is consistent with the technical requirements developed and recommended by the Interstate Technology and Regulatory Cooperation Work Group for On-Site Thermal Desorption of Solid Media Contaminated with Hazardous Chlorinated Organics.

The Work Plan is divided into the following sections:

**Section 2 – Engineering Description:** Provides a detailed description of the major components and instrumentation used in the APE 1236 LTDD system. Operating procedures for soil treatment and automatic waste feed shut off (AWFSO) procedures are also included.

**Section 3 – Waste Characterization:** Provides a preliminary summary of the analytical data that are available for the waste soil that is proposed to serve as the feed stock for LTDD system. Soil handling and stockpiling procedures are also included.

**Section 4 – Demonstration Study Protocol:** Identifies the operating parameters for the different demonstration tests.

**Section 5 – Sampling and Analytical Plan:** Details the sampling and analytical procedures for the different demonstration tests. QA/QC procedures for sampling and analysis and water discharge requirements are also included. This section also lists the process conditions that will be monitored during the demonstration tests and outlines the report to be submitted to the regulatory agencies summarizing the test sequence.

**Section 6 – Operations Recordkeeping:** Identifies the information and data that will be recorded during the demonstration study.

**Section 7 – Quality Assurance/Quality Control Procedures:** Presents details of the procedures that will be used to ensure that demonstration data are of high and reproducible quality.

**Section 8 – Cost and Performance Report:** Provides an outline of the proposed report summarizing the

results and findings of the demonstration study.

**Section 9 – Health and Safety Plan:** Defines procedures that will be in place to safeguard the health and safety of workers involved in the demonstration study.

**Section 10 – Public Involvement and Participation:** Defines procedures that will be used to inform and solicit public participation in the proposed process.

**Section 11 – Test Sequence Schedule:** Defines a schedule for the events during the demonstration study.

**Appendices:** Large Process Flow and Instrumentation Diagrams (**Appendix A**); Provides sample calculations (**Appendix B**); laboratory certifications (**Appendix C**); ASTM test procedures references incorporated in the work plan (**Appendix D**); and responses to comment received on the prior draft work plan (**Appendix E**).



## SECTION 2

### ENGINEERING DESCRIPTION

This section provides a detailed engineering description of the APE 1236 deactivation system that will be converted to a Low Temperature Thermal Desorption (LTTD) unit and evaluated during the proposed test sequence.

The APE 1236 deactivation system was designed by the Ammunition Equipment Division (AED) at Tooele Army Depot. AED provides all design drawings for APE equipment used at all Army facilities country-wide, as well as providing all operator training and process trouble-shooting. The APE 1236 is a rotary kiln incinerator that has been upgraded to include an afterburner and additional instrumentation. The US Army previously employed the APE 1236 at SEDA to deactivate munitions.

This section provides the following information:

- Description of major components
- Description of instrumentation
- Operating procedures

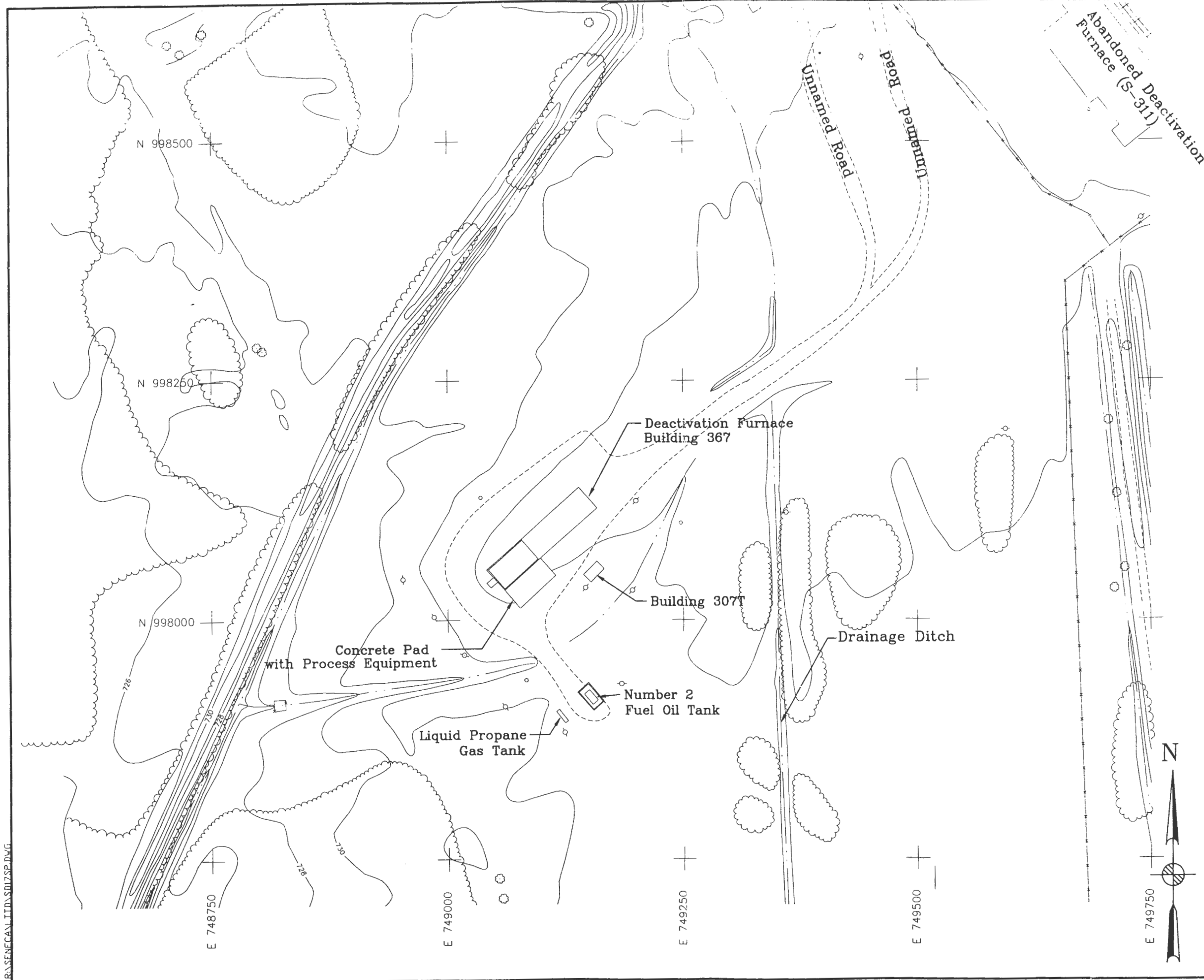
A site plan of the APE 1236 deactivation furnace is shown in **Figure 2-1**. An isometric of the APE 1236 system is shown in **Figure 2-2**. Other figures showing additional detail of the APE-1236 design are provided in **Appendix A** of this document.

#### 2.1 Description of Major Components

##### 2.1.1 Fuel and Waste Feed Systems

Number (No.) 2 fuel oil is used to fire the burners in both the kiln and afterburner, and propane is used as pilot fuel for the afterburner. The propane and fuel oil piping from the storage and pumping area to the system area are installed in a concrete ditch for leak containment. The propane storage tank is a 1,000-gallon horizontal drum mounted on a concrete pad. The appropriate valves, fittings, regulators, and piping are installed for propane pressure reduction and transportation to the afterburner burner pilot train.

The fuel oil storage tank is a 4,000-gallon drum mounted on a 24 x 14-foot rectangular, 4-inch thick concrete pad. The fuel oil storage tank pad has a 30-inch high wall on all sides for secondary containment. A pump with the required valves and piping, is used to transport the fuel oil to the APE 1236 area.



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**LEGEND**

	MINOR WATERWAY
	MAJOR WATERWAY
	FENCE
	UNPAVED ROAD
	BRUSH LINE
	LANDFILL EXTENT
	RAILROAD
	GROUND SURFACE ELEVATION CONTOUR
	ROAD SIGN
	DECIDUOUS TREE
	GUIDE POST
	FIRE HYDRANT
	MANHOLE
	COORDINATE GRID (250' GRID)
	POLE
	UTILITY BOX
	MAILBOX/RR SIGNAL
	OVERHEAD UTILITY POLE
	SURVEY MONUMENT



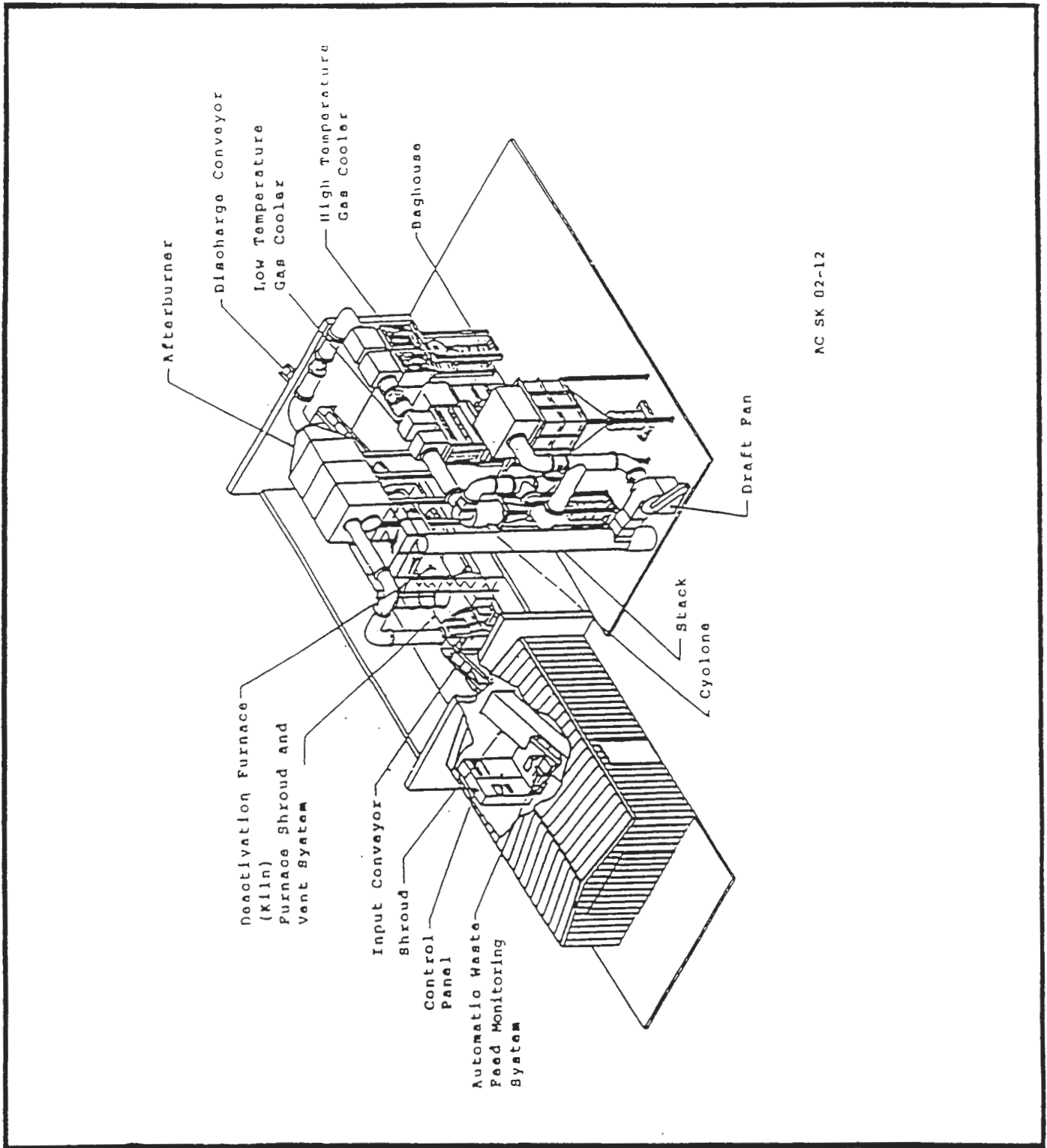
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 LTID DEMONSTRATION WORKPLAN**

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**FIGURE 2-1  
 SEAD-17 ACTIVE DEACTIVATION FURNACE  
 SITE PLAN**

SCALE **AS NOTED** DATE **JULY 1999** REV **A**



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Figure 2-2 APE 1236 - Isometric View

The waste feed system consists of the waste loading conveyor and the kiln feed conveyor. The waste loading conveyor transports the waste feed through the concrete kiln barrier wall to the kiln feed conveyor located inside the kiln area. The conveyor arrangement is shown in **Figure 2-3**.

The waste loading conveyor is 18-feet 6-inches long, 8-inches wide, and approximately 2-inches deep with flights spaced 18-inches apart. The conveyor is covered by a shroud. The Automatic Waste Feed Shut Off (AWFSO) system (described in **Section 2.3.3**) can disable the waste loading conveyor by terminating power to the drive motor.

The kiln feed conveyor is located within the kiln barrier walls. This conveyor transports the waste feed from the waste loading conveyor to the kiln feed chute. If the AWFSO system is activated, the waste loading conveyor stops but the kiln feed conveyor continues to run. This safety feature ensures that raw soil feed material will be loaded into the kiln once it reaches the proximity of the kiln feed chute.

The kiln feed conveyor is 6-feet long, 8-inches wide and approximately 2-inches deep with flights spaced 18-inches apart. The conveyor has a positive gear drive that is powered by an electric motor.

Modification to the APE 1236 is necessary to adapt this unit to feed soil rather than munitions for which it was designed. The original system loaded waste feed onto the waste loading conveyor in the feed room by the automatic waste feed monitoring system (AWFMS). The AWFMS consisted of a weigh scale and push-off system. This system was designed to weigh and load low weight munitions onto the waste loading conveyor.

A temporary feed system will be set up to pre-screen and feed the soil into the rotary kiln. The temporary soil feed system will consist of existing and rented equipment that will be brought to the site prior to the initiation of the test sequence. Rented equipment will include a powerscreen and an additional conveyor belt. The powerscreen will be used to screen the waste soil prior to processing to ensure that all fed material is smaller than two inches in diameter, and to provide a temporary storage hopper that will facilitate waste soil loading operations onto the conveyor belt. The additional conveyor belt will be used to transport the soil from the powerscreen hopper to the base of the waste loading conveyor that is inside the control room.

Soil feed materials will initially be loaded into pre-tared 55-gallon drums that will then be re-weighed. The weight difference will be recorded. The weighed soil will then be dumped onto the top of the powerscreen hopper where large agglomerates of soil will be broken or removed. Removed materials will be recovered and re-weighed to allow for the subtraction of their lost weight from the soil feed total. Lost weight will be recorded. Once the hopper is loaded, soil will empty out of the hopper onto the temporary conveyor belt

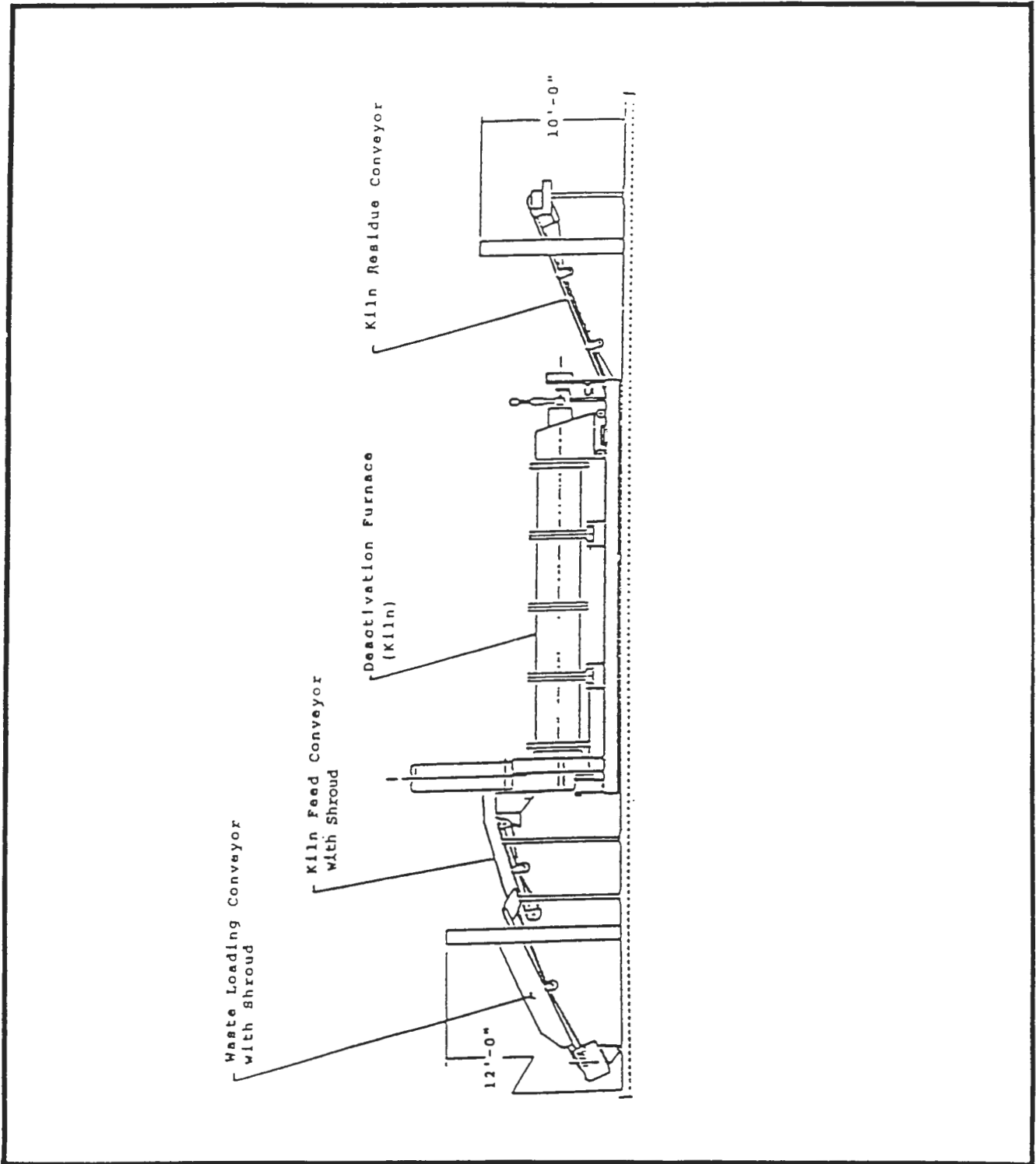


Figure 2-3 Input Conveyor Concept

that will transport the soil from the outside storage/processing location into the control room. The soil will dump from the temporary conveyor onto the waste loading conveyor, which in turn, will dump it onto the kiln feed conveyor. Soil remaining in the hopper or on the conveyors at the conclusion of each run will be determined at the end of the test period to allow for its subtraction from the total processed weight.

### **2.1.2 Rotary Kiln (Deactivation Furnace)**

The rotary kiln is designed to heat the waste soil feed materials to induce volatilization of volatile and semivolatile organic compounds. The heat required to promote volatilization is provided by fuel oil firing countercurrent to the direction of soil feed. Volatilized gases, aerosols, vapors and mists, and entrained ash and dusts exit the kiln adjacent to the waste material feed chute. Non-entrained residues are discharged at the burner end of the kiln. The kiln is shown on **Figure 2-4**.

The soil feed material is fed through the kiln toward the flame at the burner end by means of spiral flights that are integral components of the kiln casting. As the soil feed approaches the flame it is heated and the volatile and semivolatile organic compounds contained are vaporized (partially or fully, depending on compound, concentration, and mixing) and enter the combustion gas stream. The combination of the rotating action and the spiral flights located along the kiln walls provide physical separation and mixing of the soil feed as it moves through the kiln. The rotating speed of the kiln determines the residence time for the soil material in the furnace.

The kiln is 20 feet long with an average internal diameter of 30.5-inches. It is made of four, 5-foot long sections that are bolted together. The two center sections have a wall thickness of 3.25-inches and the two end sections have a wall thickness of 2.25-inches. The kiln is constructed of ASTM A217 chromium molybdenum steel for high strength and ductility at elevated temperatures. For additional personnel safety, the kiln is surrounded by barricade walls.

The kiln is equipped with a Hauck 783 proportioning burner installed in the breaching at the residue discharge end of the kiln. This is a distillate oil fired burner with a capacity of 3 million BTU/hr and a nominal turndown ratio of 4:1. Both atomizing air and combustion air are provided by a Hauck 5-horsepower (hp) centrifugal blower.

Fuel oil and combustion air are ratioed by links and levers connecting the fuel and air control valves. The control valves are operated by an actuator that receives a signal from the kiln exit temperature controller. The controller set point ranges from 250 degrees Fahrenheit (°F) to 900°F. The input to the controller is provided by a thermocouple located in the kiln exit duct.

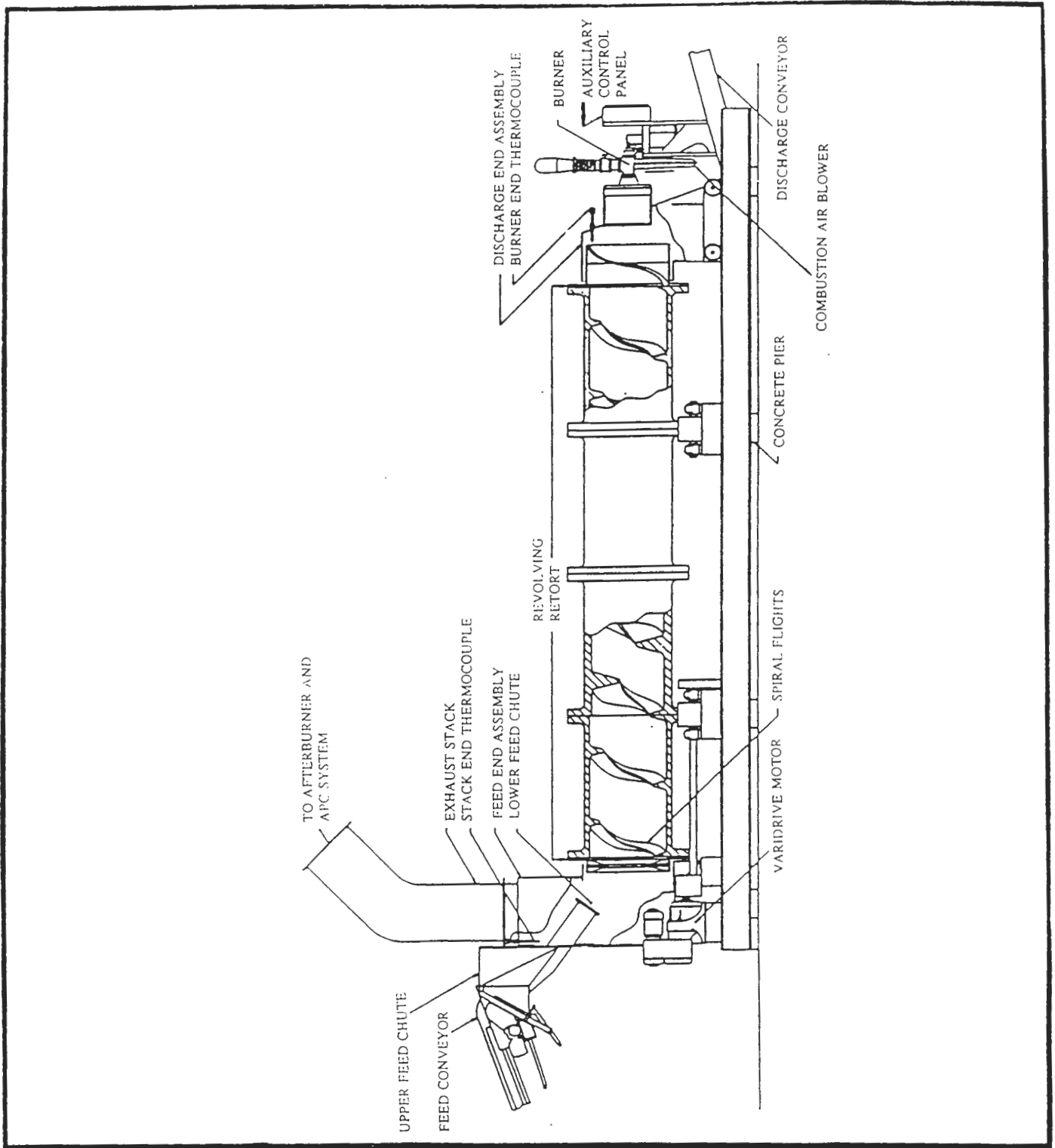


Figure 2-4 Deactivation Furnace

The combustion control supervisory system is a Factory Mutual (FM) approved flame safety system which includes the proper safety shut-off valves, pressure switches, pressure regulators, flame detector, and burner controller. (This is shown as the Flame Safeguard Panel, FSG on the drawing.) The burner must be ignited for waste soil materials to be fed to the rotary kiln.

The kiln is operated under a slight negative pressure (vacuum) to control and limit fugitive emissions. Typically, this pressure is -0.15 to -0.25 inches water column. The vacuum is produced by an Induced Draft (ID) fan that is located between the baghouse and the APE 1236's exhaust stack. The negative pressure in the kiln is determined by the gas flowrate and pressure drop through the air pollution control system and ID fan. A damper installed in the duct upstream of the ID fan is opened and closed by an electric actuator to control the gas flow rate and maintain the appropriate negative pressure. The kiln vacuum is an input to the AWFSO system. The input to the damper actuator is provided by the kiln pressure controller. The input to the pressure controller is a pressure (draft) transmitter measuring the kiln discharge pressure.

Fugitive emissions escaping the kiln are captured and controlled by a metal shroud that covers the entire kiln assembly including the feed chute and end plates. Ducts connect the shroud to the inlet of the combustion air blower for the kiln burner. The combustion air blower creates a negative pressure inside the shroud that pulls any fugitive emissions through the blower and discharges them into the kiln via the kiln burner. The shroud is fabricated from 11 gauge, A36 carbon steel. **Figure 2-5** depicts the fugitive emissions control system. This shroud does not extend over the discharge end of the kiln and is not required to do so. (Operating experience has shown that fugitive emissions are not a problem for the discharge end.)

The kiln is trunnion driven by an electric motor. The kiln must be turning for the AWFSO interlocks to clear, allowing waste soil to be fed into the APE 1236. The drive system can vary the kiln rotation speed from 0.5 to 4.5 revolutions per minute (rpm). Varying the kiln's rotational speed changes the amount of time (i.e., kiln residence time) required for material to travel through the kiln. Data presented in **Table 2-1** shows kiln rotation speed versus kiln residence time. [This table is based on actual testing conducted at Tooele Army Depot (Tooele UT). SEDA's deactivation furnace is identical in every respect to the APE system in place at Tooele.]

Residue from the kiln is removed by the kiln residue conveyor. The kiln residue conveyor transports the waste from the kiln through the barrier wall to a collection point. The kiln residue conveyor must be operational for the AWFSO interlocks to clear, allowing waste soil to be heated. This interlock prevents the build-up soil residues within the kiln.



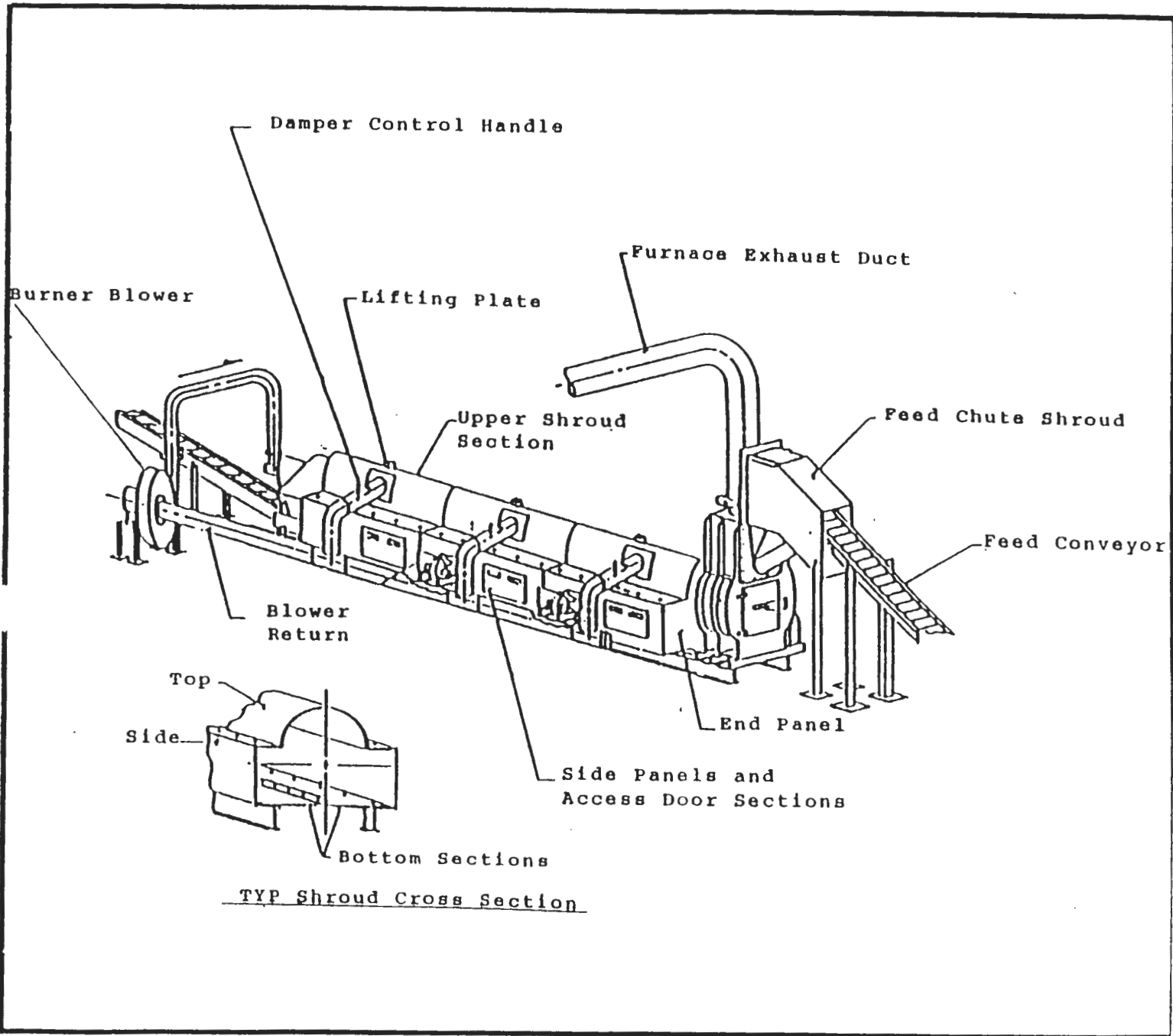


Figure 2-5 Fugitive Emission Control Concept

**TABLE 2-1**  
**KILN ROTATIONAL SPEED versus KILN RESIDENCE TIME**

<u>Kiln Speed (rpm)</u>	<u>Inert Material Kiln Residence Time (minutes)</u>
0.5	16.0
1.0	8.0
1.5	5.2
2.0	4.0
2.5	3.2
3.0	2.6
3.5	2.3
4.0	2.0
4.5	1.8

### 2.1.3 Afterburner

The kiln combustion gases are transported to the afterburner through a 24-inch diameter steel duct. Combustion gases and volatilized organic compounds previously contained in the soil feed materials enter the afterburner directly above the burner at the upstream end where they are mixed with, and heated by, gases from fuel oil combustion. The afterburner is designed to heat 4,000 standard cubic feet per minute (scfm) of combustion gas from 400-900°F to 1,200-1,800°F with a minimum gas residence time of one second. Operational experience has shown that the nominal maximum operating temperature of the afterburner is 1,600°F.

The afterburner is rectangular, with outer dimensions of 6-feet by 6-feet by 15 feet-long and with a transition cone at the discharge end. The afterburner is internally insulated with 8-inch thick, 12-pound/cubic foot ( $\text{lb}/\text{ft}^3$ ), ceramic fiber modules that are individually anchored to the afterburner casing. The ceramic fiber surface is coated with a rigidizer/surface coating which provides surface hardness and erosion resistance. The skin temperature remains below 150°F during normal operation. The inside cross-section of the insulated afterburner is 4-feet 8-inches by 4-feet 8-inches with a total internal volume of 390 cubic feet. The afterburner is equipped with a Hauck WRO-164 Wide Range burner. This burner is oil-fired with a nominal capacity of 8 million Btu/hr and a 10:1 turndown ratio.

Afterburner fuel oil and combustion air are ratioed by links and levers connecting the fuel and air control valves. The control valves are operated by an actuator that receives a signal from the afterburner temperature controller. The afterburner temperature controller setpoint ranges from 1,200-1,800°F. The input to the controller is provided by a thermocouple located in the afterburner exit duct.

The combustion supervisor system is a Factory Mutual (FM) approved flame safety system that includes the proper safety shut-off valves, pressure switches, pressure regulator, flame detector and burner controller. (This is shown as the Flame Safeguard Panel, FSG on the drawing.) The burner must be ignited before waste feed materials can be feed to the rotary kiln. The air blower is a Cincinnati Fan #HPF-7 capable of providing 1,600 scfm of air for both atomization and combustion.

### 2.1.4 High Temperature Gas Cooler

High temperature combustion gases exiting the afterburner flow through a 30-inch diameter stainless steel duct to the High Temperature (HT) gas cooler. The HT gas cooler is a gas-to-air, cross-current, forced air heat exchanger that reduces the temperature of the combustion gases to less than 850°F. The HT gas cooler is capable of cooling 4,000 scfm of combustion gas from 2200°F to 850°F. If the exit temperature exceeds 850°F, waste feed to the rotary kiln is automatically shut off. The HT gas cooler requires 25,400 cubic feet

per minute (cfm) of 100°F ambient air to cool the combustion gases.

The gas cooler consists of two sections, each containing 65 plates. The plates are 39-inches tall and 20.5-inches wide. The HT gas cooler is constructed of 310 stainless steel. Combustion gases enter the inlet plenum of the cooler and pass alternately downward and upward through the first and second sections and then exit through the outlet plenum. The heat exchanger plates are spaced so that the combustion gases pass on one side and the ambient cooling air passes on the other. There are a series of plates, a series of exhaust chambers, and a series of cooling chambers.

A 40-hp blower forces cooling air through the HT gas cooler. The blower is capable of providing 26,313 cfm of air at a static pressure of 5.2-inches water column. The amount of air delivered by the blower is determined by the HT gas cooler exit temperature. As the temperature changes, the output signal of the HT gas cooler temperature controller varies the damper on the blower inlet to control air flow. A thermocouple in the exit duct from the gas cooler provides the input to the HT gas cooler temperature controller.

The HT gas cooler is equipped with a sonic horn to remove particles from the exchanger plates. The horn emits sound pressure waves of sufficient vibrational energy to shear deposits from the surface of the plates, and it is operated by compressed air. The frequency of the sound waves and the duration of the cleaning cycle are adjustable from a local panel. Adjustments are made based on the temperature differential across the HT gas cooler. The sonic horn is an Envirocare #AH 30.

Particles and residue are removed from the HT gas cooler by a double chamber dumping valve. The valve has two gates that are driven by an electric motor. Only one gate may be opened at any time so the vacuum in the HT gas cooler is maintained.

### **2.1.5 Low Temperature Gas Cooler**

Combustion gases exit the HT gas cooler through a 24-inch diameter steel duct and enter the low temperature (LT) gas cooler. The LT gas cooler is a gas-to-air, cross-current, forced air heat exchanger that reduces the combustion gas temperature to less than 350°F. The LT gas cooler is capable of cooling 4,000 scfm of combustion gases from 900°F to 250°F. Waste feed to the rotary kiln is automatically shut off if the LT gas cooler exit temperature exceeds 350°F. The LT gas cooler requires 16,400 cfm of 100°F ambient air to cool the combustion gases.

The LT gas cooler consists of two sections containing 75 plates each. The plates are 50-inches tall and 26-inches wide. The LT gas cooler is constructed of carbon steel. Combustion gases enter the inlet plenum of the cooler and pass alternately downward and upward through the first and second sections and then exit

through the outlet plenum. Heat exchanger plates are spaced so that the combustion gases pass on one side and the ambient cooling air passes on the other. There are a series of plates, a series of exhaust chambers, and a series of cooling chambers.

A 20-hp blower forces cooling air through the LT gas cooler. The blower is capable of providing 17,054 cfm of air at a static pressure of 3.6-inches water column. The amount of air delivered by the blower is determined by the LT gas cooler exit temperature. As the temperature changes, the output signal of the LT gas cooler temperature controller varies the damper on the blower inlet to control air flow. A thermocouple in the exit duct from the gas cooler provides the input to the LT gas cooler temperature controller.

The LT gas cooler is equipped with a sonic horn to remove particles from the exchanger plates. The horn emits sound pressure waves with sufficient vibrational energy to shear deposits from the surface of the plates, it is operated by compressed air. The frequency of the sound waves and the duration of the cleaning cycle are adjustable from a local panel. Adjustments are made based on the temperature differential across the LT gas cooler. The sonic horn is an Envirocare #AH 30.

Particles and residue are removed from the LT gas cooler by a double chamber dumping valve. The valve has two gates that are driven by an electric motor. Only one gate may be open at any time so the vacuum in the LT gas cooler is maintained.

### **2.1.6 Cyclone**

Combustion gases exit the low temperature gas cooler and enter the cyclone through a 20-inch diameter steel duct.

The cyclone is a Ducon type VM model 700/150, size 165 with a 20-inch inlet and outlet. The cyclone is 43 inches in diameter and the inlet area is 1.65 square feet. The cyclone is fabricated from 0.1875-inch thick carbon steel.

Residue is removed from the cyclone collection hopper through an air tight slide gate valve. The slide gate valve is kept closed during operation and it is manually opened for clean-out after shutdown. The gas pressure drop across the cyclone at normal flowrates is 2- to 5-inches water column.

### **2.1.7 Baghouse**

Combustion gases leave the cyclone and enter the baghouse by a 20-inch diameter steel duct. The baghouse is a rectangular enclosure that measures 6 feet by 6 feet wide and 15 feet tall. It contains 100 bags that are

each 4.5 inches in diameter and 8 feet long. This results in a total filter area of approximately 950 square feet and an air-to-cloth ratio of 5.0. The bag material is Nomex felt and is silicone treated, heat set, and flame-proofed.

The dust laden combustion gas stream enters the baghouse near the bottom of a hopper where it is dispersed evenly along the rows of bags (**Figure 2-6**). The combustion gas flows up through the filter bags and collects in the clean gas plenum, or exhaust manifold. As particles build up on the bags, the porosity of the bags is reduced creating a higher differential pressure between the dirty side and the clean side of the bags. This increased pressure drop across the bags reduces combustion gas flow through the baghouse.

The magnitude of baghouse pressure drop increase is limited by periodically cleaning the bags. The baghouse has a jet-pulse cleaning system that operates by inducing momentary surges of high pressure air in the reverse direction to normal air flow. The backflow of high pressure air flexes the bags outward and dislodges the dust particles causing them to fall into the hopper below. The bag cleaning is controlled automatically by a timing device that actuates one of a series of valves at a preset interval to clean one row of filter bags at a time.

The discharge temperature of the baghouse is measured by a thermocouple installed in the duct downstream of the baghouse. This temperature is indicated and recorded at the main control panel. Additionally, a high temperature thermocouple at the baghouse exit activates an alarm at the main control panel if the gas temperature reaches 600°F (This temperature indicates a fire situation).

The Differential Pressure (DP) is also monitored across the baghouse with low and high DP alarms set at 2 inches and 6 inches water column, respectively. A DP below 2 inches indicates a ruptured bag, while a DP higher than 6 inches indicates excessive fouling of the bags.

The baghouse is equipped with isolation and bypass valves. The isolation valves are located in the duct immediately upstream and downstream of the baghouse. The bypass valve is located in the baghouse bypass duct. These three valves operate in unison, i.e., when the bypass valve is closed the isolation valves are open and vice-versa. The baghouse is bypassed only under the following conditions: (a) when the exit temperature measurement fails, (b) during high baghouse temperature, and (c) during startup to protect the bags from moisture condensation and corrosion. The bypass line and valves are interlocked with the AWFMS so that waste soil cannot be fed if the baghouse is bypassed.

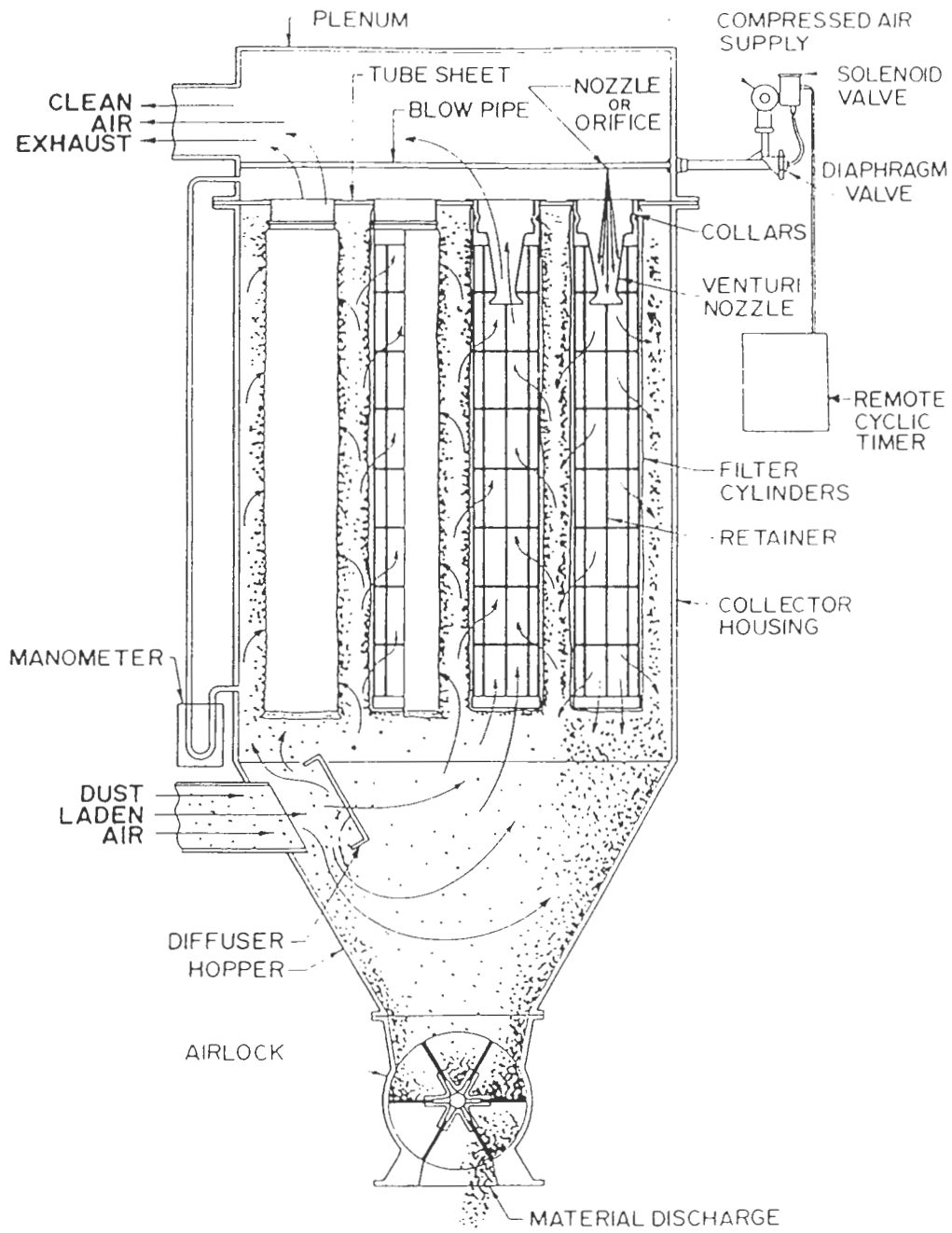


Figure 2-6 Baghouse Operation - Cutaway View

### **2.1.8 Induced Draft Fan**

Combustion gases are drafted through the entire APE 1236 system by the Induced Draft (ID) fan located downstream of the baghouse. The baghouse and ID fan are connected by a 20-inch diameter steel duct. Under normal operating conditions, the total system pressure drop is 25 inches water column at 4,000 scfm. The ID fan must be operating for the AWFSO interlocks to clear, allowing waste soil to be fed to the rotary kiln and heated.

The ID fan is belt driven by a 50-hp, 1,750 rpm electric motor. The capacity of the ID fan is 6,700 actual cubic feet per minute (acfm) at 30-inches water column. The ID fan is designed to operate at 300°F. The upper limit for the ID fan is 500°F.

A damper is installed in the duct upstream of the ID fan. This damper controls the amount of combustion gas that the fan pulls through the APE 1236 system. The damper is operated by an electric actuator that receives a signal from the kiln pressure controller. This loop is discussed in **Section 2.2.2** of this section.

### **2.1.9 Exhaust Stack**

Exhaust combustion gases from the ID fan are discharged into the exhaust stack and then to the atmosphere. The stack is 20 inches in diameter (outside diameter - OD) and 38-feet high.

The stack currently has four sets of sampling ports, and a fifth set will be added to support the stack sampling requirements for this treatability demonstration. Existing ports located at approximately 20 feet above grade are used for integral component continuous gas analyzers and gas velocity measurements. The gas analyzer port services the sampling system that supplies the continuous oxygen and carbon monoxide analyzers that are used to indicate APE 1236 system performance and are interlocked with the AWFSO. The gas velocity port accommodates probes that measure gas velocity, temperature and pressure in the stack. This information provides an indication of gas residence time in the APE 1236 system and is interlocked with AWFSO.

The stack has other existing ports at approximately 20 feet above grade which will be used for the proposed Volatile Organic Sampling Train sampling and verification continuous emission monitors that will be brought to the site (See additional discussion in **Sections 5.3.8** and **5.3.9**). A new set of ports will be added to the stack at an elevation of approximately 26.5 feet above grade to support the proposed extractive sampling for total particulates, semi-volatile organic compounds, and dioxins/furans.



## 2.2 Description of Instrumentation

### 2.2.1 Measurement Parameters and Methods

The following paragraphs discuss the different APE 1236 process parameters to be measured and the techniques employed to make the measurements.

Temperature is the most common process measurement. Temperatures throughout the APE 1236 system are controlled, recorded, indicated and alarmed. Type K (Chromel-Alumel) thermocouples are used for temperature measurement. . The temperature range encountered at the different measurement points depends on where the thermocouple is installed in the system. Thermocouples are installed in the duct downstream of each major system components. In addition, prior to this demonstration test, a thermocouple will be installed in the residue discharge chute where the treated soil residue exits the rotary kiln and passes to the kiln residue conveyor. This thermocouple will be used to monitor the exit temperature of the soil. Temperatures measured with this thermocouple will be recorded, and the values will be compared to direct measurements made using a thermometer for treated soil removed from the discharge conveyor belt at regular intervals.

Pressure and differential pressure (DP) are measured at various locations in the APE 1236 system. The pressure measurement recorded at the kiln's gaseous stream exit is actually a vacuum measurement. The scale is inches of water column and the value represents the number of inches of water column below atmospheric pressure. A pressure transmitter converts the vacuum measurement into an electronic signal that is transmitted to a remote device. DP is also measured in inches of water column. DP measurements are used to indicate the pressure drop across major components in the APE 1236 system. Differential pressure is measured with a local pressure gauge or a pressure transmitter that transmits an electronic signal that is proportional to the differential pressure being measured.

The total fuel oil flow to the APE 1236 burner systems is measured by a flowmeter. The flowmeter is located in the fuel oil piping, and is installed prior to the piping split that is located between the storage tank and the kiln burner and afterburner burner. The flowmeter is a positive displacement type that transmits an electronic signal to the main control panel for recording.

The stack gas velocity, oxygen, carbon monoxide, are monitored continuously and are described in further detail in **Section 5**.

### **2.2.2 Panel Instrumentation**

The panel instrumentation includes the devices located in the main control panel or in local panels throughout the APE 1236 system. Instruments that control, indicate, record and alarm process parameters are considered panel instrumentation. The following paragraphs describe the equipment employed to perform the various functions listed above.

The APE 1236 system is equipped with process controllers to control process parameters. A process controller receives an analog signal from a transmitter that represents the value of the process parameter or process variable (PV) being measured. The process controller compares the PV to a Set Point (SP) which represents the desired value of the process variable. If a difference (i.e., error) between the PV and the SP exists, the process controller generates an output signal that is proportional to the error. The output signal is transmitted to a final control element that adjusts the process by some method to obtain the SP. The final control element may be a control valve, a damper or a variable motor speed drive.

The APE 1236 system uses process controllers to control the kiln temperature (Loop # TIC-601), kiln draft (Loop # PIC-1201), afterburner temperature (Loop # TIC-701), high temperature gas cooler exit (Loop #TIC-801) and low temperature gas cooler exit temperature (Loop # TIC-901). The process controllers also communicate with the computer system that is described later. The APE 1236 system uses Honeywell UDC 3000 process controllers.

The APE 1236 system is equipped with burner control systems to monitor and control the kiln and afterburner burners. A burner controller is a sequence controller that supervises the pre-ignition air purge, ignition, main flame operation and post operation air purge. The burner controller monitors pre-ignition interlocks such as combustion air availability, fuel oil pressure and ID fan status. The flame status is monitored by a flame detector. Burner controller outputs spark the flame ignitor during ignition, open the pilot valve during ignition and open the fuel oil safety shut-off valves during main flame operation. The burner controller systems are FM approved flame safety systems. Honeywell BC 7000 burner controllers are used.

A multi-point digital recorder is used to record process parameters. The recorder accepts analog input signals from transmitters which represent the value of the process parameter being measured. The recorder is capable of recording 14 process parameters on an input value versus time scale. The Honeywell DPR 1500 recorder also communicates with the computer system. The following is a list of the process parameters that are recorded:

- Total fuel oil flow, Process Loop FR-101

- Kiln temperature, Process Loop FR-601
- Kiln draft, Process Loop PR-1201
- Afterburner temperature, Process Loop TR-701
- High temperature gas cooler exit temperature, Process Loop TR-801
- Low temperature gas cooler exit temperature, Process Loop TR-901
- Baghouse differential pressure, Process Loop PDR-1001
- Baghouse exit temperature, Process Loop TR-1002
- Stack gas velocity, Process Loop FR-1401
- Stack gas oxygen concentration, Process Loop AR-1301
- Stack gas CO concentration, Process Loop AR-1301

The baghouse status (on-line or standby) is not usually recorded; however, this information is stored internally on the computer system and can be accessed as required. Logic control for the APE 1236 system is performed by a programmable logic controller (PLC). The PLC receives both discrete (on/off) inputs from switches and analog inputs from transmitters. The PLC operates motor starters, the AWFSO and other interlocks, and alarms by employing configurable functions of math, counter, sequence, relay and time. The PLC is a Honeywell IPC 620 system complete with discrete and analog I/O and a data communication link so information can be shared with the computer system.

The computer system is a Personal Computer Operating Station (PCOS) which provides centralized and integrated data management, process graphics, operator interface, and report generation. Through a serial data link, the PCOS communicates with the process controllers, the PLC and recorder. All process parameters and information contained in these devices are available to the PCOS. The PCOS generates reports, logs data, records historical trends, displays process parameters, and alarms process parameters based on information gathered from the process controllers, PLC and recorder. One of the primary functions of the PCOS is to record process data for internal use and regulatory compliance. The PCOS includes the following items: personal computer with keyboard and color graphics monitor, line printer and distributed automation and control software.

**Table 2-2** is the functional chart of process conditions which list the functions performed by the panel instrumentation on each process measurement.

### **2.2.3 Automatic Waste Feed Shut Off (AWFSO) System**

Certain process conditions are required before waste feed can be introduced into the APE 1236 system. The required conditions include minimum and maximum values of some process parameters, status of certain motors, status of burner flames, and operability of certain instruments. If waste soil is being fed and the

**TABLE 2-2  
FUNCTIONAL CHART OF PROCESS CONDITIONS**

		Indicated	Recorded	Controlled	High Alarm	Low Alarm	AWFSO
Process Conditions	Loop No.						
Fuel Oil Flow	F-101		•				
Waste Feed Rate	W-501	•	•	•			
Kiln Rotational Speed	S-602	•		•	No Motion		15 sec delay
Kiln Temperature	T-601	•	•	•	800 °F	200 °F	10 min delay
Kiln Flame	B-601	•			No Flame		15 sec delay
Kiln Residue Conveyor		•			No Motion		15 sec delay
Kiln Pressure	P-1201	•	•	•	2.5 in H2O	0.1 in H2O	15 sec delay
Afterburner Temperature	T-701	•	•	•	1800 °F	1200 °F	2 min delay
Afterburner Flame	B-1002	•			No Flame		15 sec delay
High Temperature Gas Cooler Exit Temperature	T-801	•	•	•	1000 °F	600 °F	15 sec delay
Low Temperature Gas Cooler Exit Temperature	T-901	•	•	•	340 °F	200 °F	15 sec delay
Baghouse Pressure Drop	PD-1001	•	•		6 in H2O	0.1 in H2O	15 sec delay
Baghouse Exit Temperature	T-1002	•	•		300 °F	250 °F	15 sec delay
Baghouse Bypass		•					15 sec delay
ID Fan		•					15 sec delay
Exhaust Stack Gas Velocity	F-1401	•	•		55 fps		15 sec delay
Exhaust Stack Temperature	T-1401	•	•				
Exhaust Stack Pressure	P-1401	•	•				

**TABLE 2-2**  
**FUNCTIONAL CHART OF PROCESS CONDITIONS**  
**(Cont'd)**

		Indicated	Recorded	Controlled	High Alarm	Low Alarm	AWFSO
Process Conditions	Loop No.						
Stack Oxygen Concentration	AR-1301	•	•		15%		
Stack Carbon Monoxide Concentration	AR-1301	•	•		100 ppm	-1 ppm	15 sec delay

APE 1236 deviates from any of the required conditions, waste feed is automatically shut off. When waste feed is automatically shut off, the waste loading conveyor is stopped instantly but the kiln feed conveyor continues to run so that any waste soil located in the kiln area will be loaded into the kiln. Other components of the APE-1236 continue to operate until they are manually shut down by the operator after allowing the fed waste to clear the kiln and emissions to be processed through the air pollution control train. **Table 2-3** lists the process conditions that automatically shut off waste to the APE 1236 system. These conditions include those listed by ITRC Technical Requirements (ITRC, 1997).

## 2.3 Operating Procedures

This subsection outlines the procedures used to operate the APE 1236 system. The description presents an overview of the operating procedures and is not intended to be used to operate the system. The APE 1236 operational manual and the standard operating procedures (SOP) contain more detail and are the official documents used to operate the APE 1236 system.

The different operational items to be performed are listed for each of the various operating procedures. The following procedures are covered:

- Startup
- Operation
- Shutdown
- Scrap and residue handling
- Baghouse bypass

### 2.3.1 Startup Procedures

- Perform operational inspection and complete pre-startup check list.

The following procedures will be completed automatically upon automatic start-up but would be conducted in this manner if manual start-up were to be undertaken.

- Bypass the baghouse.
- Start the ID fan with the kiln pressure controller in manual.
- Start the gas cooler blowers with the LT gas cooler motor speed controller in manual.
- Start the air compressor.
- Start the fuel oil pump and open the hand valves to the burners.
- Start the afterburner combustion air blower.

**TABLE 2-3**  
**AUTOMATIC WASTE FEED SHUT-OFF**  
**CONDITIONS AND VALUES**

Condition	Minimum Value	Maximum Value
Carbon Monoxide in Exhaust Stack	None	Permit Limit
Afterburner Temperature	1200 °F	1800 °F
Kiln Temperature	250°F	1100 °F
Kiln Pressure	None	-0.08 Inches WC
Waste Feed Rate	None	Waste Specific
Gas Velocity in Exhaust Stack	None	55 fps
Pressure drop across Baghouse	2 in. wc	6 in. wc
HT Gas Cooler Exit Temperature	None	850 °F
LT Gas Cooler Exit Temperature	None	350 °F

Additional conditions which engage the AWFSO:

- Kiln Flameout
- Bypass Baghouse
- Kiln Residue Conveyor Stops
- Oxygen Analyzer Failure
- Failure of Data Recorder
- Failure of the Automatic Waste Feed Monitoring System
- Failure of any Process Controller
- Afterburner Flameout
- Kiln Rotation Stops
- ID Fan Stops
- Carbon Monoxide Analyzer Failure
- Failure of any Temperature Monitoring System
- Baghouse Differential Pressure Transmitter Failure

In addition, in accordance with ITRC Guidance, the following conditions shall result in AWFSO if not corrected within the time given:

1. The outlet kiln temperature is below set point for period of 10 minutes. A drop in the outlet kiln temperature is an indication that the exit soil temperature has dropped.
2. The afterburner temperature is below the set point for a period of 2 minutes.

NOTES:

1. The Carbon Monoxide measurement is corrected to 7% Oxygen. Waste feed is shut off when the rolling average of the CO corrected for O<sub>2</sub> on a dry basis is above the limit set in the permit. The waste feed can only be restarted when the rolling average drops below the permitted limit.

- Place the afterburner temperature controller in manual and slightly open the control valve.
- Ignite the afterburner burner.
- Start the kiln rotation.
- Start the kiln combustion air blower.
- Place the kiln temperature controller in manual and slightly open the control valve.
- Ignite the kiln burner.
- Adjust the set points on the process controllers and place the controls in the automatic mode.
- Date and sign the recorder chart. Verify all recorded conditions are being correctly recorded.
- Enter the name of the waste feed being fed to the kiln into the computer system.
- Adjust the rotation speed of kiln to the desired level (based on desired residence time).
- Adjust the kiln temperature set point to the desired level.
- Start the waste loading, waste feed, and residue conveyors.
- Start the baghouse bag cleaning cycle.
- Open the baghouse block valves and close the baghouse bypass valve.
- Start the gas cooler sonic cleaners.
- Close the kiln barrier walls.
- Feed the soil at specified feedrate.

Note that no waste is fed to the kiln until the baghouse is on-line.

### **2.3.2 Operation Procedures**

These procedures will be performed while the APE 1236 system is processing waste soils. Necessary data and observations will be recorded in the operating log that is kept for the system.

- Monitor the main control panel closely to:
  - Monitor process conditions.
  - Verify that correct recording and data logging are being performed;
    - Verify that control functions are being performed.
    - Handle alarm conditions as required.
- Inspect exhaust stack emissions hourly (minimum).
- Check all local indicators on the APE 1236 system for proper values.
- Inspect the operation of rotating equipment outside of kiln barrier walls.
- Monitor the waste feed stockpile, the kiln residue stockpile, and all components of the deactivation furnace/LTTD for evidence of fugitive emissions.



### 2.3.3 Shutdown Procedures

The following procedures will be performed during automatic shutdown (Note: these procedures can be initiated manually or as an automatic response from the AWFSO system):

- Stop waste feed to kiln.
- Maintain all other operating conditions, including kiln and afterburner temperature, for 15 minutes (minimum) or until kiln residue conveyor is empty, whichever is greater.
- Place process controllers in manual.
- Shut-off the kiln burner flame but keep combustion air blower on and combustion air valve open.
- Shut-off the afterburner burner flame but keep combustion air blower on and combustion air valve open.
- Shutdown fuel oil pump.
- Open ID fan damper fully.
- Once kiln temperature is below 400°F and afterburner temperature is below 600°F, the following equipment is shutdown:
  - Kiln combustion air blower.
  - Afterburner combustion air blower.
  - ID fan.
  - Gas cooler blowers.
  - Baghouse residue valve.
  - Gas cooler residue valves.
  - Kiln rotation drive.
  - Kiln residue conveyor.

Conditions that would initiate an automatic shutdown are discussed in **Section 2.2.3** and are shown on **Table 2-3**. It is important to note that kiln and afterburner conditions are maintained until all the waste passes through the rotary kiln and the offgases are treated in the afterburner. This continues the volatilization and combustion of organic compounds contained in the feed that is in the kiln and ensures safety and treatment of offgases.

### 2.3.5 Baghouse Bypass

If the baghouse is bypassed for any reason, waste feed to the rotary kiln is stopped by the AWFSO System. Bypass of the baghouse will only occur when: 1) there is an exit temperature measurement failure; 2) the high baghouse temperature alarm sounds during a fire condition; and 3) during startup operations prior to the initiation of waste feed.

The bypass is interlocked with the AWFSO system so that waste cannot be fed if the baghouse is bypassed.

## SECTION 3

### FEED CHARACTERIZATION

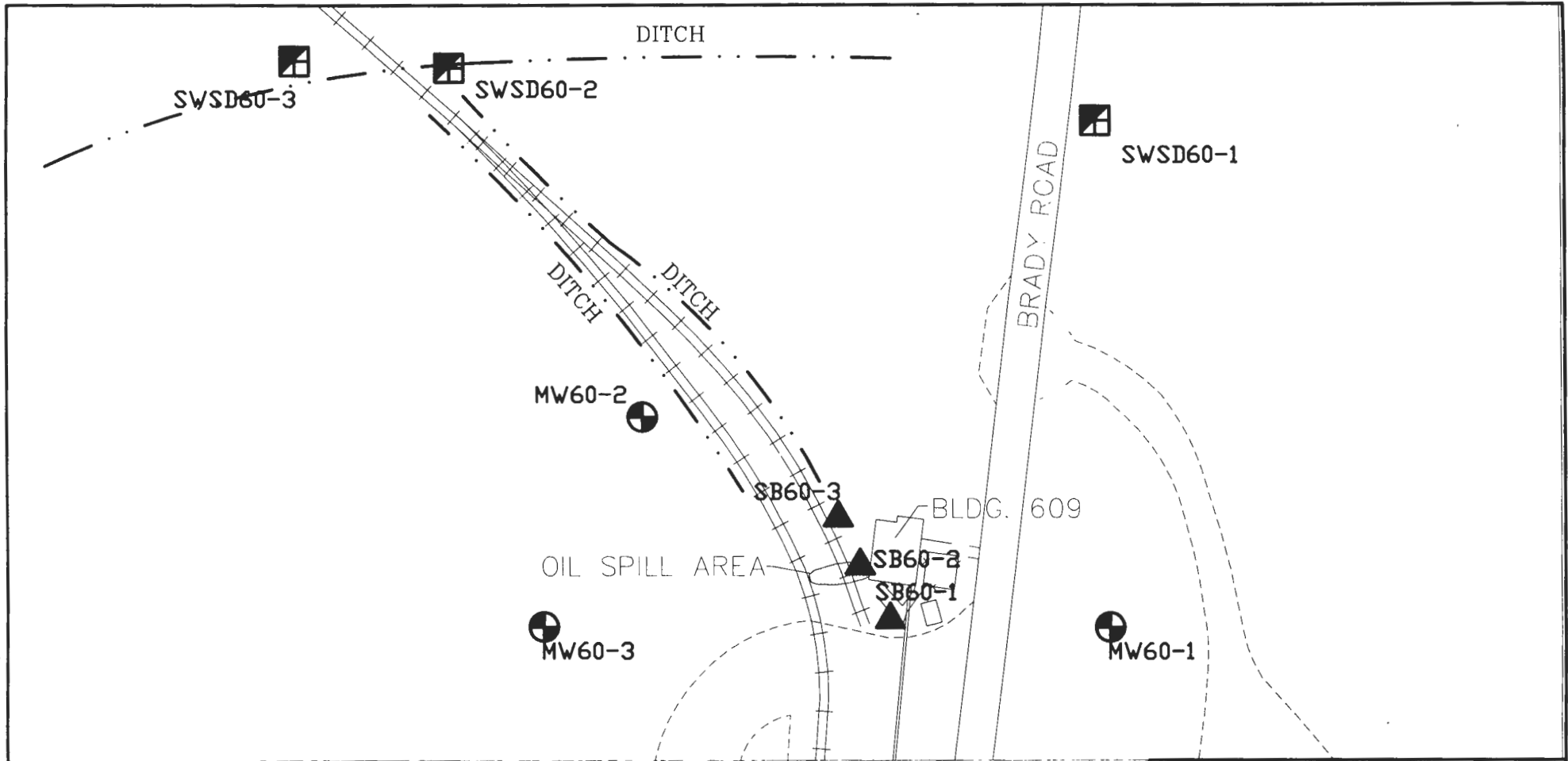
#### 3.1 SOIL SELECTED FOR DEMONSTRATION STUDY

Soil from SEAD-60 (Oil Discharge Area adjacent to Building 609) will be used as feed material in the LTDD treatability study. SEAD-60 was part of an Expanded Site Inspection (ESI) which confirmed that a release of petroleum hydrocarbons had occurred (Parsons ES, 1996) at the site. On March 3 and 4, 1999, approximately 150 cubic yards of soil from this site was excavated from the area shown in **Figure 3-1** and stockpiled near the APE 1236 system (LTDD). NYSDEC visited the site on June 7, 1999 and closed out SEAD-60 pending treatment of the excavated soil.

The ESI conducted at SEAD-60 identified an area impacted by a release of fuel oil to the ground surface immediately west of Building 609. Soils from the area near the oil release are characterized by soil samples SB60-1.00, SB60-1.01, SB60-2.00, and SB60-3.00 collected during the ESI. These soils were excavated during the removal action referenced above and stockpiled for use in the demonstration study. The results of the four soil samples are presented in **Table 3-1**. The surface soils in this area have been impacted primarily by total petroleum hydrocarbons (TPHs) and polynuclear aromatic hydrocarbons (PAHs). Surface soils (0 to 0.2 feet) from these locations are the most significantly impacted. TPH concentrations of 218,000 mg/kg and 50,900 mg/kg were found in the area of the oil-stained soil. Concentrations of PAHs (up to 18,000 mg/kg) correlated spatially with the elevated TPH concentrations in the surface soils. TAGM exceedances for PAHs were more numerous in the surface soil samples. The concentrations of TPH and PAHs in soil were reduced at depth.

While the concentrations of volatile organic compounds (VOCs), pesticides, and polychlorinated biphenyls (PCBs) present in the two surface soil samples from the release area were generally below TAGM values, two PCBs (Aroclor 1248 and Aroclor 1260) were found at concentrations above their TAGM values. Heavy metals concentrations above TAGM values were present in all of the samples.

Due to the availability of the soil from SEAD-60 for treatment and the relatively high concentrations of petroleum hydrocarbons and PAHs present in the soil, it has been selected as representative feed for the demonstration study.



**LEGEND:**

- SOIL BORING
- SB60-3
- SURFACE WATER/  
SEDIMENT SAMPLE
- SWSD60-1
- MONITORING WELL WITH  
WATER TABLE ELEVATION
- MW60-1
- DITCH

<b>PARSONS</b>	
<b>PARSONS ENGINEERING SCIENCE, INC.</b>	
CLIENT/PROJECT TITLE	
<b>SENECA ARMY DEPOT ACTIVITY LTTD DEMONSTRATION STUDY WORKPLAN</b>	
DEPT.	Dwg. No.
<b>ENVIRONMENTAL ENGINEERING</b>	<b>754603-01001</b>
<b>FIGURE 3-1</b>	
<b>SAMPLE LOCATIONS AND AREA OF SOILS REMOVED AT SEAD-60</b>	
SCALE	DATE
<b>AS NOTED</b>	<b>JULY 1990</b>
REV	
<b>▲</b>	

TABLE 3-1

SENECA ARMY DEPOT ACTIVITY  
LTTD DEMONSTRATION WORK PLAN  
SEAD-60 SOIL ANALYSIS RESULTS FROM THE ESI

COMPOUND	MATRIX LOCATION			SOIL	SOIL	SOIL	SOIL
	DEPTH (FEET)	SDG NUMBER	TAGM	SEAD-60	SEAD-60	SEAD-60	SEAD-60
	SAMPLE DATE			0-0.2	0-2	0-0.2	0-0.2
	ES ID	NUMBER		05/27/94	02/28/94	06/07/94	06/08/94
	LAB ID	ABOVE		SB60-1-00	SB60-1.01	SB60-2-00	SB60-3.00
		TAGM		222473	212883	223339	223499
	UNITS			44410	42510	44410	44665
<b>VOLATILE ORGANICS</b>							
Methylene Chloride	ug/Kg	100	0	12 U	11 U	27 J	21
Acetone	ug/Kg	200	0	12 U	11 U	170 J	14 U
Carbon Disulfide	ug/Kg	2700	0	12 U	11 U	1 J	14 U
2-Butanone	ug/Kg	300	0	12 U	11 U	26 J	14 U
2-Hexanone	ug/Kg	NA	NA	12 U	11 U	11 UJ	14 U
Tetrachloroethene	ug/Kg	1400	0	12 U	11 U	11 UJ	14 U
Toluene	ug/Kg	1500	0	12 U	11 U	13 J	14 U
Ethylbenzene	ug/Kg	5500	0	12 U	11 U	4 J	14 U
Xylene (total)	ug/Kg	1200	0	12 U	11 U	9 J	14 U
<b>SEMIVOLATILE ORGANICS</b>							
Naphthalene	ug/Kg	13000	0	38 J	370 U	18000 U	2200 U
2-Methylnaphthalene	ug/Kg	36400	0	390 U	370 U	1100 J	2200 U
Acenaphthene	ug/Kg	50000*	0	59 J	370 U	1400 J	2200 U
Dibenzofuran	ug/Kg	6200	0	29 J	370 U	18000 U	2200 U
Fluorene	ug/Kg	50000*	0	48 J	370 U	1300 J	2200 U
Phenanthrene	ug/Kg	50000*	0	570 J	25 J	8900 J	680 J
Anthracene	ug/Kg	50000*	0	98 J	370 U	2000 J	2200 U
Carbazole	ug/Kg	50000*	0	79 J	370 U	18000 U	2200 U
Di-n-butylphthalate	ug/Kg	8100	0	390 U	370 U	1500 J	2200 U
Fluoranthene	ug/Kg	50000*	0	1100 J	33 J	14000 J	1300 J
Pyrene	ug/Kg	50000*	0	700 J	31 J	27000 J	2000 J
Benzo(a)anthracene	ug/Kg	220	1	340 J	370 U	18000 U	2200 U
Chrysene	ug/Kg	400	2	400	370 U	17000 J	1100 J
bis(2-Ethylhexyl)phthalate	ug/Kg	50000*	0	54 J	370 U	18000 U	2200 U
Benzo(b)fluoranthene	ug/Kg	1100	2	730 J	370 U	16000 J	1500 J
Benzo(k)fluoranthene	ug/Kg	1100	0	190 J	370 U	18000 U	2200 UJ
Benzo(a)pyrene	ug/Kg	61	1	350 J	370 U	18000 U	2200 U
Indeno(1,2,3-cd)pyrene	ug/Kg	3200	0	220 J	370 U	18000 U	1100 J
Dibenz(a,h)anthracene	ug/Kg	14	3	110 J	370 U	18000 U	1100 J
Benzo(g,h,i)perylene	ug/Kg	50000*	0	220 J	370 U	18000 U	1600 J

TABLE 3-1

**SENECA ARMY DEPOT ACTIVITY  
LTTD DEMONSTRATION WORK PLAN  
SEAD-60 SOIL ANALYSIS RESULTS FROM THE ESI**

COMPOUND	MATRIX LOCATION	SOIL SEAD-60		SOIL SEAD-60		SOIL SEAD-60	
	DEPTH (FEET)	SEAD-60	SEAD-60	SEAD-60	SEAD-60	SEAD-60	SEAD-60
	SAMPLE DATE	NUMBER	NUMBER	NUMBER	NUMBER	NUMBER	NUMBER
	ES ID	ABOVE	ABOVE	ABOVE	ABOVE	ABOVE	ABOVE
	LAB ID	TAGM	TAGM	TAGM	TAGM	TAGM	TAGM
	SDG NUMBER						
	UNITS						
<b>PESTICIDES/PCB</b>							
alpha-BHC	ug/Kg	110	0	4 UJ	1.9 U	5 J	2.9 UJ
Aldrin	ug/Kg	41	0	4 UJ	1.9 U	16 J	2.9 UJ
Endosulfan I	ug/Kg	900	0	3.2 J	1.9 U	34 J	6.3 J
4,4'-DDE	ug/Kg	2100	0	110 J	2.7 J	31 J	28 J
4,4'-DDD	ug/Kg	2900	0	7.8 UJ	3.7 U	55 J	100 J
4,4'-DDT	ug/Kg	2100	0	84 J	3.7 U	130 J	5.6 UJ
Endrin ketone	ug/Kg	NA	NA	7.8 UJ	3.7 U	14 J	5.6 UJ
alpha-Chlordane	ug/Kg	540	0	4 UJ	1.9 U	27 J	3 J
gamma-Chlordane	ug/Kg	540	0	4 UJ	1.9 U	10 J	2.9 UJ
Aroclor-1242	ug/Kg	1000/10000(a)	0	78 UJ	37 U	970 J	56 UJ
Aroclor-1248	ug/Kg	1000/10000(a)	1	78 UJ	37 U	2100 J	56 UJ
Aroclor-1260	ug/Kg	1000/10000(a)	1	78 UJ	37 U	4400 J	220 J
<b>METALS</b>							
Aluminum	mg/Kg	14593	0	10800	8440	9420	14100
Antimony	mg/Kg	3.59	0	0.28 J	0.43 J	1.8 J	0.49 J
Arsenic	mg/Kg	7.5	1	5.3	4.1 J	8.1	7
Barium	mg/Kg	300	2	77.6	98.3	679	416
Beryllium	mg/Kg	1	0	0.47 J	0.43 J	0.42 J	0.66 J
Cadmium	mg/Kg	1	2	0.58 J	0.36 J	2	1.5 J
Calcium	mg/Kg	101904	1	65800	75100	56200	23700 J
Chromium	mg/Kg	22	2	18.3	14.2	18.8	23.3
Cobalt	mg/Kg	30	0	9.6	8.3 J	9.5 J	13.1 J
Copper	mg/Kg	25	3	24.9	21.3	190	74.1
Iron	mg/Kg	26627	1	22800	18900	22800	25700
Lead	mg/Kg	30	3	17.1	47.5 J	66.7	50.6
Magnesium	mg/Kg	12222	5	13300	11300	12200	8570
Manganese	mg/Kg	669	0	422	333	317	443
Mercury	mg/Kg	0.1	0	0.06 J	0.08 J	0.03 J	0.02 U
Nickel	mg/Kg	34	1	30.9	23.5	29.5	31.3
Potassium	mg/Kg	1762	7	1920 J	1470	1870 J	1820 J
Selenium	mg/Kg	2	0	0.43 U	0.32 U	1.5 J	1.2 J
Sodium	mg/Kg	104	8	105 J	75 J	127 J	118 J
Vanadium	mg/Kg	150	0	18.6	14.8	21.2	26.2
Zinc	mg/Kg	83	5	85	58.6	569	314
<b>OTHER ANALYSES</b>							
Total Petroleum Hydrocarbons	mg/Kg	NA	NA	87 J	29 U	218000	50900
Total Solids	%V/V			85.4	88.4	90.1	59.1

### 3.2 FEED SOIL LIMITATIONS

According to ITRC Guidance, soils outside of the following limits will be subjected to pretreatment prior to treatment in the LTTD:

1. soil moisture > 35%
2. material > 2-inch diameter
3. soil has high plasticity
4. soil has high humus content
5. either soil TPHC > 20,000 parts per million (ppm) or greater than 25% lower explosive limit (LEL) in gas in desorption chamber

The soils from SEAD-60 will meet most of the limits described above prior to processing in the LTTD. Percent solids data collected during the ESI indicated that SEAD-60 soils contained between 85.4 and 95.1% total solids (i.e., soil moisture content ranged between 4.9 - 14.6%). Soil will be pretreated using a screen to ensure that soil particles are less than 2 inches in diameter before entering the kiln, as described in **Section 2.1.1**.

Soils at SEAD-60 are comprised of till that is generally gray brown and consists of silt, with little clay, little very fine sand, and little dark gray-black shale fragments. A trace of organics is sometimes noted in the boring logs from SEAD-60 and one log noted plastic soils (Parsons ES, 1996). In the event that a large degree of clumping occurs due to the plasticity of the soils that interferes with adequate treatment, SEDDA may elect to add a soil conditioner such as lime to prevent processing difficulties.

Two of the four samples collected at SEAD-60 in the area where soils were excavated had TPH concentrations which exceeded 20,000 ppm (maximum hit = 218,000 ppm); however, the actual average concentration of TPH contained in the soils excavated is anticipated to be considerably less than the maximum value recorded. This will be verified by sampling and analysis prior to the use of the soil as waste feed for the LTTD treatability study. Each day, an adequate amount of waste soil for that day's operation will be segregated from the larger waste feed stockpile, and sampled and analyzed to determine TPH content. Samples will be collected in accordance with NYSDEC guidance as provided in STARS Memo #1 "Petroleum-Contaminated Soil Guidance Policy," while analysis will be completed following procedures outlined in SW-846 Method 4030 (for TPH). Using the assumption that less than 50 cubic yards of soil will be required for each day's demonstration test, a single composite soil comprised of four aliquots will be collected and analyzed. If the result of the screening analysis of the soil indicates that the soil contains more than 15,000 ppm of TPH, the day-stockpile will be set aside for compositing with other less contaminated soil to yield a day-pile that contains 15,000 ppm or less.

Nine organochlorine pesticide and three PCB compounds were detected in soil samples collected from the excavated area during the ESI. Each of these compounds was found primarily at a single location (characterized by one sample), and typically at nominal concentrations (5 to 150 ug/Kg).

Given the evidence that chlorinated organic materials were present in some of the soil at SEAD-60, SEDA commissioned a pre-screening analysis of the excavated soil to determine whether the stockpiled soil continued to exhibit evidence of chlorinated materials or whether the mixing inherent in excavations had yielded a stockpile that did not exhibit the presence of chlorinated materials. Four grab samples of stockpiled soil were collected and analyzed to define whether total organic halogens were contained in the soil. Each of the four samples was collected from a different portion of the overall stockpile and all samples were analyzed to define total organic halogen concentrations via SW846 Method 9020B. The results of these analyses are provided in **Table 3-2**. Two of the samples showed evidence of residual Total Organic Halogens, and therefore, the entire stockpile of soil will be treated as if residual chlorinated materials are present. Due to the presence of total organic halides in the stockpiled soil means that the recommendations of the ITRC Work Group as defined in the document "Technical Requirements for On-site Thermal Desorption of Solid Media Contaminated with Hazardous Chlorinated Organics" will be followed during the proposed treatability demonstration.

With the indication that total organic halogens are contained in the waste, air samples will also be collected to verify that emissions of Hydrochloric acid do not surpass the allowable levels (i.e., 4 pounds per hour) in the stack exhaust. Basic calculations completed that assume that all total organic halogen (i.e., up to 17.5 parts per million) will be converted to Hydrochloric Acid indicate that maximum expected emissions rates at feed levels of 2 and 5 tons per hour of soil should not exceed 0.08 and 0.2 pounds per hour of acid gas.

### 3.3 SOIL HANDLING

Pre- and post-treatment soil stockpiles will be stored on an impermeable surface (such as a liner or concrete) and placed in a bermed area. If storm-water accumulates within the bermed areas, it will be collected, sampled and analyzed to develop data to determine how it must be treated and disposed. SEDA anticipates that any captured storm-water can be discharged under the Depot's existing SPDES permit, but necessary data will be developed and reviewed with NYSDEC Division of Water personnel to confirm this option. If data indicates that it can not be discharged under the existing SPDES permit, the water will be treated and disposed, or manifested off-site for final treatment and disposal.

Soil stockpiles will be covered to minimize exposure to precipitation and prevent dust generation. If necessary, water spray will be used to prevent dust generation. Fugitive dust monitoring will be performed during handling operations to ensure that unacceptable levels of dust are not generated that may migrate off-site or cause a hazard to workers. Such monitoring is described in **Section 5.0**.



Table 3-2

**LTTD TREATABILITY STUDY  
RESULTS OF SOIL STOCKPILE PRESCREENING ANALYSIS**

<b>Sample ID</b>	179000	179001	179002	179003
<b>Sample Location</b>	1st Q	2nd Q	3rd Q	4th Q
<b>Sample Date</b>	12/18/99	12/18/99	12/18/99	12/18/99
<b>Percent Solids (%)</b>	88.9	89.3	88.1	91.6
<b>Total Organic Halogen (SW846 9020B) mg/Kg</b>	7.9 U	17.1	7.2 U	14.8

Treated soil will not be handled until cooled and the kiln residue conveyor has been observed running empty. Any soil/residue accumulated after an emergency shutdown will be reprocessed. Post-treatment soil will be stockpiled in the manner described above until analytical results indicate that the soil has been treated successfully.

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## SECTION 4

### DEMONSTRATION STUDY PROTOCOL

#### 4.1 DEMONSTRATION STUDY TEST RUNS

The demonstration study will consist of three tests, each run three times for verification. The objectives of these tests are to establish target feed rates and operational conditions for successful reduction of organic compounds in soil using the LTTD. **Table 4-1** summarizes the operating conditions proposed for study during the demonstration study.

The primary objective of these tests is to determine a maximum soil feed rate at which the concentration of organic constituents, such as TPH and PAHs, contained in the feed may be effectively reduced. Therefore, all operating parameters with the exception of feed rate will remain constant. Feed rates of 2, 4, and 6 tons per hour have been selected for the three tests, but these rates may be adjusted in the field based on preliminary test results and processing information. Test 1 will be run at 4 tons per hour. Samples will be collected from both the feed soil as well as the treated soil as described in **Section 5**. If no soil handling problems associated with the feed rate are encountered, and the results of the pre- and post-treatment soil analyses show that organic constituents are effectively reduced (i.e., a reduction in TPH and PAHs levels), the soil feed rate will be increased to 6 tons per hour. However, if soil loading or feed problems are encountered, or if soil analyses indicate marginal reduction in TPH and PAH concentrations, then the soil feed rate will be reduced to 2 tons per hour for Test 2. Depending on the results of Test 2, the soil feed rate will be increased or decreased again accordingly for Test 3.

TABLE 4-1

## DEMONSTRATION STUDY OPERATIONS SUMMARY

Parameter		Test 1 SEAD-60 SOIL	Test 2 SEAD-60 SOIL
Number of Runs		3	3
Kiln Outlet Temperature (°F)	Range	250-800	250-800
Expected Setpoint		500	500
Afterburner Outlet Temp. (°F)	Range	1200-1800	1200-1800
Expected Setpoint		1600	1600
Stack Gas Velocity (fps)	Range	40-50	40-50
Kiln Pressure (in H <sub>2</sub> O)		-.15 to -.25	-.15 to -.25
Kiln Rotation (rpm)		1.0	1.0
Soil Feedrate (tons/hr)		2	5
Baghouse Pressure Drop (in H <sub>2</sub> O)		2.5 to 4.5	2.5 to 4.5
Cyclone Pressure Drop (in H <sub>2</sub> O)		2 to 4	2 to 4
Baghouse Outlet Temp. (°F)		150-250	150-250
CO Level (ppm)		< 100	< 100
Fuel Usage (gph)	Expected Range	30-50	30-50
HTHE Exit Temp. (°F)		< 1000°	< 1000°
LTHE Exit Temp. (°F)		< 250°	< 250°

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## SECTION 5

### SAMPLING AND ANALYSIS PLAN

#### 5.1 INTRODUCTION

The goal of the Sampling and Analysis Plan presented for the APE 1236 deactivation furnace at the Seneca Army Depot Activity (SEDA) is to ensure collection of valid data that may be used to show compliance with applicable air pollution regulations and standards regarding the operation of a low temperature thermal desorption (LTTD) process and to determine the degree of treatment achieved for the soil that is used as feed material. To achieve this goal, SEDA has based the proposed sampling and analysis plan for the APE 1236 on guidance provided by the US Environmental Protection Agency (USEPA), the New York State Department of Environmental Conservation (NYSDEC), and the Interstate Technology and Cooperation Work Group (ITRC). Specifically, details of the plan particular to LTTD technology are derived from guidance provided by the ITRC's Low Temperature Thermal Desorption Task Group's "Technical Requirements for On-Site Thermal Desorption of Solid Media Contaminated with Hazardous Chlorinated Organics." In addition, descriptions and definitions specific to air pollution monitoring procedures and continuous emission monitoring requirements for stationary sources are derived from material provided in Title 40 Code of Federal Regulations (40 CFR) Part 60, Appendices A and B and incorporated by reference in the NYSDEC regulations. Finally, procedures associated with the sampling and analysis of solid waste materials and residues (e.g., waste soil, soil residue or bottom ash, fly ash, etc.) and specialized air pollution monitoring procedures are based on protocols defined in USEPA's SW846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, 3rd Edition. A listing of the applicable stack sampling and analytical methods that will be used during this program is provided in **Table 5-1**.

The sampling and analytical program discussed hereafter will involve sampling of the following streams as they enter or leave the APE 1236 process:

- Waste soil feedstock,
- Residue (bottom ash) collected at the discharge of the rotary kiln,
- Fly ash sampled from the two gas coolers, the cyclone, and the baghouse,
- Stack gases downstream of all air pollution control devices (APCDs), and
- Fugitive emissions from waste feed or residue piles and from the vicinity of the kiln.

**Table 5-1**  
**Sampling, Analysis and Quality Control/Quality Assurance Matrix**  
**LTTD Treatability Study**

<b>Matrix</b>	<b>Test Specification</b>	<b>Sampling Method Reference</b>	<b>Analysis Method Reference</b>	<b>Quality Assurance/Quality Control Procedures</b>
Gaseous	Sample and Velocity Traverse for Stationary Sources.	Title 40 Code of Federal Regulations Part 60 ) 40 CFR 60), Appendix A, Method 1.	Field Determination, 40 CFR 60, Appendix A, Method 1.	
Gaseous	Determination of Stack Gas Velocity and Volumetric Flow Rate.	40 CFR 60, Appendix A, Method 2.	Field Determination, 40 CFR 60, Appendix A, Method 2.	40 CFR 60, Appendix A, Method 2.
Gaseous	Gas Analysis for Determination of Dry Molecular Weight.	40 CFR 60, Appendix A, Method 3A.	Field Instrumental Analysis, 40 CFR 60, Appendix A, Method 3A.	40 CFR 60, Appendix A, Method 3, Section 4.4. 40 CFR 60, Appendix A, Method 6C, Sections 3.2 through 3.8 and 3.10. 40 CFR 60, Appendix B, Performance Specification 3.
Gaseous	Determination of Moisture Content in Stack Gases.	40 CFR 60, Appendix A, Method 4.	40 CFR 60, Appendix A, Method 4.	
Gaseous	Determination of Particulate Emissions from Stationary Sources.	40 CFR 60, Appendix A, Method 5.	40 CFR 60, Appendix A, Reference Method 5.	40 CFR 60, Appendix A, Method 5.
Gaseous	Determination of Carbon Monoxide Emissions from Stationary Sources.	40 CFR 60, Appendix A, Method 10.	Field Instrumental Analysis, 40 CFR 60, Appendix A, Method 10.	40 CFR 60, Appendix B, Performance Specification 4.

**Table 5-1**  
**Sampling, Analysis and Quality Control/Quality Assurance Matrix**  
**LTTD Treatability Study**

<b>Matrix</b>	<b>Test Specification</b>	<b>Sampling Method Reference</b>	<b>Analysis Method Reference</b>	<b>Quality Assurance/Quality Control Procedures</b>
Gaseous	Determination of Total Gaseous Organic Concentration using a Flame Ionization Analyzer.	40 CFR 60, Appendix A, Method 25A.	Field Instrumental Analysis, 40 CFR 60, Appendix A, Method 25A.	
Gaseous	Determination of Hydrogen Chloride Emissions From Stationary Sources.	40 CFR 60, Appendix A, Method 26.	40 CFR 60, Appendix A, Method 26 or equivalent (EPA Method 300.0).	40 CFR 60, Appendix A, Method 26.
Gaseous	Determination of Metal Emissions from Stationary Sources.	40 CFR 60, Appendix A, Method 29.	40 CFR 60, Appendix A, Method 29 and SW-846 Method 6020B.	40 CFR 60, Appendix A, Method 5 and 29.
Gaseous	Determination of Semivolatile Organic Compounds Emissions from Stationary Sources.	SW-846, Test Methods for Evaluating Solid Wastes, Method 0010.	SW-846, Test Methods for Evaluating Solid Wastes, Method 0010, 8015 and 8270.	SW-846, Test Methods for Evaluating Solid Wastes, Methods 0010, 8015, 8082 and 8270. 40 CFR 60, Appendix A, Method 5.
Gaseous	Sampling Method for Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans from Stationary Sources.	SW-846 Method 0023A.	SW-846 Method 0023A SW-846 Method 8290.	SW-846 Method 0010. 40 CFR 60, Appendix A, Method 5. SW-846 Method 8290.

**Table 5-1**  
**Sampling, Analysis and Quality Control/Quality Assurance Matrix**  
**LTTD Treatability Study**

<b>Matrix</b>	<b>Test Specification</b>	<b>Sampling Method Reference</b>	<b>Analysis Method Reference</b>	<b>Quality Assurance/Quality Control Procedures</b>
Gaseous	Determination of Volatile Organic Compounds Emissions from Stationary Sources.	SW-846, Test Methods for Evaluating Solid Wastes, Method 0030.	SW-846, Test Methods for Evaluating Solid Wastes, Method 0030 and 5040.	SW-846, Test Methods for Evaluating Solid Wastes, Method 0030 and 5040.
Solid	Characterization of Solid Waste Feed and Kiln Residues.	American Society of Testing and Materials (ASTM) Procedure C702-87.	SW-846, Test Methods for Evaluating Solid Wastes, Methods 6010B (metals), 8015B (TPH), 8082 (PCBs/Pesticides), and 8270 (SVOCs). ASTM Procedure D 422.	SW-846, Test Methods for Evaluating Solid Wastes, Methods 6010B (metals), 8015B (TPH), 8082 (PCBs/Pesticides), and 8270 (SVOCs).
Solid	Characterization of Flyash captured in APCD system.	American Society of Testing and Materials (ASTM) Procedure C702-87.	SW-846, Test Methods for Evaluating Solid Wastes, Methods 6010B (metals), 8015B (TPH), 8082 (PCBs/Pesticides), 8270 (SVOCs) and 8290 (dioxins). ASTM Procedure D 422.	SW-846, Test Methods for Evaluating Solid Wastes, Methods 6010B (metals), 8015B (TPH), 8082 (PCBs/Pesticides), 8270 (SVOCs) and 8290 (dioxins/dibenzofurans).
Solid	Characterization of Solid Waste Feed – Field Screening.	American Society of Testing and Materials (ASTM) Procedure C702-87.	SW-846, Test Methods for Evaluating Solid Wastes, Methods 4030 (TPH).	SW-846, Test Methods for Evaluating Solid Wastes, Methods 4030 (TPH).



Samples of the waste soil feed will be collected using grab-sampling techniques. Multiple discrete grabs of the waste soil feed will be collected throughout each test run and the individual grabs will be composited to yield a single sample that will be submitted to the laboratory for detailed analyses after each test run. Sampling procedures and analysis methodologies will conform to guidance provided in SW846 and American Society of Testing and Materials (ASTM) procedures, which is incorporated into the guidance provided by the ITRC.

Samples of the rotary kiln residue (i.e., bottom ash) will also be collected using grab-sampling techniques. Grab sampling will be conducted at regularly scheduled intervals throughout the period of each performance test run, and the multiple sample grabs will be composited to yield a single sample that is submitted for analysis after each of the proposed test runs. Sampling and analysis protocols will conform to guidance and specifications provided in USEPA (i.e., SW846) and ASTM procedures.

Grab-sampling techniques will also be used for the collection of fly ash from the bag house, from the cyclone, and from the high- and low-temperature gas coolers. A single sample of the combined fly ash will be collected and submitted for analysis for each of the proposed tests. This sample will be collected at the conclusion of each sampling run. Sampling and analysis protocols will be consistent with guidance provided by USEPA and ASTM procedures.

Stack gas sampling will include the use of integrated grab sampling techniques and continuous emission monitors (CEMs). Total particulate, hydrochloric acid, total metal, semi-volatile and volatile organic and Polychlorinated Dibenzo-*p*-dioxins and Polychlorinated Dibenzofurans (dioxins/furans) compound emission determinations will be made using integrated grab sampling techniques (e.g., total particulates, total metal and semi-volatile organics by 40 CFR 60, Method 5 and Method 29 and Modified Method 5 - MM5, SW846 Method 0010; volatile organics by Volatile Organic Sampling Train – VOST, SW846 Method 0030; and dioxins/furans by SW846 Method 0023 procedures and hydrochloric acid by 40 CFR 60, Method 26). Each of these sampling systems will be operated in accordance with procedures defined in USEPA's SW846 "Test Methods for Evaluating Solid Waste Physical/Chemical Methods" and other pertinent USEPA Reference Methods (Title 40 CFR Part 60, Appendix A).

Carbon Monoxide (CO), Oxygen (O<sub>2</sub>), Carbon Dioxide (CO<sub>2</sub>), and Total Hydrocarbons (THC) will be measured continuously with CEMs. Each of the CEMs will be operated and maintained in accordance with procedures defined in Title 40 CFR Part 60, Appendix A and Appendix B.

Each APE 1236 performance test will consist of three valid sampling runs for each of the identified analytes

(i.e., semi-volatile and volatile organic compounds, dioxins/dibenzofurans, hydrochloric acid, total particulates, total metal, moisture, stack gas molecular weight, CO, CO<sub>2</sub>, O<sub>2</sub>, THC, and waste soil and residue/ash composition). The duration of each run conducted for semi-volatile organics and dioxins/dibenzofurans will be at least 360 minutes to:

- ensure that the required minimum sample volume [i.e., 106 dry, standard cubic feet (dscf) of gas] for the MM5 determination is collected;
- provide additional sample for analysis of principal organic hazardous constituents (POHCs) content to enhance the possibility of computing a higher destruction and removal efficiency for constituents contained in the waste feed; and
- provide adequate sample volume for the analysis of potential dioxin/furan emissions.

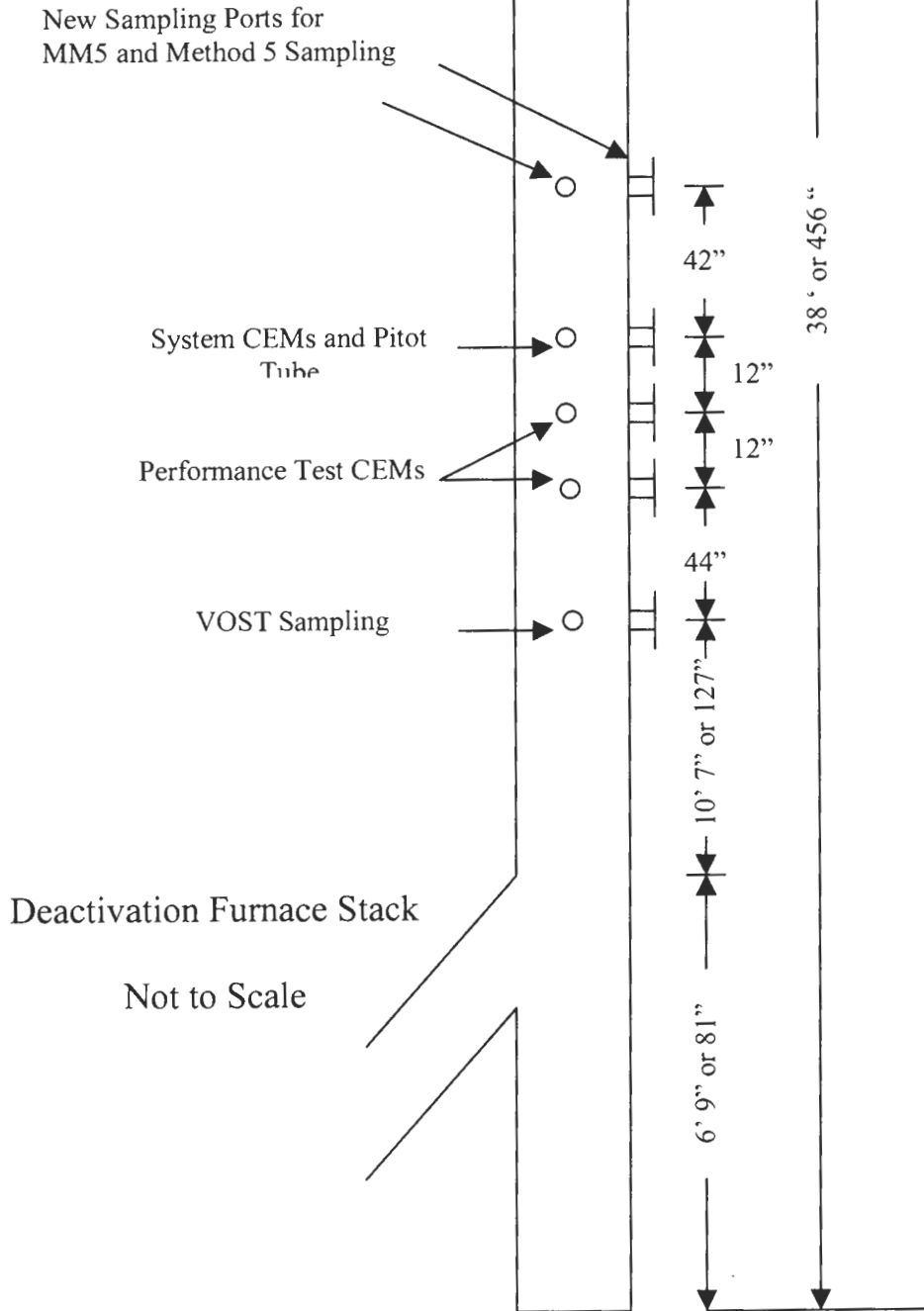
At six hours of collection time, it is assumed that at least 180 standard cubic feet of exhaust gas will be collected and concentrated within both the MM5 and the Method 0023 sampling trains.

Concurrent with the performance of the MM5 and dioxin/furan determinations, six repetitions of sample collection for volatile organic emissions within the VOST system will also be completed. All VOST determinations will include the collection of 20 liters of gas in a period of approximately 20 minutes. Additionally, since the total particulate and hydrochloric acid determinations will also be completed using the MM5 system, both of these determinations will be 360 minutes in length. Since CO, CO<sub>2</sub>, O<sub>2</sub>, and THC determinations are continuous, determinations for each of these analytes will coincide with the sampling period for the MM5 and Method 0023 train traverses. Sampling of the soil feed and residue materials will correspond to the time needed for the MM5 and the Method 0023 determinations.

Individual demonstration runs will be considered invalid and will be repeated if post-sample collection determinations indicate that any of the integrated grab sampling determinations (i.e., Method 5, MM5, or Method 0023) was not completed under isokinetic conditions (i.e., sampling rate into nozzle and stack gas flow rate agree within a range of  $\pm 10\%$ ) rates, do not pass post-sampling leak checks, or fail required calibration and bias checks. Furthermore, loss of any sample fraction from the integrated grab sampling operations (i.e., Method 5, MM5, or Method 0023) will invalidate the run. Additionally, loss or incomplete soil/residue/ash determinations will also invalidate test runs. Operational problems occurring during testing may also cause a run to be rejected. Such rejections will be considered on a case-by-case basis, with concurrence of the regulatory observers.

The proposed sampling locations for stack testing are shown in **Figure 5-1**. The APE 1236 system is

**FIGURE 5-1**  
Deactivation Furnace Stack  
Configuration



equipped with a 38-foot stack that has a 20-inch outside diameter (OD). Four sets of sampling ports currently exist on the stack, and a fifth set will be installed to support the required continuous emissions monitoring instruments and the extractive sample trains. The four sets of existing ports are located at four different elevations ranging from approximately 18 to 23 feet above grade; the proposed set of ports to be added will be located at an elevation of approximately 26.5 feet. The highest set of ports will be installed prior to the initiation of the demonstrations tests, and these will be used for perpendicular sampling traverses for the required MM5 and Method 0023 determinations. The lower sampling ports will be used for the installation of sampling probes for the system and performance evaluation CEM probes, system exhaust flow-rate pitot tube assembly, and for collection of VOST samples as shown on **Figure 5-1**.

Based on the measurements provided in **Figure 5-1**, the amount of straight-run upstream of the proposed MM5 and Method 0023 sampling ports is roughly two stack-diameter equivalents (42 inches/20 inch OD), while the available straight-run downstream of the proposed sampling plane is more than six stack-diameter equivalents (i.e., 138 inches/20 inch OD). Based on procedures defined in USEPA Reference Method 1 (i.e., RM1 – 40 CFR 60, Appendix A, Method 1), this positioning for the sampling plane means that each particulate/semi-volatile organic/dioxin/dibenzofuran determination will involve extraction of stack exhaust gas at 24 traverse points (12 per axis). The location of the proposed traverse points along each axis is shown in **Figure 5-2**.

**Section 4** described the two operating conditions that have been identified for evaluation during the proposed performance testing. A summary of sampling and analytical procedures, monitoring procedures, and the test schedule are presented in the following sections.

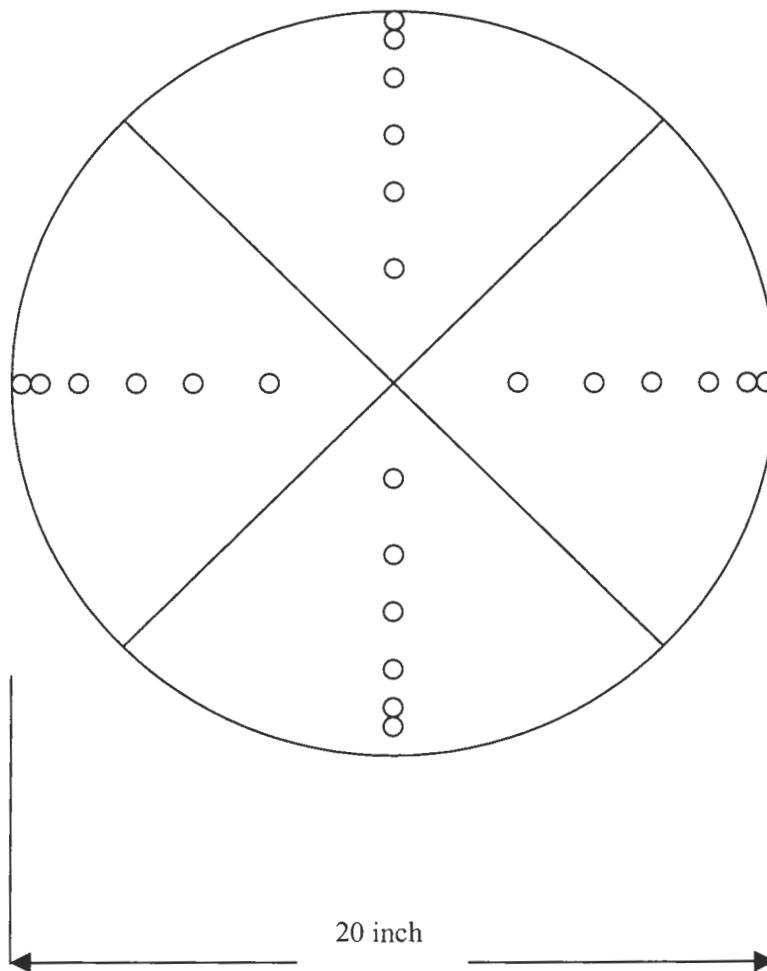
## 5.2 APE 1236 SYSTEM PERFORMANCE MONITORING PROCEDURES

Key systematic operating data will be continuously monitored and recorded during the operation of the APE 1236 system. As is described in greater detail in **Section 2.2.1** of this work plan, the temperature of combustion and exhaust gases are measured at many locations, typically downstream of each major system component (e.g., rotary kiln, afterburner, high and low temperature gas coolers, etc.) within the system. Similarly, system component pressure (i.e., both pressure and vacuum) or differential pressure readings are monitored and recorded throughout the APE 1236 system. Additionally, auxiliary fuel flow data is continuously monitored and recorded. The APE 1236 system is also equipped with instrumentation that continuously monitors and records the stack gas velocity and the concentration of oxygen and carbon monoxide prior to its discharge to the atmosphere. All of these data will be compiled during the performance test period and used during the economic analysis for the thermal treatment of the soil in the

**Figure 5-2 Tentative Traverse Points**

Traverse Point	Percentage of Diameter	Calculated (1)	Repositioned
1	2.1	0.42	0.5
2	6.7	1.34	1.34
3	11.8	2.36	2.36
4	17.7	3.54	3.54
5	25	5	5
6	35.6	7.12	7.12
7	64.4	12.88	12.88
8	75	15	15
9	82.3	16.46	16.46
10	88.2	17.46	17.46
11	93.3	18.66	18.66
12	97.9	19.58	19.5

(1) Assumes inside diameter of 20 inches; actual measurement to be field verified.



APE 1236 system.

### 5.3 AIR POLLUTION SAMPLING AND ANALYSIS PROCEDURES

The following section provides details of the proposed extractive sampling procedures that will be used to characterize the air emissions from the APE 1236 system.

#### 5.3.1 Sampling Location Selection and Cyclonic Flow Check

Prior to the initiation of stack sampling, USEPA Reference Method 1 (RM1 – 40 CFR Part 60, Appendix A) will be used to verify the suitability of the extractive sampling locations proposed for the MM5 total particulate and semi-volatile organic compound determinations. As is indicated above, new ports will be installed in the system to support the proposed MM5 determinations. After these ports are installed, initial measurements will verify the distance between the sampling ports and possible flow disturbances up- (i.e., ports where the APE system's flow monitor pitot is installed) and down-stream (point of stack discharge to the atmosphere). Using distances determined and information provided in the RM1 procedure, the number of stack diameter equivalents up- and down-stream of the proposed sampling ports will be computed and the number of sampling points required for each MM5 test will be determined. Based on the proposed placement of the new sampling ports, a 24-point traverse will be used for each MM5 determination. Sampling point locations for the 24-point traverse are defined in **Figure 5-2**.

After verification of the suitability of the proposed sampling ports, a cyclonic flow check will be performed to ensure that the exhaust gas' flow profile at the proposed sampling plane conforms to prescribed limits. This determination requires that a manometer be leveled and zeroed, and then connected to a properly constructed and calibrated<sup>1</sup> Strausscheibe (i.e., Type "S" or reverse type) pitot tube. The tip of the Type "S" pitot tube is then positioned at the first traverse point in the stack, with its velocity impact and static pressure surfaces rotated 90 degrees out of the stack's cross-sectional plane of flow. This is defined as the pitot's "0" position. The pressure reading shown on the manometer is then read. If the reading is zero, the angle of deflection or "yaw" angle (i.e., in this case 0 degrees) for the traverse point is recorded in the field notes, and the pitot tube is moved to the next traverse point location. If the reading on the manometer is not 0, an inclinometer is attached to the pitot tube and the tube is slowly rotated in either a clock-wise or counter clock-wise manner until the manometer reading is again 0. Once a "0" reading is re-established, the "yaw" angle as indicated on the inclinometer is recorded in the field log before the pitot is moved to the next location. The yaw angle needed to re-establish the pitot's "0" position at each traverse point is

measured and recorded in similar fashion. Once all “yaw” angle measurements are obtained, the overall average is computed. If the average “yaw” angle exceeds 20 degrees, sampling is not permitted at the location without regulatory review and approval. A cyclonic flow check will be performed prior to the initiation of testing at each of the proposed waste feed rates.

### **5.3.2 Exhaust Gas Flow Rate**

Stack gas flow determinations will be made in accordance with procedures identified in USEPA Reference Method 2 (RM2 – 40 CFR Part 60, Appendix A). A preliminary flow determination will be made each time the soil feed rate to the rotary kiln is adjusted, or when the operation of the rotary kiln or afterburner is altered (substantially). Additionally, flow determinations will be made as part of each of the proposed MM5 determinations. All velocity head and static pressure determinations will be performed at each of the proposed traverse points required for the MM5 determinations.

### **5.3.3 Stack Gas CO<sub>2</sub> and O<sub>2</sub> Content**

The CO<sub>2</sub> and O<sub>2</sub> content of the exhaust gas of the APE 1236 will be measured using continuous emission monitors (CEMs) in accordance with USEPA Reference Method 3A (RM3A – 40 CFR Part 60 Appendix A). The RM3A train will be operated simultaneous to each MM5 determination, and the necessary sample will be collected either from a single point that is located near the location of the MM5 profile, or from each of the traverse points immediately adjacent to the MM5 probe tip. Determination of whether single or multi-point sampling will be used will be based on results of a preliminary profile that is conducted to determine if there is evidence of stratification in the exhaust gas stream. Multi-point gas sampling will be performed unless the preliminary data demonstrates that the mean pollutant concentration determined for the stack gas is less than 10% different from that found at any single point. If evidence of stratification is absent, a single point sample will be used.

Stack gas for the molecular weight determination will be extracted from the stack using a stainless steel probe, passed through a Balston filter to remove particulates, and then passed through a condenser unit (M & C Products equipped with two Peltier Effect cooled stainless steel condensers) to remove moisture. The cleaned and conditioned gas is then channeled through a non-reactive sample line and delivered to the CEMs for analysis.

The CO<sub>2</sub> content in the stack will be measured with a Servomex, Model 1440 analyzer using the NDIR

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<sup>1</sup> i.e., minimal specifications provided in USEPA Reference Method 2 - 40 CFR 60 Appendix A, Method 2

method of detection. The analyzer will be multi-point calibrated before the testing program and calibrated before and after each test run. Operating conditions are as follows:

Zero Drift	≤ 2% of full-scale
Span Drift	≤ 2% of span value
Response Time	≤ 1 minutes
Sample Residence Time	≤ 1 minutes
Instrument full-scale	0-25% (v/v) (0 – 10% and 0 – 25% ranges)

The O<sub>2</sub> content will be continuously recorded using a Servomex, Model 1440 analyzer employing the paramagnetic method of detection. The analyzer will be multi-point calibrated before the testing program and calibrated before and after each test run. The following criteria applies to instrument operation:

Zero Drift	≤ 2% of chart
Span Drift	≤ 2% of full-scale
Response Time	≤ 1 minute
Sample Residence Time	≤ 1 minutes
Instrument full-scale	0-25% (v/v) (0 – 10% and 0 – 25% ranges)

The CO<sub>2</sub> and O<sub>2</sub> analyzers will be calibrated with two concentrations of span gas plus zero gas. The calibration gases for each parameter are currently certified USEPA Protocol 1 gases and balanced in N<sub>2</sub>. Additional details of the CEMs that will be used for this determination are provided in **Sections 5.3.8** through **5.3.9** of this section.

#### **5.3.4 Stack Gas Moisture**

A preliminary stack gas moisture determination will be completed prior to the initiation of each series of performance tests in accordance with the procedures identified in USEPA Reference Method 4 (RM4 – 40 CFR Part 60, Appendix A). The data collected from the preliminary RM4 determination will be used to predict the moisture level that will be encountered during subsequent MM5 tests. Stack gas moisture determinations will also be completed during each of the proposed MM5 determinations in accordance with procedures identified in RM5 and SW846 Method 0010.



### 5.3.5 Particulate Matter, Semi-volatile Organic Compound and Total Metal Emission Rates

USEPA's SW846 Method 0010 "Modified Method 5 – MM5" will be used to collect samples of the exhaust gas for determinations of total particulate, semi-volatile organic compound and total metal emission rates, simultaneously. The MM5 sampling system will be operated in accordance with USEPA Reference Method 5 (RM5 – 40 CFR, Part 60, Appendix A, Reference Method 5), Reference Method 29 (RM29 – 40 CFR, Part 60, Appendix A, Reference Method 29), and SW846 Method 0010 procedures. A diagram of the USEPA MM5 sampling train is shown in **Figure 5-3**. A typical MM5 sampling train consists of:

- a glass or quartz<sup>2</sup> sampling nozzle;
- a heated borosilicate or quartz glass probe capable of maintaining the sampled gas' temperature at  $120 \pm 14^{\circ} \text{C}$  ( $248^{\circ} \text{F} \pm 25^{\circ} \text{F}$ );
- a Type-S pitot tube;
- a dual inclined manometer;
- a borosilicate glass filter holder with a teflon or other non-metallic contaminating filter support to support the particle filter;
- a high-efficiency fiber filter<sup>3</sup>, containing no organic binders, and exhibiting at least a 99.95% efficiency for the collection of 0.3 um dioctyl phthalate smoke particles;
- a filter heating system capable of maintaining the sample gas temperature at  $120 \pm 14^{\circ} \text{C}$ ;
- a temperature gauge capable of measuring gas temperature to within  $1^{\circ} \text{C}$  ( $2^{\circ} \text{F}$ );
- an organic sorbent module consisting of three sections (i.e., a gas-conditioning section, the sorbent module, and a condensate knock-out section);
- a condenser section containing 4 to 7 impingers to capture volatile metal compounds and to dehumidify the sampled gas to a temperature of  $20^{\circ} \text{C}$  ( $68^{\circ} \text{F}$ ) or less; and
- a gas pumping, flow control and metering system.

In MM5 determinations, an integrated sample of exhaust gases and entrained particulate matter are withdrawn isokinetically (i.e., at a matched rate  $\pm 10\%$ ) from the stack at a location that is upstream of the exhaust gas' discharge point to the atmosphere. The sampled exhaust gas is maintained under controlled

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<sup>2</sup> Metal sample nozzles may be used but are not recommended as they may contaminate the sample collected for metals. No blank correction is allowed if metal nozzles are used. See 40 CFR Subpart 60, Appendix A, Reference Method 29, Section 3.1.1.

<sup>3</sup> Without organic binders. The filter shall contain less than  $1.3 \text{ ug/in}^2$  of each of the metals to be measured. Quartz fiber filters meeting these requirements are recommended. However, if glass fiber filters become available which meet these requirements they may be used. See 40 CFR Subpart 60, Appendix A, Reference Method 29, Section 4.2.1.

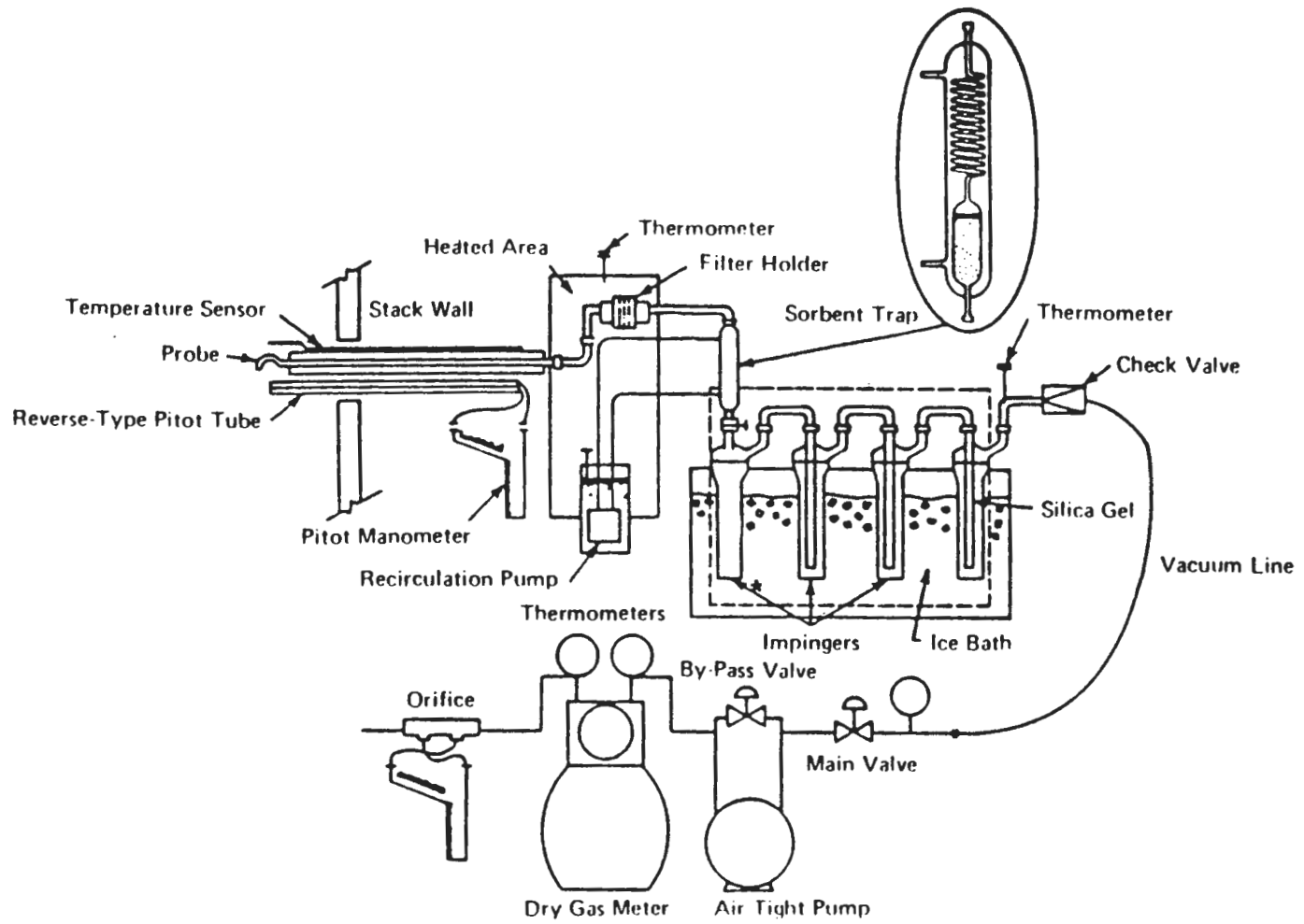


Figure 5-3: Typical Modified Method 5 (MM5) Train Set-up

temperature conditions (i.e., elevated) as it is drawn through the sampling nozzle, the sample probe, the cyclone (optional), and a high-efficiency, heated borosilicate glass or quartz-fiber filter. At the face of the filter, the exhaust gas' temperature must be  $120 \pm 14^\circ \text{C}$  ( $248 \pm 25^\circ \text{F}$ ). Downstream of the filter, the sampled gas is rapidly cooled to a temperature of  $17 \pm 3^\circ \text{C}$  (i.e.,  $62.5 \pm 5.4^\circ \text{F}$ ) in the sorbent module's gas-conditioning system before it is passed through a packed bed of porous polymeric resin (e.g., XAD-2 or equivalent). Moisture that condenses is allowed to percolate through the sorbent trap before being captured in the moisture knock-out trap placed beneath the sorbent module. Downstream of the moisture knock-out, the sampled gas is drawn through a set of four to six impingers to remove volatile metal compounds and residual, entrained moisture. The first two impingers are filled with 100 milliliters (mLs) each of an acidified hydrogen peroxide solution, the third is left dry and then the fourth (and fifth, optional) if filled with 100 mLs each of an acidified potassium permanganate solution. The last impinger (either fifth or sixth) is loaded with a known weight of desiccated silica gel. In operation, the temperature of the sampled gas exiting the last impinger must be maintained at a temperature of  $20^\circ \text{C}$  ( $68^\circ \text{F}$ ) or less. Downstream of the impinger train, the sampled gas enters a gas metering system comprised of a volume, flow, temperature and pressure measuring devices.

Particulate matter entrained within the sampled gas stream is captured in the front portion (i.e., between the filter and the sample nozzle) of the sampling system via gravitational fallout or impaction. At the completion of each test run, the particulate matter captured in the front-half of the sampling train is quantitatively recovered for subsequent gravimetric determinations. The captured particulate mass, which includes all materials that condense at or above the filtration temperature, is then recovered quantitatively and weighed under controlled atmospheric conditions to determine the particulate mass loading. The particulate catch will also be subsequently characterized for semi-volatile organic and metal compound content.

Semi-volatile organic compounds contained in the sampled gas stream are collected in the MM5 system via adsorption onto captured particulate, adsorption onto the porous polymeric resin, and condensation onto the sampling nozzle, the probe liner, the filter or filter housing, and into the moisture that is captured in the knock-out trap below the sorbent module. All front-half and sorbent module components are recovered in accordance with SW846 Method 0010 procedures after the completion of a sample run and the recovered materials are sent to an analytical laboratory for the determination of captured organic compounds via SW846 Method 8270 (semivolatile), 8082 (PCBs/pesticides), and 8015 (for TPH).

Metals are captured as part of the particulate catch and in knock-out/impinger train section via condensation in/reaction with acidified impinger solutions. All front-half and back-half components are analytically

recovered in accordance with RM29 procedures after completion of the sample run and the recovered samples are sent to an analytical laboratory for determination of the captured metals via SW846 Method 6020.

During each series of the proposed LTTD system performance testing, triplicate determinations of the system's total particulate matter, semi-volatile organic, and metal compound emission rates will be completed for each waste feed/system operating condition tested. Each MM5 determination will include the traverse of the stack along two perpendicular axes at a location that is approximately 26.5 feet above grade on the exhaust stack. Each MM5 determination will encompass a period of no less than 360 minutes of sampling time and the collection of no less than 106 dry, standard cubic feet of gas. As is discussed above, each MM5 determination will require collection of stack gas from a 24-point traverse.

Sample recovery operations from the MM5 system will be modified to accommodate the collection and analysis of all desired species in the sampling system. The collection filter will be quantitatively recovered and prepared for gravimetric determinations to allow for the computation of total particulate emissions. Subsequently, the particulate filter will be split into two pieces, the weight of each piece determined, and then one piece will be extracted and analyzed for semi-volatile organic compounds, while the other is extracted and analyzed for metal components.

Traditional RM5 probe rinses normally completed using acetone and/or distilled, deionized water will be replaced by a four step process that includes use of : 1) a 1:1 V/V methanol/methylene chloride solution; 2) a rinse of distilled, deionized water; 3) a rinse of a 0.1 Normal solution of nitric acid; and 4) a rinse of distilled, deionized water. The methanol/methylene chloride rinses are used to improve the recovery of target organic compounds, while the nitric acid solution is used to enhance the recovery of metals compounds contained in the sampled gases. The first two, and the last two, rinse solution combinations will be captured in separate sample bottles and returned for analysis.

Liquids contained in the knock-out trap will be quantitatively measured so the moisture content of the sampled gas can be determined. Subsequently, all components between the filter housing and knock-out trap (inclusive) will be rinsed with the same four step rinse sequence used for the sample probe. Once the volume of the moisture captured in the knock-out trap is known, the sample will be returned to the laboratory where it will be split and analyzed for metals and organic compound content.

Solutions contained in impingers located downstream of the knock-out trap beneath the sorbent module will be recovered and analyzed in accordance with RM29 methods to allow for the determination of total metal

content. The volume contained each impinger, and the weight of the silica gel will also be determined to allow for the determination of the stack gas moisture content.

The resulting particulate mass loading determined in the MM5 sampling system is ratioed to the volume of exhaust gas released, adjusted to a prescribed oxygen level (7%), from the system to determine the a total particulate emission rate. This value is then compared to NYSDEC's regulatory limit of 0.05 grains per dry standard cubic foot.

Results of the SW846 Method 8270, 8082 and 8015 organic compounds determinations will be used to compute the amount of semi-volatile organic and PCB/pesticide compounds that are emitted from the stack. The amount of individual organic compounds emitted will also be compared to the amount of the same compound contained in the waste feed to compute a destruction and removal efficiency (DRE) value for each of the trials completed. The most prominent organic compound currently known to be contained in the feed material is Total Petroleum Hydrocarbons and the levels of this compound found in the exhaust gases will be used to compute the level of DRE achieved during the test. Additional DRE computations will be made using any other organic compound found to be present in both APE 1236 system's exhaust gas and in the waste feed. If no organic compounds are detected in the exhaust gas, the DRE will be calculated using the lowest and highest detection limits recorded for any organic compound in the MM5 train.

Results of the SW846 Method 6020 determinations will be used to compute the amount of total metal compounds that are emitted from the LTTD system.

During the collection of each MM5 sample, concurrent determinations of:

- the stack pressure and temperature and the range of velocity heads will be measured using RM2,
- dry gas molecular weight of the stack gas will be determined by RM3A,
- the moisture content of the stack gas will be measured using RM5
- the concentration of Carbon Monoxide present in the exhaust gas by Reference Method 10,
- the concentration of Total Hydrocarbons present in the exhaust gas by Reference Method 25A, and
- the concentration of volatile organic compound by SW846 Method 0030 (VOST sampling).

The results of each of these determinations will be recorded in the data from the performance test.

Necessary calibration procedures (e.g., gas meter and orifice calibrations, nozzle calibrations, thermometer calibrations, etc.) associated with the MM5, RM5 and RM29 sampling will be completed prior to the

deployment of sampling equipment and subsequent to the completion of the field activity. These data will be provided in the final report for the performance tests.

Examples of sample calculations that will be completed for each demonstration test are described in **Appendix B**.

### **5.3.6 Volatile Organic Sampling Train (VOST)**

Equipment and procedures described in USEPA's SW846 Method 0030 "Volatile Organic Sampling Train – VOST" will also be used to characterize the organic emissions from the APE 1236 system. A typical VOST sampling system is shown in **Figure 5-4** and includes:

- a temperature regulated borosilicate or quartz glass sampling probe encased in a stainless steel sheath;
- a glass- or quartz-wool particulate filter;
- a sample gas isolation valve;
- two condensers;
- two sorbent traps;
- a silica gel trap;
- sample transfer lines of inert (e.g., glass, quartz, teflon, etc) construction; and
- a gas metering system consisting of a sample pump, flow meters, displaced volume meter, pressure gauges, and temperature sensors.

In VOST determinations, an integrated sample of the system's exhaust gas is withdrawn from the stack at a controlled rate (i.e., typically 1 liter per minute) from a location that is upstream of the system's discharge point to the atmosphere. Initially, the sampled gas is maintained under controlled temperature conditions [i.e., at least 130° C (266° F)] as it is drawn through the glass- or quartz-wool particulate filter, the sample probe, the sample gas isolation valve and into the first of the two condensers. Upon arrival at the first condenser, the temperature of the sample gas is cooled and maintained at 20° C (i.e., 68° F) or less, prior to its passage into the first of the two sorbent traps. The first sorbent trap is loaded with porous polymeric resin (e.g., Tenax® GC) which is capable of absorbing volatile organic compounds. Moisture that condenses out of the cooled gas is allowed to percolate through the resin and is collected in the moisture trap that is located downstream (i.e., beneath) of the sorbent trap. After passage through the first condenser and sorbent trap, the cooled and dehumidified gas is passed through a second condenser / sorbent trap pair for final organic compound removal. The second trap is packed with a combination of porous polymeric resin (i.e., Tenax® GC) and charcoal. Subsequently, the gas is passed through a silica gel trap, a flow

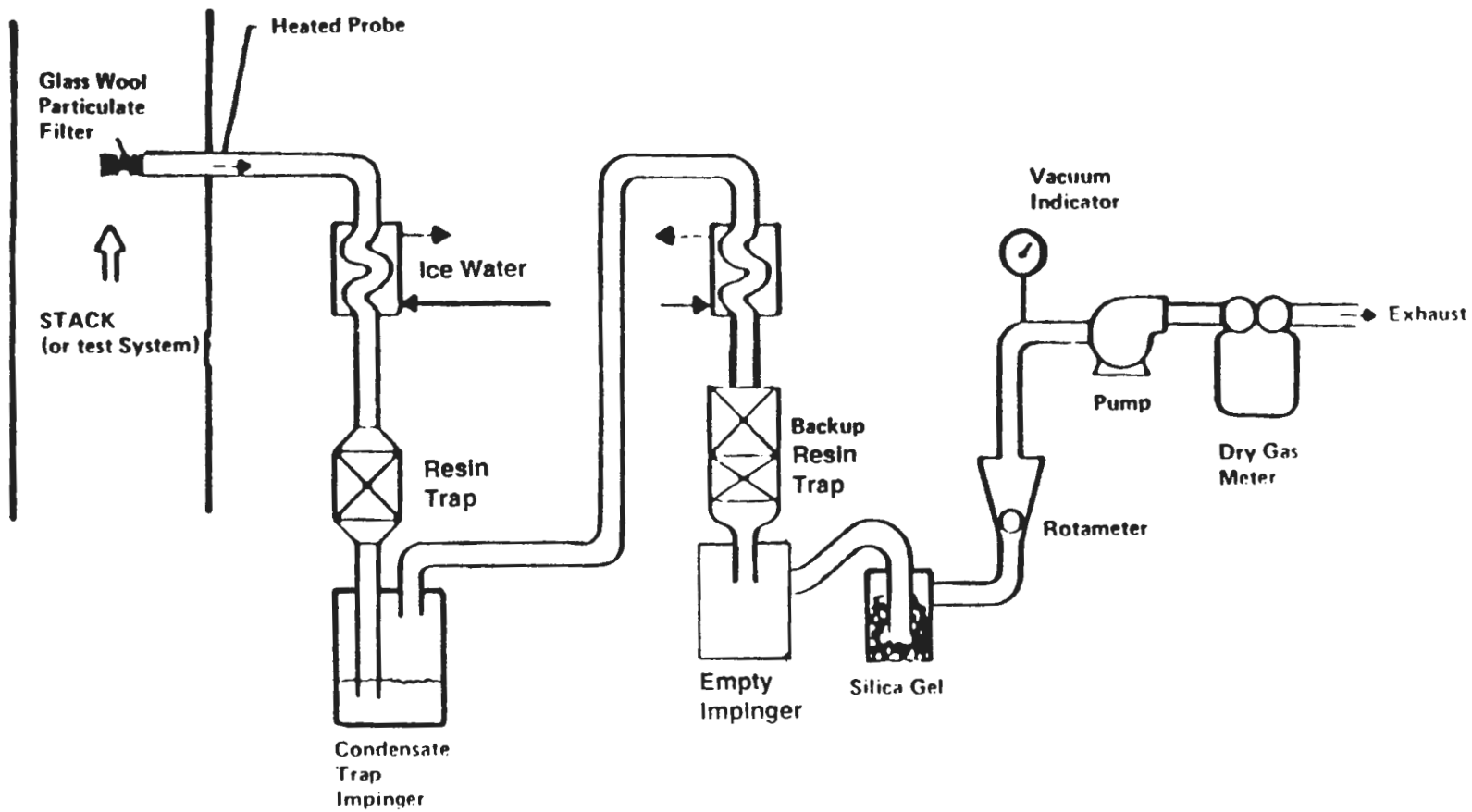


Figure 5-4: Typical Volatile Organic Sampling Train (VOST) Set-up

meter, the pump and volumetric gas meter prior to its discharge to the atmosphere.

Each VOST determination will include the exposure and field collection of six replicates of pairs of sorbent traps and the recovery of any associated moisture condensate. Each sampling run will be twenty minutes in length and the sample flowrate will be set at one liter per minute for a total sample volume of 20 liters. All gas will be collected from a point near the center of the stack at the 17.5-foot level.

Volatile organic compounds captured by the VOST system via their adsorption onto the resin traps, or due to condensation in the moisture will be sent to an analytical laboratory for the determination of captured organic compounds via SW846 Method 5040.

Results of the SW846 Method 5040 organic compounds determinations will be used to compute the amount of volatile organic compounds that are emitted from the stack. The amount of individual volatile organic compounds emitted will also be compared to the amount of the same compound contained in the waste feed to compute a destruction and removal efficiency (DRE) value for each of the trials completed. Additional DRE computations will be made using any other organic compound found to be present in both APE system's exhaust gas and in the waste feed. If no organic compounds are detected in the exhaust gas, the DRE will be calculated using the lowest and highest detection limits recorded for any organic compound in the VOST system.

Examples of sample calculations that will be completed for each demonstration test are described in **Appendix B**.

### **5.3.7 Polychlorinated Dibenzo-*p*-dioxins and Polychlorinated Dibenzofurans and Hydrochloric Acid Determinations**

USEPA's SW846 Method 0023 will be used to determine Polychlorinated Dibenzo-*p*-dioxins and Polychlorinated Dibenzofuran concentrations emitted from the APE 1236 system. The Method 0023 will also be used for the collection of samples for Hydrochloric Acid concentration determinations. The Method 0023 system is essentially identical to the sampling system that is used for the MM5 or Method 0010 determinations for semi-volatile organic compounds and total particulates with the following exceptions:

- stainless steel nozzles may not be used in the Method 0023 configuration and must be replaced with either quartz or borosilicate glass nozzles;
- the glass filter frit support must be replaced with a Teflon® frit and the filter seal should also be made



of Teflon®;

- stopcock grease may not be used on any connective joint during assembly of the sampling system;
- special cleaning and storage procedures are required for all glass/quartz components of the sampling system;
- additional quality control samples (glassware blanks, reagent blanks, etc.) should be collected for the Method 0023 system; and
- different solvents (acetone/methylene chloride/toluene versus methanol/methylene chloride) are used for the recovery of samples from the Method 0023 system.

The Method 0023 system will be operated in accordance with USEPA Reference Method 5 (RM5 – 40 CFR, Part 60, Appendix A, Reference Method 5) and SW846 Method 0023 procedures. A diagram of the USEPA Method 0023 sampling train is shown in **Figure 5-3**. A typical Method 0023 sampling train consists of:

- a glass or quartz sampling nozzle;
- a heated, borosilicate or quartz glass probe capable of maintaining the sampled gas' temperature at  $120 \pm 14^\circ \text{C}$  ( $248^\circ \text{F} \pm 25^\circ \text{F}$ );
- a Type-S pitot tube;
- a dual inclined manometer;
- a borosilicate or quartz filter holder equipped with a Teflon® filter frit support and seal to support the particle filter;
- a glass or quartz filter, containing no organic binders, and exhibiting at least a 99.95% efficiency for the collection of 0.3  $\mu\text{m}$  dioctyl phthalate smoke particles;
- a filter heating system capable of maintaining the sample gas temperature at  $120 \pm 14^\circ \text{C}$ ;
- a temperature gauge capable of measuring gas temperature to within  $1^\circ \text{C}$  ( $2^\circ \text{F}$ );
- an organic sorbent module consisting of three sections (i.e., a gas-conditioning section, the sorbent module, and a condensate knock-out section);
- an impinger or condenser section to dehumidify the sampled gas to a temperature below  $20^\circ \text{C}$  ( $68^\circ \text{F}$ ) and to capture hydrochloric acid gases within a scrubbing solution; and
- a gas pumping, flow control and metering system.

In Method 0023 determinations, an integrated sample of exhaust gases and entrained particulate matter are withdrawn isokinetically (i.e., at a matched rate  $\pm 10\%$ ) from the stack at a location that is upstream of the exhaust gas' discharge point to the atmosphere. The sampled exhaust gas is maintained under controlled temperature conditions (i.e., elevated) as it is drawn through the sampling nozzle, the sample probe, the

cyclone (optional), and a high-efficiency, heated glass or quartz-fiber filter. At the face of the filter, the exhaust gas' temperature must be  $120 \pm 14^\circ \text{C}$  ( $248 \pm 25^\circ \text{F}$ ). Downstream of the filter, the sampled gas is rapidly cooled to a temperature of  $17 \pm 3^\circ \text{C}$  (i.e.,  $62.5 \pm 5.4^\circ \text{F}$ ) in the sorbent module's gas-conditioning system before it is passed through a packed bed of porous polymeric resin (e.g., XAD-2 or equivalent). Moisture that condenses is allowed to percolate through the sorbent trap before being captured in the moisture knockout trap placed beneath the sorbent module.

Downstream of the moisture knockout, the sampled gas is drawn through a set of four impingers (i.e., three modified Greenberg-Smith impingers in positions 1, 3 and 4 and one Greenberg-Smith impinger in position 2) placed in an ice bath to remove residual, entrained moisture. Normally, the first two impingers of the Method 0023 train would be filled with reagent grade or distilled water, the third left dry and the fourth loaded with a known weight of desiccated silica gel; however since the Method 0023 train will also be used for the determination of hydrochloric acid emissions from the APE 1236 System, the first two impingers will be filled with 100 milliliters (mL) of a 1 Normal (N) sodium acetate solution. Sodium acetate will be used to capture the hydrochloric acid gases that are present in the exhaust gas instead of sodium hydroxide and sulfuric acid solutions, which are recommended in EPA Reference Method 26, to minimize the possibility of reaction between the absorbent solution and carbon dioxide that is contained in the exhaust gas.

In operation, the temperature of the sampled gas exiting the last impinger will be maintained at a temperature of  $20^\circ \text{C}$  ( $68^\circ \text{F}$ ) or less. Downstream of the impinger train, the sampled gas enters a gas metering system comprised of a volume, flow, temperature and pressure measuring devices.

Particulate matter entrained within the sampled gas stream is captured in the front portion (i.e., between the filter and the sample nozzle) of the sampling system via gravitational fallout or impaction. At the completion of each test run, the particulate matter captured in the front-half of the sampling train is quantitatively recovered for subsequent gravimetric determinations. The captured particulate mass, which includes all materials that condense at or above the filtration temperature, is then recovered quantitatively and weighed under controlled atmospheric conditions to determine the particulate mass loading.

Dioxin/furan compounds contained in the sampled gas stream are collected in the Method 0023 system via their adsorption onto captured particulate, their adsorption onto the porous polymeric resin, and their condensation onto the sampling nozzle, the probe liner, the filter or filter housing. All front-half and sorbent module components are recovered in accordance with SW846 Method 0023 procedures after the completion of a sample run and the recovered materials are sent to an analytical laboratory for the

determination of captured organic compounds via SW846 Method 8290.

Condensate captured in the back-half (i.e., behind the sorbent module) of the sampling system will also be quantitatively recovered and measured. Resulting condensate volumes are used to calculate the stack gas' percent moisture. Additionally, the moisture captured in the knockout trap and the impinger train will be used the determination of hydrochloric acid via ion chromatography (SW846 Method 9056).

During each series of the proposed LTTD system performance testing, triplicate determinations of the system's dioxin/furan and hydrochloric acid emission rates will be completed for each waste feed/system operating condition tested. Each Method 0023 determination will include the traverse of the stack along two perpendicular axes at a location that is approximately 26.5 feet above grade on the exhaust stack. Each Method 0023 determination will encompass a period of no less than 360 minutes of sampling time and the collection of no less than 106 dry, standard cubic feet of gas. As is discussed above, each Method 0023 determination will required collection of stack gas from a 24-point traverse.

The resulting dioxin/furan and hydrochloric acid loading contained in the APE 1236 system's exhaust gas will be determined in accordance with procedures defined in EPA Reference Method 26.

Results of the SW846 Method 8290 dioxin/furan determinations will be used to compute the amount of dioxin/furan compounds that are emitted from the stack.

During the collection of each Method 0023 sample, concurrent determinations of:

- the stack pressure and temperature and the range of velocity heads will be measured using RM2,
- dry gas molecular weight of the stack gas will be determined by RM3A,
- the moisture content of the stack gas will be measured using RM5
- the concentration of Carbon Monoxide present in the exhaust gas by Reference Method 10,
- the concentration of Total Hydrocarbons present in the exhaust gas by Reference Method 25A.

The results of each of these determinations will be recorded in the data from the performance test.

Necessary calibration procedures (e.g., gas meter and orifice calibrations, nozzle calibrations, thermometer calibrations, etc.) associated with the Method 0023 and RM5 sampling will be completed prior to the deployment of sampling equipment and subsequent to the completion of the field activity. These data will be provided in the final report for the performance tests.

Examples of sample calculations that will be completed for each demonstration test are described in **Appendix B**.

### **5.3.8 Carbon Monoxide Monitor**

The concentration of carbon monoxide (CO) will be measured by a analyzer that is permanently installed in the control room, and by a separate CEM that is provided by the stack sampling contractor. Both analyzers will be operated in a manner that is consistent with the procedures identified in USEPA's Reference Method 10 (RM10 – 40 CFR Part 60, Appendix A). The analyzer located in the control room is an integral component of the APE 1236 system and is monitored by the system's computer as one of the system parameters that can cause the activation of the APE 1236's AWFSO system (see **Section 2**).

Both CO analyzers use non-dispersive infrared (NDIR) technology to continuously measure the amount of CO present in the gas stream. Analysis of CO is based upon the absorption of infrared radiation by the CO molecule. The intensity of the absorption is proportional to the concentration of CO present. Two infrared light beams are generated, with one passing through the sample cell while the other beam passes through a reference cell. Contained within the reference cell is a gas, such as nitrogen, that does not adsorb the infrared light. Light passing through each cell (i.e., reference and sample) is then measured by a detector based on the Luft principle. The detector converts the difference in energy between sample and reference cells to a change in capacitance. The capacitance change is equivalent to the amount of CO present. The output signal from the analyzer is sent to a data acquisition system (DAS) that converts the signal to a concentration reading in parts per million (ppm) of CO. The value for CO obtained from the permanently installed CO analyzer is automatically corrected to 7% O<sub>2</sub>. This corrected value is recorded. The CO value reported from the CO analyzer provided by the stack sampling contractor will be corrected to a 7% O<sub>2</sub> level prior to reporting.

When the APE 1236 is operating, sample gas (i.e., stack gas exhaust) is withdrawn continuously from the stack through a stainless steel probe that is placed in a port located approximately 20 feet above grade level. Two separate sampling probes and sample delivery/conditioning systems will be used for CO analysis: one that is permanently installed and associated with the CO and O<sub>2</sub> analyzers that are integral components of the APE 1236 system; and the second that is provided by the sampling contractor for comparative determinations.

Both of the sample delivery/conditioning systems contain equivalent components, as described below.

Sampled gas passes through the probe before it is channeled through a three-way valve into a heated sample line. During passage through the probe/sample line, the sampled gas is cooled in condensers to remove moisture and filtered to remove entrained particulate matter. Ultimately, the sample delivered to the CO analyzer (either in the control room or in the instrumentation shed/van) for analysis is cool and dry.

The permanent CO analyzer is a Rosemount/Beckman 880 NDIR that features dual span ranges (i.e., a 0-200 ppm range and a 0-3,000 ppm range). The CO analyzer that will be provided by the stack sampling contractor will be a Thermo Electron Model 48 analyzer that can be operated in the 0 – 10 ppm, 0 – 20 ppm, 0 – 50 ppm, 0 – 100 ppm, 0 – 200 ppm, 0 – 500 ppm, or 0 – 1,000 ppm ranges.

Once the sampling system is ready for use, calibration gas is introduced directly into the instrument and the analyzer calibration error check is performed. When this is completed, calibration gas is introduced to the analyzer through the sampling and sample gas conditioning and a sampling system bias check is performed. An automatic calibration is performed daily when the furnace is operating. These procedures are used for quality control/quality assurance purposes to validate the analyzer's responses during the sampling period, and to calculate the measurement system error and drift.

Both analyzers will be multi-point calibrated before testing program and system bias check before and after each test runs. The following criteria covers instrument operation:

Zero Drift	≤ 2% of chart
Span Drift	≤ 2% of full-scale
Response Time	≤ 1 minute
Sample Residence Time	≤ 1 minute
Instrument full-scale	2-1,000 ppm (v/v)

The CO analyzers will be calibrated with two concentrations of span gas plus zero gas. The calibration gases for this parameter are currently certified USEPA Protocol 1 gases and balanced in N<sub>2</sub>.

Relative accuracy calculations will be in accordance with 40 CFR, Part 60, Appendix B, Performance Specifications 4 (CO). Three test runs of 60-minute duration will be performed and six additional 30-minute runs will be performed to provide the required nine data sets. These nine runs will be used to calculate the Relative Accuracy for the furnaces CO analyzer. The relative accuracy of the APE system's CO monitor shall be no greater than 10 percent of the mean value of the reference method test data or 5 percent of the applicable standard (100 ppm), whichever is greater.

### 5.3.9 Oxygen Monitor

Oxygen concentration in the stack gas will be measured by an O<sub>2</sub> monitor permanently installed in the control room, and by a separate CEM provided by the stack sampling contractor. Both of these analyzers will be operated in a manner that is consistent with the procedures that are identified in USEPA Reference Method 3A (RM3A – 40 CFR Part 60, Appendix A). The analyzer that is located in the control room is an integral component of the APE 1236 system and is monitored and recorded by the system's computer.

In both analyzers, oxygen is detected using Faraday's principle that comparatively measures the magnetic susceptibility of a gas volume by the force acting upon a non-magnetic test body suspended in a disproportionate magnetic field. The test body is mounted on a platinum suspension in a strong, relatively disproportionate magnetic field. Because oxygen is more paramagnetic than the test body, the magnetic force acts to reject the test body from the magnetic field. As oxygen is introduced to the analyzer, a force manifests itself upon the test body and rotates it out of the magnetic field. When this occurs, a diamond-shaped mirror mounted on the platinum suspension also is rotated. This rotation causes the mirror to reflect a pre-focused light source unequally across two photocells (when the mirror is in a neutral position, the photocells are illuminated equally). Through an operational amplifier, the photocells apply a feedback current to the test body. The electromagnetic force that is created by the feedback current is opposite and almost equal to the magnetic force applied to the test body. The feedback current is a linear function of the oxygen concentration and an output signal is generated that can be converted and recorded as oxygen concentration in stack gas.

The stack gas sampling, conditioning, and delivery system used for the O<sub>2</sub> analyzer is equivalent to the system described above for the CO analyzer. In both cases, a cooled and dehumidified sample is delivered to the back of the O<sub>2</sub> analyzer for characterization.

The integral O<sub>2</sub> analyzer is a Rosemount Analytical 755R Paramagnetic Oxygen Analyzer that features five standard full-scale operating ranges (i.e., 0 – 5%, 0 – 10%, 0 – 25%, 0 – 50%, and 0 – 100% O<sub>2</sub>). During the performance tests, the oxygen analyzer will be set to operate in the 0 – 25% O<sub>2</sub> range. The oxygen analyzer provided by the stack sampling contractor is a Servomex Model 1440 analyzer that will operate in 0 – 25% range.

Once the analyzer and sampling system is ready for use, calibration gas (i.e., both zero and span gases) is introduced directly into the instrument and the analyzer calibration error check is completed. When this is completed, calibration gas is introduced into the sampling system near the tip of the sampling probe and a

sampling system bias check is performed. A calibration error check and a sampling system bias check are performed daily. These procedures are used for quality control/quality assurance purposes to validate the analyzers responses during the sampling period, and to calculate the measurement system error and drift.

The analyzer will be multi-point calibrated before the testing program and calibrated before and after each test run. The following criteria applies to instrument operation:

Zero Drift	$\leq 2\%$ of chart
Span Drift	$\leq 2\%$ of full-scale
Response Time	$\leq 1$ minute
Sample Residence Time	$\leq 1$ minutes
Instrument full-scale	0-25% (v/v) (0 – 10% and 0 – 25% ranges)

The analyzers will be calibrated with two concentrations of span gas plus zero gas. The calibration gases for each parameter (i.e., CO, CO<sub>2</sub>, O<sub>2</sub>) are currently certified USEPA Protocol 1 gases and balanced in N<sub>2</sub>.

Relative accuracy calculations will be in accordance with 40 CFR, Part 60, Appendix B, Performance Specifications 3 (O<sub>2</sub>). Three test runs of 60-minute duration will be performed and six additional 30-minute runs will be performed to provide the required nine data sets. These nine runs will be used to calculate the Relative Accuracy for the furnaces O<sub>2</sub> analyzer. The relative accuracy of the APE system's CO monitor shall be no greater than 20 percent of the mean value of the reference method test data or a maximum of 1 percent O<sub>2</sub> (absolute), whichever is greater.

### **5.3.10 Carbon Dioxide Monitor**

Carbon dioxide (CO<sub>2</sub>) concentration in the stack gas will be measured by a CEM provided by the stack sampling contractor and placed in the instrumentation van/shed. This system will be operated in a manner that is consistent with the procedures that are identified in USEPA Reference Method 3A (RM3A – 40 CFR Part 60, Appendix A).

The CO<sub>2</sub> analyzer uses non-dispersive infrared (NDIR) technology to continuously measure the amount of CO<sub>2</sub> present in the gas stream. Analysis of CO<sub>2</sub> is based upon the absorption of infrared radiation by the CO<sub>2</sub> molecule. The intensity of the absorption is proportional to the concentration of CO<sub>2</sub> present. Two infrared light beams are generated, with one passing through the sample cell while the other beam passes

through a reference cell. Contained within the reference cell is a gas, such as nitrogen, that does not adsorb the infrared light. Light passing through each cell (i.e., reference and sample) is then measured by a detector based on the Luft principle. The detector converts the difference in energy between sample and reference cells to a change in capacitance. The capacitance change is equivalent to the amount of CO<sub>2</sub> present. The output signal from the analyzer is sent to a data acquisition system (DAS) that converts the signal to ppm or percent of CO<sub>2</sub> present.

The stack gas sampling, conditioning, and delivery system used for the CO<sub>2</sub> analyzer is equivalent to the system described above for the CO analyzer. In both cases, a cooled and dehumidified sample is delivered to the back of the CO<sub>2</sub> analyzer for characterization.

The CO<sub>2</sub> analyzer is a Servomex Model 1440 Analyzer that features a full-scale operating range of 0 – 25%.

Once the analyzer and sampling system is ready for use, calibration gas (i.e., both zero and span gases) is introduced directly into the instrument and the analyzer calibration error check is completed. When this is completed, calibration gas is introduced into the sampling system near the tip of the sampling probe and a sampling system bias check is performed. A calibration error check and a sampling system bias check are performed daily. These procedures are used for quality control/quality assurance purposes to validate the analyzers responses during the sampling period, and to calculate the measurement system error and drift.

The analyzer will be multi-point calibrated before the testing program and calibrated before and after each test run. Operating conditions are as follows:

Zero Drift	≤ 2% of full-scale
Span Drift	≤ 2% of span value
Response Time	≤ 1 minutes
Sample Residence Time	≤ 1 minutes
Instrument full-scale	0-25% (v/v) (0 – 10% and 0 – 25% ranges)

The analyzers will be calibrated with two concentrations of span gas plus zero gas. The calibration gases for each parameter (i.e., CO, CO<sub>2</sub>, O<sub>2</sub>) are currently certified USEPA Protocol 1 gases and balanced in N<sub>2</sub>.



### 5.3.11 Total Hydrocarbon Emissions Measurement

Total Hydrocarbons (THC) emissions will be measured using USEPA Reference Method 25A. This method analyzes a sample of stack gas to determine the concentration of total gaseous organic vapors. A flame ionization detector (FID) analyzer is used to continuously monitor the stack gas for total hydrocarbon concentration. The principle of operation is that the combustion of hydrocarbon in the analyzer's flame detector releases a large number of ions that create a current between two electrodes. The strength of the current produced is measured by an electrometer amplifier and is directly proportional to the hydrocarbon concentration present in the flame.

During each performance test, stack gas will be drawn from the stack at the designated sampling point (i.e., the sampling port that is approximately 20 feet above grade). The sampled gas enters a heated sampling probe and flows through a heated sample line until it is delivered to the THC analyzer located in a mobile continuous emission monitoring unit located less than 100 feet away from the stack. The extracted stack gas is not conditioned (i.e., cooled or dehumidified) before being introduced to the analyzer; instead it is analyzed hot and wet. During operation, the FID's output is recorded and monitored by a PC-driven data acquisition system at thirty second intervals. The recorded responses may then be imported into a computerized spreadsheet program (e.g., Lotus 1-2-3 or Excel) for data manipulation and reduction.

The FIDs operating range is selected to be between 1.5 and 2.5 times the applicable emission limit. The THC analyzer is a J.U.M. Engineering Model 3 – 300 with multiple ranges as follows: 0-10 ppm, 0-100 ppm, 0-1,000 ppm, 0-10,000 ppm, 0-100,000 ppm. The analyzer will be multi-point calibrated before the testing program and system bias checked by alternately introducing the zero gas and upscale gas at the three way valve before and after each test runs. The following criteria applies to instrument operation:

Zero Drift	≤ 2% of full scale
Span Drift	≤ 2% of span value
Response Time	≤ 1 minutes
Sample Residence Time	≤ 30 seconds
Instrument full-scale	100-10,000 ppm (v/v)

Once the sampling system is ready for use, calibration gas is introduced into the sampling system at a point near the tip of the sampling probe to conduct a sampling system calibration error check. A calibration error check is performed within two hours of the start of every run. At the completion of each run, a calibration drift check and a sampling system bias are also performed. These procedures are used for quality

control/quality assurance purposes to validate the analyzers responses during the sampling period, and to calculate the measurement system error and drift.

The analyzer will be calibrated with three concentrations of span gas plus zero gas. The calibration gas will be propane in air and are currently certified USEPA Protocol 1 gases.

### **5.3.12 Fugitive Particulate Emission Monitoring**

During each of the performance test runs, ambient particulate concentrations will be measured. The goal of this work will be to demonstrate that uncontrolled particulate emissions are not generated during the operation of the APE 1236 system. Sampling stations will be set up at the point where fugitive particulate emissions are most likely to occur (e.g., near the location where the kiln ash or residue conveyor exits the shroud), and at a location upwind of the APE 1236 system which will be representative of background.

The MINIRAM (Miniature Real-time Aerosol Monitor manufactured by Monitoring Instruments for the Environment, Inc.) personal monitor model PDM-3 or equivalent will be used for ambient measurements at both locations. The operating principle of the MINIRAM is based on the detection of scattered electromagnetic radiation in the near infrared region of the spectrum. The MINIRAM detects both aerosols and particulate matter, preferentially in the 0.1 to 10 micron range (respirable or inhalable size). Air surrounding the instrument passes freely through the sensing chamber, requiring no pump for operation. The average concentration of the particulate and aerosol level is recorded every 10 seconds. The instrument can also calculate a time weighted average for the run on a continuous basis with all results reported in units of milligrams per cubic meter ( $\text{mg}/\text{m}^3$ ).

During set-up, each monitor will be placed 4 to 6 feet above ground. The actual placement of the sampling stations will be modified daily to accommodate shifts in the ambient winds, and the actual locations will be recorded in the field notes. After set-up, each instrument will be turned on at least 10 minutes and the device will be zeroed in accordance with manufacturer's specifications. Ambient monitoring will then commence at least 10 minutes prior to the introduction of soil feed to the APE 1236, and will continue until all treated soil has been discharged from the rotary kiln. Throughout this period, data will be obtained and recorded at 10-second intervals.

All of the data produced by the MINIRAM will be included in the performance test report. Data collected by the MINIRAM will be compared to the national primary and secondary 24-hour ambient air quality standard of  $150 \text{ ug}/\text{m}^3$ .

### 5.3.13 Sample Analysis

All samples recovered from integrated grab sampling systems (i.e., MM5, VOST and Method 0023 systems) will be analyzed by personnel of Alta Analytical Laboratory, Inc., 5070 Robert J. Mathews Parkway, El Dorado Hills, CA. The Director of the laboratory facility is Mr. Robert Mitzel. Copies of laboratory certifications needed for the proposed work are provided in **Appendix C**.

## 5.4 SOLID WASTE MATERIAL SAMPLING AND ANALYSIS

### 5.4.1 Waste Soil Feed Sampling

The soil feed system consists of a powerscreen and three conveyor belts that are used to move the soil to the rotary kiln from the storage pile. After being screened, feed soil falls onto the hopper conveyor belt which transports it into the control building where it is transferred to the waste loading conveyor. In turn, the waste loading transfers the soil feed onto the kiln feed conveyor. Finally, if all operational conditions are proper, the kiln feed conveyor dumps the feed soil into the rotary kiln. Sample aliquots collected of the feed to quantify the composition of the untreated soil will be collected from the point in the conveyor system where the hopper conveyor passes the untreated soil onto the waste loading conveyor.

Data is provided in **Section 3** of this work plan that defines the general nature of the soils that are proposed as feed for the proposed series of performance tests. As is described in **Section 3** of this work plan, the US Army is proposing to compare the APE 1236's ability to treat the soil feed at two different waste feed rates, namely 2, and 5 tons per hour. To provide necessary data to compute the contaminant removal level achieved during each performance demonstration, SEDA will sample waste feed during each repetition of testing (i.e., during each combined MM5/Method 0023 determination) and compare concentrations of the key contaminants present in the waste feed and in the treated soil.

**Table 5-2** shows the sampling frequency and the analytical parameters that will be collected for the feed soil and the ash during the proposed tests. In general accordance with existing ITRC guidance, waste soil feed sampling will be completed using grab sampling techniques to yield discrete sample aliquots that are subsequently composited or blended to yield one sample that is submitted for analysis. As volatile organic compounds are not of significant concern (see analytical data provided in **Section 3**) in the designated waste feed material, samples will be obtained for TPH, semi-volatile organic, pesticides/PCBs and metals determinations only. It is currently anticipated that each "final" sample submitted for analysis will be made

**Table 5-2**  
**Soil/Ash Sampling Parameters**  
**LTTD Treatability Study**  
**Seneca Army Depot Activity, Romulus, NY**

Test No.	Feed Rate tons/hr	Analytical Parameters						
		Feed (1, 2)	Hi-T (3) Gas Cooler	Lo-T (3) Gas Cooler	Cyclone (3)	Baghouse (3)	Bottom Ash Kiln Residue (1)	QA/QC (4)
1A	2	P, SV, T, M	P, SV, T, M, D	P, SV, T, M, D	P, SV, T, M, D	P, SV, T, M, D	P, SV, T, M	dup, MS, MSD, field blank
1B		P, SV, T, M	P, SV, T, M, D	P, SV, T, M, D	P, SV, T, M, D	P, SV, T, M, D	P, SV, T, M	
1C		P, SV, T, M	P, SV, T, M, D	P, SV, T, M, D	P, SV, T, M, D	P, SV, T, M, D	P, SV, T, M	
2A	5	P, SV, T, M	P, SV, T, M, D	P, SV, T, M, D	P, SV, T, M, D	P, SV, T, M, D	P, SV, T, M	dup, MS, MSD, field blank
2B		P, SV, T, M	P, SV, T, M, D	P, SV, T, M, D	P, SV, T, M, D	P, SV, T, M, D	P, SV, T, M	
2C		P, SV, T, M	P, SV, T, M, D	P, SV, T, M, D	P, SV, T, M, D	P, SV, T, M, D	P, SV, T, M	

Notes:

P - Organochlorine Pesticide/PCB by SW846 8082

SV - Semivolatile Organics by SW846 Method 8270

T- TPH by SW846 Method 8015B

M-Metals by SW846 Method 6010B

D - Dioxins/Dibenzofurans by SW846 Method 8290

(1) Nine or more discrete grab samples will be collected during each MM5/Method 0023 test run and composited to yield a single sample.

Compositing will be completed according to ASTM Method C702-87 provided in Appendix B.

(2) Each waste feed pile will be prescreened for TPH (SW846 Method 4030) content prior to use as feed material.

(3) A single sample of all "flyash" will be collected and analyzed for each test (e.g., 1A, 1B,...) performed. All flyash captured in the system's APCD train components will be composited and sampled to yield one sample submitted for analysis for each test.

(4) One set of QA/QC samples will be collected per test condition and will be analyzed for Pesticides/PCB, Semi-Volatile Organics, Dioxins/Dibenzofurans, TPH and metals.

by compositing nine or more grab samples collected at regularly spaced intervals during each MM5/Method 0023 test. Each discrete grab would contain a uniform amount of waste soil feed (based on volume). Sample aliquots will be collected at a point along the conveyor belt that is used to transfer the soil from the hopper to the rotary kiln.

The first grab of waste soil material fed to the rotary kiln will be sampled using a shovel or trowel and will be collected at the beginning of the MM5/Method 0023 determination. Subsequent discrete grabs will be collected at forty-five minute intervals throughout the period when the combined MM5/Method 0023 determinations are being conducted. Thus, if the stack sampling was completed in 360 minutes (start to finish), a total of nine waste feed aliquots would be used to create the composite sent for analysis (timed at 0, 45, 90, 135, 180, 225, 270, 315 and 360 minutes).

After collection, each discrete grab will be retained in a tightly sealed glass jar that is kept cold pending sample mixing and final sample compositing. Procedures described in ASTM's Procedure C702-87 Method A (Mechanical Splitter) or B (Quartering) will be used to reduce the volume of waste feed soil collected in the grabs to that which is necessary for the composite sample submitted to the laboratory for analysis. A copy of this method is provided in **Appendix D**.

Soil proposed for use in the APE system will also be screened prior to being fed to the system to ensure that TPH concentrations in excess of 15,000 parts per million are not loaded into the system. As was indicated in **Section 3.2** of this work plan, the overall quantity of soil delivered to the APE system will be broken down into smaller "day" piles that will be used as waste feed for each proposed day of operation. Four grab samples will be collected and field screened for TPH concentration according to SW846 Method 4030 prior to use as feed. If the concentration of TPH exceeds 15,000 ppm in any of the samples tested, the "day" pile will be re-blended to reduce the overall concentration of organics contained in the feed.

#### **5.4.2 Kiln Residue or Ash Sampling (Treated Soil Sampling)**

The treated soil or kiln residue falls out of the rotary kiln into a hopper where it is transferred to a moving conveyor belt. Once on the conveyor belt, it is transported away from the APE-1236 until it is discharged into an accumulation pile that resides outside of the system's confining wall. Sample aliquots used to prepare the sample of kiln ash or residue sent for analysis will be collected at the discharge of the conveyor belt at the point where the material falls into the accumulation pile.

Kiln ash or residue sampling will be completed in a manner similar to that which is described for the waste

soil feed, only the time when discrete grabs are obtained will be delayed by a period that is consistent with the operational residence time of the feed soil in the kiln. Each final sample of kiln ash/residue submitted for characterization will be collected as nine or more equally sized volume grabs that are subsequently composited, in accordance with ASTM Procedure C702-87 methods.

#### **5.4.3 Fly Ash Sampling**

Fly ash is collected in four components of the APE-1236's air pollution control system (i.e., high and low temperature gas coolers, cyclone, and baghouse). Each of these devices is equipped with a

A fly ash sample will be collected from all locations in the APE 1236 system (e.g., high and low temperature gas coolers, cyclone, bag house) where fly ash is captured prior to the exhaust gases release to the atmosphere. Prior to the initiation of each performance test, fly ash contained in all air pollution control device (APCD) components will be removed. The jet-pulse cleaning system for the baghouse will be activated and used to clear the bags of residual fly ash from prior operations. The fly ash residing in the collection hoppers located below each of the APCD components train will be emptied. The collection hoppers will then be sealed and the performance test will be run. Immediately at the conclusion of the performance test, the ash captured by the APCD components will be recovered and composited to yield a single sample of fly ash. The baghouse's jet-pulse cleaning system will again be activated and used to empty the bags of residual fly ash. If fly ash can not be dislodged from the bags using the available cleaning system, the bags will be considered to be "clean" and the unit resealed pending the next test.

The quantity of the fly ash collected from all portions of the APCD train will be weighed and then a sample for required analytical determinations will be recovered in accordance with procedures identified in ASTM Procedure C702-87, Method A or B.

#### **5.4.4 Solid Waste Analysis Procedures**

All of the aforementioned solid waste samples (i.e., waste soil feed, kiln residue or ash, fly ash) will be submitted for the determination of Total Petroleum Hydrocarbon levels, the concentration of semi-volatile organic, pesticide/PCBs, total metal compounds and the amount of moisture that is present. Analysis of total petroleum hydrocarbon levels in the solid wastes will be completed using SW846 Method 8015B, while the determination of the semi-volatile organic compounds will be conducted using SW846 Method 8270. Pesticide/PCB determinations will be completed using SW846 Method 8082 while metal determination will be completed in accordance with SW846 Method 6010B. Dioxin/Dibenzofuran analyses

completed on fly ash will be completed using SW46 Method 8290. Moisture determinations will be based on drying a preweighed sample at 103 to 105 °C and then reweighing the sample. Additionally, soil waste feed and treated residue samples will be submitted for sieve analysis via ASTM Method D 422.

Samples of feed and treated soils will be characterized by Severn Trent Laboratories, 55 South Park Drive, Colchester VT 05446. The point of contact at the laboratory is Ms. Lori Arnold. Severn Trent is MRD and New York certified for all of the proposed analyses in solid wastes. Copies of the laboratories certifications are provided in **Appendix C**.

## 5.5 TEST SCHEDULE

**Table 11-1** presents the detailed source testing schedule for the performance tests. Sampling of fly ash from the LTTD process will occur at the conclusion of each sample run, if enough material is available. Process monitoring data will be recorded continuously during the demonstration study. Waste feed rate will be set prior to each run of a test condition and then monitored during the run.

The source test schedule has been planned using a six and one-half hour sampling times for each repetition of the MM5/Method 0023 determinations. Concurrent determinations of RM2, RM3, and RM4 determinations will also be completed. The schedule is designed to simultaneously test for the waste feed parameters of concern and other parameters such as CO, CO<sub>2</sub>, O<sub>2</sub>, and THC.

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## SECTION 6

### OPERATIONS RECORDKEEPING

The following information and data will be recorded during the demonstration study.

- Test conditions, including:
  - test and run number,
  - date of testing,
  - time of test,
  - soil feed rate,
  - total quantity of soil used in the test.
  
- Continuously monitored operating conditions including:
  - continuous emission monitor records or logs,
  - afterburner temperature,
  - total fuel oil flow,
  - kiln temperature,
  - kiln draft,
  - high temperature gas cooler exit temperature,
  - low temperature gas cooler exit temperature,
  - baghouse differential pressure,
  - baghouse exit temperature,
  - stack gas velocity,
  - stack gas oxygen concentration, and
  - stack gas CO concentration.
  
- Periodically monitored operating conditions including:
  - exit soil temperature, and
  - soil processing rate.
  
- Performance data including:
  - soil feed and treatment verification sampling,
  - results of “day” pile screening analyses, and
  - mass balance calculations,
  - stack testing and air monitoring data, and
  - sampling equipment calibration data.
  
- Occurrence and reasons of shutdown events.
  
- Documentation on the re-treatment or disposal of failed batches.



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## SECTION 7

### QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

All quality assurance/quality control (QA/QC) procedures outlined in the Generic Installation RI/FS Workplan (Parsons ES, 1995) will be followed with the following modifications/additions:

1. Composite sampling for pre- and posted-treatment soils will be performed according to ASTM Method C702-87, provided in **Appendix D**.
2. QA/QC and calibration procedures required for the air emission monitoring procedures defined in Section 5.3 will be completed in accordance with protocols defined and documented in the specific citations (40CFR Part 60, Appendix A and Appendix B).

All samples collected will be sent to an independent laboratory for analysis. QA/QC samples for solid and liquid streams exclusive of the exhaust gases will be collected as specified in **Table 5-1**. These samples will include a duplicate, rinse blank, trip blank, matrix spike and matrix spike duplicate and will be collected at a rate of one set per 20 samples collected.

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## SECTION 8

### COST AND PERFORMANCE TEST REPORT

The following is the proposed outline for the cost and performance test report:

- Executive Summary
- Site Information
- Background
  - Origin of Waste Feed Material
  - Chemical Characterization of Waste Feed Material
  - Soil Waste Characteristics Affecting Treatment Costs or Performance
- Description of the Modified APE 1236 LTTD System
  - Detailed Description of Rotary Kiln
  - Afterburner Description
  - Description of Air Pollution Control Devices
  - Automatic Control System
- Treatment System Performance
  - Clean-up Goals/Standards
  - Summary of Performance Test Results
- Treatment System Costs
- Conclusions and Recommendations
- References
- Appendices
  - Detailed Test Run Information
  - CEM data
  - System Operating Data
  - Analytical Results
  - Stack Sampling Equipment Calibration Data

## **SECTION 9**

### **HEALTH AND SAFETY**

The Health and Safety Plan in the Generic Installation RI/FS Work Plan (Parsons ES, 1995) will be followed for this work.

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## SECTION 10

### PUBLIC INVOLVEMENT AND PARTICIPATION

Consistent with ITRC's guidance for "On-site Low Temperature Thermal Treatment of Non-Hazardous Soil Contaminated with Petroleum/Coal Tar/Gas Plant Wastes," the Army welcomes public involvement and participation in the proposed feasibility analysis of the deactivation furnace's conversion for use as a LTTD unit. Prior to the performance of the proposed tests, SEDA will make a presentation of the proposed performance test at one of the regularly scheduled monthly Remedial Advisory Board (RAB) meetings for the activities at the base. During this meeting, we will solicit public comments and questions, and respond to the issues to the fullest extent practicable. Additionally, after the completion of the performance test and the required report, SEDA will make a public presentation of the findings and conclusions of the work..

## SECTION 11

## SCHEDULE

Table 11-1 presents the proposed schedule for the test runs for the LTTD field treatability study:

**TABLE 11-1  
TENTATIVE LTTD TREATABILITY STUDY TEST SCHEDULE**

Event	Elapsed Days									
	1	2	3	4	5	6	7	8	9	10
<b>Mobilize and Set-up</b>										
<b>Test 1 – 2 Tons / hour; one test per day.</b> 3 – MM5, SVOCs; RM5, total particulates and RM29, total metals (6 hour test – run time) 3 – Method 0023; Dioxins/Furans; and RM26 Hydrochloric Acid (6 hour test – run time) 3 – Method 0010 VOST for VOCs 3 – Repetitions of Continuous Emission Monitors including O <sub>2</sub> , CO, CO <sub>2</sub> , THC 3 – Samples of waste feed/kiln ash/flyash for TPH, VOCs, SVOCs, PCBs/Pesticides and dioxin/dibenzofurans (fly ash only) analyses.										
<b>Test 2 – 5 Tons / hour; one test per day.</b> 3 – MM5, SVOCs; RM5, total particulates and RM29, total metals (6 hour test – run time) 3 – Method 0023; Dioxins/Furans; and RM26 Hydrochloric Acid (6 hour test – run time) 3 – Method 0010 VOST for VOCs 3 – Repetitions of Continuous Emission Monitors including O <sub>2</sub> , CO, CO <sub>2</sub> , THC 3 – Samples of waste feed/kiln ash/flyash for TPH, VOCs, SVOCs, PCBs/Pesticides and dioxin/dibenzofuran (fly ash only) analyses.										

Target dates for implementing the demonstration study are given below:

<b>Event</b>	<b>Date</b>
LTTD Demonstration Study Work Plan Approval	July 2000
Field Demonstration Study	August 2000
Receipt of Analytical Data	October 2000
Submit Draft Cost and Performance Report	November 2000

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## SECTION 12

### REFERENCES

Title 40, Code of Federal Regulation, Part 60, Appendices A and B.

American Society for Testing and Materials, Standard Methods, Method C702-98 Standard Practice for Reducing Samples of Aggregate to Testing Size, Copyright 1999.

Develop On-site Innovative Technologies (DOIT), Interstate Technology and Regulatory Cooperation Subgroup, "A Guide to Tribal and Community Involvement in Innovative Technology Assessment", May 4-5, 1995.

Interstate Technology and Regulatory Cooperation Work Group, Low Temperature Thermal Desorption Work Team, "Technical Requirements for On-Site Low Temperature Thermal Treatment of Non-Hazardous Soils Contaminated with Petroleum/Coal Tar/Gas Plant Wastes, December 1997.

Parsons Engineering Science, Inc., Expanded Site Inspection, Seven Low Priority AOCs, SEADs 60, 62, 63, 64(A, B, C, and D), 67, 70, and 71, Volumes 1 and 2, Draft Final, April 1996.

Parsons Engineering Science, Inc., Generic Installation Remedial Investigation / Feasibility Study (RI/FS) Workplan for Seneca Army Depot Activity, Final, August 1995 (Updated for Modified CLP Methods, 1998).

US Environmental Protection Agency, Office of Solid Waste, SW-846 Test Methods for Evaluating Solid Waste Physical/Chemical Methods, 3<sup>rd</sup> Edition, December 1996.

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## **Appendix A**

### **Process Flow and Instrumentation Diagrams**



**Appendix B**  
**Sample Calculations**

## Reference Method 1 - Cyclonic Flow Check Calculations

### Nomenclature

- R = Average "yaw" angle, degree.  
Y(i) = yaw angle measured at traverse point i, degree.  
n = Total number of traverse points.

Calculate the average "yaw" angle found in the stack:

$$\bar{R} = \frac{\sum Y(i)}{n}$$

The measurement location is acceptable if  $\bar{R} \leq 20^\circ$ .

## Reference Method 2 - Determination of Stack Gas Velocity

### Nomenclature

A	Cross-sectional area of stack, m <sup>2</sup> (ft <sup>2</sup> )
B(ws)	Water vapor in the gas stream (from Method 5 or Reference Method 4), proportion by volume.
C(p)	Pitot tube coefficient, dimensionless.
K(p)	Pitot tube constant

$$34.97 \text{ (m / sec)} \left[ \frac{(\text{g/g-mole})(\text{mm Hg})}{(\text{°K})(\text{mm H}_2\text{O})} \right]^{\frac{1}{2}}$$

for the metric system and

$$85.49 \text{ (ft / sec)} \left[ \frac{(\text{lb/lb-mole})(\text{in Hg})}{(\text{°R})(\text{in. H}_2\text{O})} \right]^{\frac{1}{2}}$$

for the English system.

M(d)	Molecular weight of stack gas, dry basis (see section 3.6) g/g-mole (lb/lb-mole).
M(s)	Molecular weight of stack gas, wet basis, g/g-mole (lb/lb-mole)

$$= M(d) (1 - B(ws)) + 18.0 B(ws)$$

P(bar)	Barometric pressure at measurement site, mm Hg (in. Hg).
P(g)	stack static pressure, mm Hg (in. Hg).
P(s)	Absolute stack gas pressure, mm Hg (in. Hg) = P(bar)+ P(g)
P(std)	Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
Q(sd)	Dry volumetric stack gas flow rate corrected to standard conditions, dscm/hr (dscf/hr).
t(s)	Stack temperature, °C (°F).
T(s)	Absolute stack temperature, °K, (°R).

$$= 273 + t(s) \text{ for metric.}$$

$$= 460 + t(s) \text{ for English.}$$

T(std)	Standard absolute temperature, 293°K (528°R).
v(s)	Average stack gas velocity, m/sec (ft/sec).
p	Velocity head of stack gas, mm H <sub>2</sub> O (in. H <sub>2</sub> O).
3,600	Conversion factor, sec/hr.
18.0	Molecular weight of water, g/g-mole (lb/lb-mole).

## Reference Method 2 - Determination of Stack Gas Velocity (continued)

### Average Stack Gas Velocity.

$$\sqrt{\frac{K(p) \cdot C(p) \cdot (\Delta p_{avg})}{T(s)_{avg}}}$$

$$v(s) = \frac{K(p) \cdot C(p) \cdot (\Delta p_{avg})}{P(s) \cdot M(s)}$$

### Average Stack Gas Dry Volumetric Flow Rate.

$$Q(sd) = 3,600 (1 - B(ws)) \cdot V(s) \cdot A \cdot \frac{[T(std)]}{[T(s)_{avg}]} \cdot \frac{[P(s)]}{[P(std)]}$$

To convert Q(sd) from dscm/hr (dscf/hr) to dscm/min (dscf/min), divide Q(sd) by 60.

## Reference Method 4 – Moisture Content

### Nomenclature

B(ws)	= Proportion of water vapor, by volume, in the gas stream.
M(w)	= Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).
P(m)	= Absolute pressure (for this method, same as barometric pressure) at the dry gas meter, mm Hg (in. Hg).
P(std)	= Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
R	= Ideal gas constant, 0.06236 (mm Hg) (m <sup>3</sup> )/(g-mole) (°K) for metric units and 21.85 (in. Hg) (ft <sup>3</sup> )/(lb-mole) (°R) for English units.
T(m)	= Absolute temperature at meter, °K (°R).
T(std)	= Standard absolute temperature, 293°K (528°R).
V(m)	= Dry gas volume measured by dry gas meter, dcm (dcf).
ΔV(m)	= Incremental dry gas volume measured by dry gas meter at each traverse point, dcm (dcf).
V(m(std))	= Dry gas volume measured by the dry gas meter, corrected to standard conditions, dscm (dscf).
V(wc(std))	= Volume of water vapor condensed corrected to standard conditions, scm (scf).
V(wsg(std))	= Volume of water vapor collected in silica gel corrected to standard conditions, scm (scf).
V(f)	= Final volume of condenser water, ml.
V(i)	= Initial volume, if any, of condenser water, ml.
W(f)	= Final weight of silica gel or silica gel plus impinger, g.
W(i)	= Initial weight of silica gel or silica gel plus impinger, g.
Y	= Dry gas meter calibration factor.
ρ(w)	= Density of water, 0.9982 g/ml (0.002201 lb/ml).

### Volume of Water Vapor Condensed

$$V(wc(std)) = \frac{(V(f) - V(i)) * \rho(w) * R * T(std)}{P(std) * M(w)} = K_{(1)} * (V(f) - V(i))$$

Where:

$$K_{(1)} = 0.001333 \text{ m}^3/\text{ml} \text{ for metric units} \\ = 0.04707 \text{ ft}^3/\text{ml} \text{ for English units}$$

### Volume of Water Vapor Collected in Silica Gel.

$$V(wsg(std)) = \frac{(W(f) - W(i)) * R * T(std)}{P(std) * M(w)} = K_{(2)} * (W(f) - W(i))$$

Where:

$$K_{(2)} = 0.001335 \text{ m}^3/\text{g} \text{ for metric units} \\ = 0.04715 \text{ ft}^3/\text{g} \text{ for English units}$$

## Reference Method 4 – Moisture Content (continued)

### Sample Gas Volume

$$V(m(std)) = V(m) * Y * \frac{(P(m)) * (T(std))}{(P(std)) * (T(m))} = K_{(3)} * Y * \frac{V(m) * P(m)}{T(m)}$$

Where:

$$K_{(3)} = 0.3858 \text{ } ^\circ\text{K/mm Hg for metric units}$$
$$= 17.64 \text{ } ^\circ\text{R/in. Hg for English units}$$

NOTE: If the post-test leak rate (Section 2.2.6) exceeds the allowable rate, correct the value of V(m) per guidance in Method 5

### Moisture Content

$$B(ws) = \frac{V(wc(std)) + V(wsg(std))}{V(wc(std)) + V(wsg(std)) + V(m(std))}$$

NOTE: In saturated or moisture droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one using a value based upon the saturated conditions (see Section 1.2), and another based upon the results of the impinger analysis. The lower of these two values of B(ws), shall be considered correct.

Verification of Constant Sampling Rate. For each time increment, determine the V(m). Calculate the average. If the value for any time increment differs from the average by more than 10 percent, reject the results and repeat the run.

## Reference Method 5 – Determination of Particulate Emissions from Stationary Sources

### Nomenclature

A(n)	Cross-sectional area of nozzle, m <sup>2</sup> (ft <sup>2</sup> ).
B(ws)	Water vapor in the gas stream, proportion by volume.
C(a)	Acetone blank residue concentration, mg/mg.
C(s)	Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).
I	Percent of isokinetic sampling.
L(a)	Maximum acceptable leakage rate for either a pretest leak check or for a leak check following a component change; equal to 0.00057 m <sup>3</sup> /min (0.02 cfm) or 4 percent of the average sampling rate, whichever is less.
L(i)	Individual leakage rate observed during the leak check conducted prior to the "[i]th" component change (i = 1, 2, 3 .... n), m <sup>3</sup> /min (cfm).
L(p)	Leakage rate observed during the post-test leak check, m <sup>3</sup> /min (cfm).
m(a)	Mass of residue of acetone after evaporation, mg.
m(n)	Total amount of particulate matter collected, mg.
M(w)	Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).
P(bar)	Barometric pressure at the sampling site, mm Hg (in. Hg).
P(s)	Absolute stack gas pressure, mm Hg (in. Hg).
P(std)	Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
R	Ideal gas constant, 0.06236 mm Hg-m <sup>3</sup> /°K-g-mole (21.85 in. Hg-ft <sup>3</sup> /°R-lb-mole).
T(m)	Absolute average dry gas meter temperature, °K (°R).
T(s)	Absolute average stack gas temperature, °K (°R).
T(std)	Standard absolute temperature, 293°K (528°R).
V(a)	Volume of acetone blank, ml.
V(aw)	Volume of acetone used in wash, ml.
V(lc)	Total volume of liquid collected in impingers and silica gel, ml.
V(m)	Volume of gas sample as measured by dry gas meter, dcm (dscf).
V(m(std))	Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscm (dscf).
V(w(std))	Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).
v(s)	Stack gas velocity, calculated by Method 2, using data obtained from Method 5, m/sec (ft/sec).
W(a)	Weight of residue in acetone wash, mg.
Y	Dry gas meter calibration factor.
ΔH	Average pressure differential across the orifice meter, mm H <sub>2</sub> O (in. H <sub>2</sub> O).
l(a)	Density of acetone, mg/ml (see label on bottle).
l(w)	Density of water, 0.9982 g/ml (0.002201 lb/ml).
φ	Total sampling time, min. - <b>(1)</b> = Sampling time interval, from the beginning of a run until the first component change, min. - <b>(i)</b> = Sampling time interval, between two successive component changes, beginning with the interval between the first and second changes, min. - <b>(p)</b> = Sampling time interval, from the final (n[th]) component change until the end of the sampling run, min.
13.6	Specific gravity of mercury.
60	Seconds / minute
100	Conversion to percent.

**Reference Method 5 – Determination of Particulate Emissions from Stationary Sources**  
(continued)

**Dry Gas Volume.**

Correct the sample volume measured by the dry gas meter to standard conditions (20°C, 760 mm Hg or 68°F, 29.92 in. Hg) using:

$$V(m(std)) = \frac{V(m) * Y * \left[ \frac{\Delta H}{T(m)} \right] * \left[ \frac{P(bar) + (13.6)}{P(std)} \right]}{T(m)}$$

$$= \frac{K(1) * V(m) * Y * \left[ \frac{\Delta H}{T(m)} \right] * [P(bar) + (13.6)]}{T(m)}$$

Where

$$K(1) = 0.3858 \text{ } ^\circ\text{K/mm Hg for metric units}$$

$$= 17.64 \text{ } ^\circ\text{R/in. Hg for English units}$$

NOTE: Equation can be used as written unless the leakage rate observed during any of the mandatory leak checks (i.e., the post-test leak check or leak checks conducted prior to component changes) exceeds L(a). If L(p), or (i) exceeds L(a), Equation must be modified as follows:

(a) Case I. No component changes made during sampling run. In this case, replace V(m) in Equation with the expression:

$$V(m) - \{(L(p) - L(a)) * \phi\}$$

(b) Case II. One or more component changes made during the sampling run. In this case, replace V(m) by the expression:

$$\left[ V(m) - [(L(i) - L(a)) * \phi(1)] - \sum_{i=2}^n [(L(i) - L(a)) * \phi(i)] - [(L(p) - L(a)) * \phi(p)] \right]$$

and substitute only for those leakage rates (L(i), or L(p)) which exceed L(a).



**Reference Method 5 – Determination of Particulate Emissions from Stationary Sources**  
(continued)

**Volume of Water Vapor**

$$V(w(\text{std})) = \frac{V(lc) * \{ \rho(w) \} * \{ RT(\text{std}) \}}{(M(w)) * (P(\text{std}))} = K(2) * V(lc)$$

Where:

$$K(2) = 0.001333 \text{ m}^3/\text{ml} \text{ for metric units}$$
$$= 0.04707 \text{ ft}^3/\text{ml} \text{ for English units.}$$

**Moisture Content.**

$$B(ws) = \frac{V(w)((\text{std}))}{V(m)((\text{std})) + V(w)((\text{std}))}$$

NOTE: In saturated or water droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one from the impinger analysis, and a second from the assumption of saturated conditions. The lower of the two values of B(w) shall be considered correct. The procedure for determining the moisture content based upon assumption of saturated conditions is given in the Note of Section 1.2 of Method 4. For the purposes of this method, the average stack gas temperature from Figure 5-2 may be used to make this determination, provided that the accuracy of the in-stack temperature sensor is  $\pm 1^\circ\text{C}$  ( $2^\circ\text{F}$ ).

**Acetone Blank Concentration**

$$C(a) = \frac{M(a)}{V(a) * \rho(a)}$$

**Acetone Wash Blank**

$$W(a) = C(a) * V(aw) * \rho(a)$$

Total Particulate Weight. Determine the total particulate catch from the sum of the weights obtained from Containers 1 and 2 less the acetone blank (see Figure 5-3).

**Particulate Concentration.**

$$c(s) = 0.001 \text{ g/mg} * \frac{m(n)}{V(m)(\text{std})}$$

**Reference Method 5 – Determination of Particulate Emissions from Stationary Sources**  
(continued)

**Conversion Factors:**

From	To	Multiply by
Scf	m <sup>3</sup>	0.02832
G	mg	0.001
g/ft <sup>3</sup>	gr/ft <sup>3</sup>	15.43
g/ft <sup>3</sup>	lb/ft <sup>3</sup>	2.205 x 10 <sup>-3</sup>
g/ft <sup>3</sup>	g/m <sup>3</sup>	35.31

**Isokinetic Variation.**

*Calculation From Raw Data.*

$$I = \frac{100 * T(s) * K_{(3)} * V(lc) + \frac{V(m) * Y}{T(m)} * P(bar) + \frac{\Delta H}{13.6}}{60 * \phi * v(s) * P(s) * A(n)}$$

Where:

K<sub>(3)</sub> = 0.003454 mm Hg - m<sup>3</sup>/ml - °K for metric units.  
 = 0.002669-in. Hg - ft<sup>3</sup>/ml - °R for English units.

*Calculation From Intermediate Values.*

$$I = \frac{100 * T(s) * V(m(std)) * P(std)}{60 * T(std) * v(s) * \phi * A(n) * P(s) * (1 - B(ws))}$$

$$= \frac{K_4 * T(s) * V(m(std))}{P(s) * V(s) * A(n) * \phi * (1 - B(ws))}$$

where:

K<sub>4</sub> = 4.320 for metric units  
 = 0.09450 for English units.

6.12 Acceptable Results. If 90 percent ≤ I ≤ 110 percent, the results are acceptable. If the particulate results are low in comparison to the standard, and I is over 110 percent or less than 90 percent, the Administrator may accept the results.

## Reference Method 25A – Total Gaseous Nonmethane Organic Emissions as Carbon

### Nomenclature

- C(gas) = Effluent gas concentration, dry basis, ppm.
- $\bar{C}$  = Average gas concentration indicated by gas analyzer, dry basis, ppm.
- C(o) = Average of initial and final system calibration bias check responses for the zero gas ppm.
- C(m) = Average of initial and final system calibration bias check responses for the upscale calibration gas, ppm.
- C(ma) = Actual concentration of the upscale calibration gas, ppm.

### Calculate the effluent gas concentration.

$$C(\text{gas}) = \{\bar{C} - C(o)\} * \frac{C(\text{ma})}{C(m) - C(o)}$$

Determine the average organic concentration in terms of ppmv as propane or other calibration gas. The average shall be determined by the integration of the output recording over the period specified in the applicable regulation.

If results are required in terms of ppmv as carbon, adjust measured concentrations using the following equation.

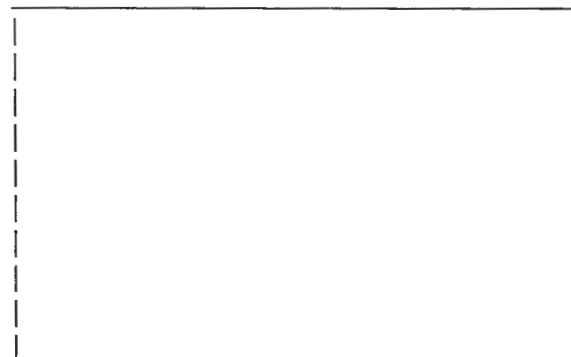
$$C(c) = K * C(\text{meas})$$

Where:

- C(c) = Organic concentration as carbon, ppmv.
- C(meas) = Organic concentration as measured, ppmv.
- K = Carbon equivalent correction factor,
- K = 2 for ethane.
- K = 3 for propane.
- K = 4 for butane.
- K = Appropriate response factor for other organic calibration gases.

**Sample Data Sheet**  
**Field Moisture Determination Reference Method**

Plant \_\_\_\_\_  
 Location \_\_\_\_\_  
 Operator \_\_\_\_\_  
 Date \_\_\_\_\_  
 Run No. \_\_\_\_\_  
 Ambient temperature \_\_\_\_\_  
 Barometric pressure \_\_\_\_\_  
 Probe length m (ft) \_\_\_\_\_

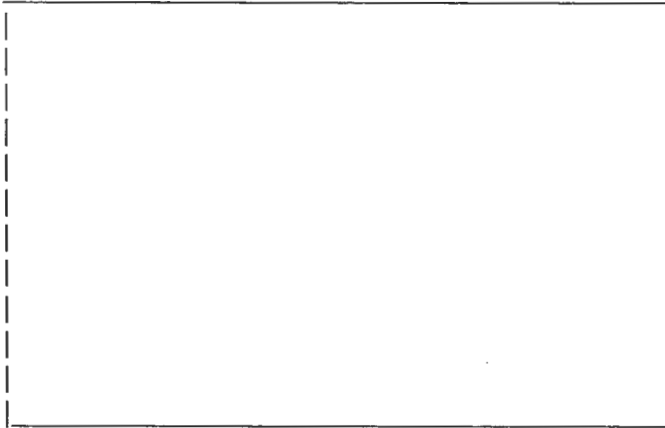


Schematic of Stack Cross Section

Traverse point number	Sampling time  min.	Stack temperature  °C (°F)	Pressure differential across orifice meter $\Delta H$ mm (in.) H <sub>2</sub> O	Gas Meter Reading Sample Volume M <sup>3</sup> (ft <sup>3</sup> )	Change in Volume $\Delta V(m)$  m <sup>3</sup> (ft <sup>3</sup> )	Gas Sample temperature at dry gas meter		Temperature of gas leaving condenser or last impinger °C (°F)
						Inlet (T <sub>m</sub> (in)) °C (°F)	Outlet (T <sub>m</sub> (out)) °C (°F)	
Total ..... Average .....					Avg.	Avg.	Avg.	

**Sample Data Sheet  
Particulate Reference Method**

Plant \_\_\_\_\_  
 Location \_\_\_\_\_  
 Operator \_\_\_\_\_  
 Date \_\_\_\_\_  
 Run No. \_\_\_\_\_  
 Sample box No \_\_\_\_\_  
 Meter box No \_\_\_\_\_  
 Meter  $\Delta H@$  \_\_\_\_\_  
 C factor \_\_\_\_\_  
 Pitot tube coefficient,  $C_p$  \_\_\_\_\_

	Ambient temperature _____
	Barometric pressure _____
	Assumed moisture, % _____
	Probe length m (ft) _____
	Nozzle ID No. _____
	Avg nozzle diameter, cm (in.) _____
	Probe heater setting _____
	Leak rate, m <sup>3</sup> /min, (cfm) _____
	Probe liner material _____
	Static pressure, mm. Hg (in. Hg) _____
Filter No. _____	

Schematic of Stack Cross Section

Traverse Point Number	Sampling Time  Min.	Vacuum  mm Hg (in.Hg)	Stack Temp T(s)  °C(°F)	Velocity Head $\Delta P(s)$ mm H <sub>2</sub> O (in.H <sub>2</sub> O)	Pressure differential across orifice meter mm H <sub>2</sub> O (in. H <sub>2</sub> O)	Gas Sample Volume  m <sup>3</sup> (ft <sup>3</sup> )	Gas Temp Inlet	Gas Temp Outlet	Filter Holder Temp  °C(°F)	Last Impinger Temp  C (°F)
							°C (°F)	°C (°F)		
Total							Avg.	Avg.		
Average							Avg.			

## **Appendix C**

### **Laboratory Certifications**



REPLY TO  
ATTENTION OF

**DEPARTMENT OF THE ARMY**  
CORPS OF ENGINEERS, OMAHA DISTRICT  
HTRW CENTER OF EXPERTISE  
12565 WEST CENTER ROAD  
OMAHA, NEBRASKA 68144-3869

January 14, 2000

Hazardous, Toxic and Radioactive Waste  
Center of Expertise

Alta Analytical Laboratory, Inc.  
5070 Robert J. Mathews Parkway  
El Dorado Hills, CA 95762

Gentlemen:

This correspondence addresses the recent evaluation of Alta Analytical Laboratory, Inc. of El Dorado Hills, CA by the U.S. Army Corps of Engineers (USACE) Hazardous, Toxic, and Radioactive Waste Center of Expertise (HTRW CX) for performing dioxin and furan analyses. Specifically evaluated were the following parameters:

METHOD	PARAMETERS	MATRIX
8280	Dioxins/Furans	Water
8280	Dioxins/Furans	Solids
8290	Dioxins/Furans	Water
8290	Dioxins/Furans	Solids

Evaluation of your laboratory for the analytical capabilities was based on the documents you submitted, which include Statement of Qualifications, Quality Assurance Program Plan, Standard Operating Procedures for Methods 8280 and 8290, state certifications, and the EPA WS040 performance evaluation sample value.

Based on the above documents, your laboratory is deemed acceptable to perform the above analyses for the General Electric Housatonic River Project.

The expiration date of validation is December 9, 2000. It should be noted that this office reserves the right to suspend acceptance status at any time if technical performance is found to be deficient.

- 2 -

Any questions or comments can be directed to John Nebelsick at (402) 697-2572. General questions regarding laboratory validation may be directed to the Laboratory Validation Coordinator at (402) 697-2574.

Sincerely,



*fw* Marcia C. Davies, Ph.D.  
Director, USACE-Hazardous, ...  
Toxic and Radioactive Waste  
Center of Expertise



**NEW YORK STATE DEPARTMENT OF HEALTH**

*ANTONIA C. NOVELLO, M.D., M.P.H. Commissioner*



*Expires 12:01 AM April 1, 2000  
ISSUED April 1, 1999  
REVISED August 15, 1999*

**CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE**

*Issued in accordance with and pursuant to section 502 Public Health Law of New York State*

**Lab ID No.:** 11411

**Director:** MR. ROBERT MITZEL  
**Lab Name:** ALTA ANALYTICAL LAB INC  
**Address :** 5070 ROBERT J MATHEWS PKY  
EL DORADO HILLS CA 95762

*is hereby APPROVED as an Environmental Laboratory for the category*

**ENVIRONMENTAL ANALYSES NON POTABLE WATER**

*All approved subcategories and/or analytes are listed below:*

Dioxins (ALL)

**Serial No.: 105005**

**Wadsworth Center**

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*is hereby APPROVED as an Environmental Laboratory for the category*

**ENVIRONMENTAL ANALYSES/ POTABLE WATER**

*All approved subcategories and/or analytes are listed below:*

*D.W. Miscellaneous :  
2,3,7,8-Tetrachlorodibenzo-p-di*

**Serial No.: 105006**

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DEPARTMENT OF THE ARMY

CORPS OF ENGINEERS  
HTRW CENTER OF EXPERTISE  
12565 WEST CENTER ROAD  
OMAHA, NEBRASKA 68144-3869

REPLY TO  
ATTENTION OF:

May 4, 1999

Hazardous, Toxic and Radioactive Waste  
Center of Expertise

*Rec'd  
5/7/99  
KBN*

Severn Trent Laboratories  
55 South Park Drive  
Colchester, VT 05446

Gentlemen:

This correspondence addresses the recent evaluation of Severn Trent Laboratories of Colchester, VT, by the U.S. Army Corps of Engineers (USACE) for chemical analysis in support of the USACE Hazardous, Toxic and Radioactive Waste Program.

Your laboratory is now validated for the parameters listed below:

<u>METHOD</u>	<u>PARAMETERS</u>	<u>MATRIX</u> <sup>(1)</sup>
300s	Anions <sup>(4)</sup>	Water <sup>(3)</sup>
9010B/9012A	Cyanide	Water <sup>(3)</sup>
9013	Cyanide	Solids
8330	Explosives	Water <sup>(3)</sup>
8330	Explosives	Solids <sup>(3)</sup>
8151A	Herbicides	Water <sup>(3)</sup>
8151A	Herbicides	Solids
413.1	Oil and Grease	Water <sup>(3)</sup>
8081A	Organochlorine Pesticides	Water <sup>(3)</sup>
8081A	Organochlorine Pesticides	Solids
9065/9066	Phenolics	Water <sup>(3)</sup>
8082	Polychlorinated Biphenyls	Water <sup>(3)</sup>
8082	Polychlorinated Biphenyls	Solids
8270C	Semivolatile Organics	Water <sup>(3)</sup>
8270C	Semivolatile Organics	Solids <sup>(3)</sup>
SW-846	TAL Metals <sup>(2)</sup>	Water <sup>(3)</sup>
SW-846	TAL Metals <sup>(2)</sup>	Solids <sup>(3)</sup>
9060	Total Organic Carbon	Water <sup>(3)</sup>
8260B	Volatile Organics	Water <sup>(3)</sup>
8260B	Volatile Organics	Solids
8021B	Aromatic Volatile Organics	Water <sup>(3)</sup>
8021B	Aromatic Volatile Organics	Solids

Remarks: 1) 'Solids' includes soils, sediments, and solid waste.

- 2) TAL Metals: Aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.
- 3) The laboratory has successfully analyzed a performance evaluation sample for this method/matrix.
- 4) Anions: Chloride, fluoride, sulfate, nitrate, nitrite, ortho-phosphate.

This validation is based on the successful analysis of the performance evaluation samples and the outcome of the laboratory inspection conducted by the Navy August 24, 25 & 26, 1998, your laboratory will be validated for sample analysis by the methods listed above. The period of validation is 24 months and expires on April 26, 2001.

The USACE reserves the right to conduct additional laboratory inspections or to suspend validation status for any or all of the listed parameters if deemed necessary. It should be noted that your laboratory may not subcontract USACE analytical work to any other laboratory location without the approval of this office. This laboratory validation does not guarantee the delivery of any analytical samples from a USACE Contracting Officer Representative.

Any questions or comments can be directed to Richard Kissinger at (402) 697-2569. General questions regarding laboratory validation may be directed to the Laboratory Validation Coordinator at (402) 697-2574.

Sincerely,



for Marcia C. Davies, Ph.D.  
Director, USACE Hazardous,  
Toxic and Radioactive Waste  
Center of Expertise



# STATE OF NEW YORK DEPARTMENT OF HEALTH

Wadsworth Center

The Governor Nelson A. Rockefeller Empire State Plaza

P.O. Box 509

Albany, New York 12201-0509

Antonia C. Novello, M.D., M.P.H.  
Commissioner

Dennis P. Whalen  
Executive Deputy Commissioner

*Rec'd on  
8/17/99  
JEG*

DEAR LABORATORY DIRECTOR:

Enclosed are the amended ELAP Certificate(s) of Approval for permit year 1999-2000 issued to your environmental laboratory. The Certificate(s) supersede any previously issued and are in effect through March 31, 2000. Please carefully examine the Certificate(s) to insure that the categories, subcategories and analytes for which your laboratory is approved are listed correctly, as well as verifying your laboratory's name, address, director and identification number.

In addition, please destroy your expired 1998-99 ELAP Certificate(s) of Approval.

Please notify this office of any corrections required. We may be reached at (518) 485-5570.

Sincerely,

Linda L. Madlin  
Administrative Assistant  
Environmental Laboratory  
Approval Program

LLM:mes  
Enclosure(s)

NEW YORK STATE DEPARTMENT OF HEALTH

ANTONIA C. NOVELLO, M.D., M.P.H. Commissioner



Expires 12:01 AM April 1, 2000  
ISSUED April 1, 1999  
REVISED August 13, 1999

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

Lab ID No.: 10391

Director: MR. BRYCE STEARNS  
Lab Name: SEVERN TRENT LABORATORIES  
Address : 55 SOUTH PARK DR  
COLCHESTER VT 05446-3500

is hereby APPROVED as an Environmental Laboratory for the category

ENVIRONMENTAL ANALYSES NON POTABLE WATER

All approved subcategories and/or analytes are listed below:

- |                          |                                |                                     |                                  |
|--------------------------|--------------------------------|-------------------------------------|----------------------------------|
| Hydrocarbon Pesticides : | Wastewater Miscellaneous :     | Acrolein and Acrylonitrile (ALL)    | Fenitrothion (ALL)               |
| 4,4'-DDD                 | Bromide                        | Chlorophenoxy Acid Pesticides (ALL) | Chlorinated Hydrocarbons (ALL)   |
| 4,4'-DDE                 | Boron, Total                   | Derand (ALL)                        | Haloethers (ALL)                 |
| 4,4'-DDT                 | Cyanide, Total                 | Wastewater Metals III (ALL)         | Wastewater Metals I (ALL)        |
| 4,4'-DHC                 | Color                          | Wastewater Metals II (ALL)          | Mineral (ALL)                    |
| 4,4'-DHC                 | Corrosivity                    | Nitroaromatics and Isophorone (ALL) | Nitrosamines (ALL)               |
| 4,4'-DHC                 | Phenols                        | Nutrient (ALL)                      | Organophosphate Pesticides (ALL) |
| Chlordane Total          | Oil & Grease Total Recoverable | Polynuclear Aromatics (ALL)         | Polychlorinated Biphenyls (ALL)  |
| Delta-EHC                | Hydrogen Ion (pH)              | Phthalate Esters (ALL)              | Priority Pollutant Phenols (ALL) |
| Dieldrin                 | Specific Conductance           | Purgeable Aromatics (ALL)           | Purgeable Halocarbons (ALL)      |
| Endrin aldehyde          | Silica, Dissolved              | Residue (ALL)                       | TCLP Additional Compounds (ALL)  |
| Endrin                   | Sulfide (as S)                 | Volatile Chlorinated Organics (ALL) |                                  |
| Endosulfan I             | Surfactant (MEAS)              |                                     |                                  |
| Endosulfan II            | Temperature                    |                                     |                                  |
| Endosulfan sulfate       | Organic Carbon, Total          |                                     |                                  |
| Heptachlor               |                                |                                     |                                  |
| Heptachlor epoxide       |                                |                                     |                                  |
| Lindane                  |                                |                                     |                                  |
| Methoxychlor             |                                |                                     |                                  |
| Toxaphene                |                                |                                     |                                  |

Serial No.: 104871

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Address : 55 SOUTH PARK DR  
COLCHESTER VT 05446-3500

is hereby APPROVED as an Environmental Laboratory for the category

*ENVIRONMENTAL ANALYSES/ POTABLE WATER*

All approved subcategories and/or analytes are listed below:

Drinking Water Non-Metals :	Drinking Water Trihalomethane (ALL)	Drinking Water Metals I (ALL)	Drinking Water Metals II (ALL)
Alkalinity	Volatile Aromatics (ALL)	Volatile Halocarbons (ALL)	
Calcium Hardness			
Chloride			
Color			
Conductivity			
Fluoride, Total			
Nitrate (as N)			
Hydrogen Ion (pH)			
Solids, Total Dissolved			
Sulfate (as SO4)			

Serial No.: 104872

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Lab Name: SEVERN TRENT LABORATORIES  
Address : 55 SOUTH PARK DR  
COLCHESTER VT 05446-3500

is hereby APPROVED as an Environmental Laboratory for the category

**ENVIRONMENTAL ANALYSES/AIR AND EMISSIONS**

All approved subcategories and/or analytes are listed below:

<ul style="list-style-type: none"> <li>• Miscellaneous Air :</li> <li>• Nitrogen Dioxide</li> <li>• Particulates</li> <li>• Sulfur Dioxide</li> <li>• Suspended Particulates —</li> </ul>	<ul style="list-style-type: none"> <li>• Chlor. Hydrocarbon Pesticides (ALL)</li> <li>• Metals II (ALL)</li> <li>• Polychlorinated Biphenyls (ALL)</li> <li>• Purgeable Halocarbons (ALL)</li> </ul>	<ul style="list-style-type: none"> <li>• Fuels (ALL)</li> <li>• Mineral (ALL)</li> <li>• Priority Pollutant Phenols (ALL)</li> </ul>	<ul style="list-style-type: none"> <li>• Metals I (ALL)</li> <li>• Polynuclear Aromatics (ALL)</li> <li>• Purgeable Aromatics (ALL)</li> </ul>
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Serial No.: 104873

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Lab Name: SEVERN TRENT LABORATORIES  
Address : 55 SOUTH PARK DR  
COLCHESTER VT 05446-3500

is hereby APPROVED as an Environmental Laboratory for the category

ENVIRONMENTAL ANALYSES/SOLID AND HAZARDOUS WASTE

All approved subcategories and/or analytes are listed below:

- |                          |                                    |                                     |                                     |
|--------------------------|------------------------------------|-------------------------------------|-------------------------------------|
| Characteristic Testing : | Miscellaneous :                    | Acrolein and Acrylonitrile (ALL)    | Chlorophenoxy Acid Pesticides (ALL) |
| Corrosivity              | Cyanide, Total                     | Chlor. Hydrocarbon Pesticides (ALL) | Chlorinated Hydrocarbons (ALL)      |
| Stability                | Hydrogen Ion (pH)                  | Haloethers (ALL)                    | Metals I (ALL)                      |
| Activity                 | Sulfide (as S)                     | Metals II (ALL)                     | Nitroaromatics Isophorone (ALL)     |
| Toxicity                 | Organophosphate Pesticides (ALL)   | Polynuclear Arom. Hydrocarbon (ALL) | Polychlorinated Biphenyls (ALL)     |
| Halocarbons (ALL)        | Phthalate Esters (ALL)             | Priority Pollutant Phenols (ALL)    | Purgeable Aromatics (ALL)           |
|                          | Volatile Chlorinate Organics (ALL) |                                     |                                     |

Serial No.: 104874

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NEW YORK STATE DEPARTMENT OF HEALTH

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Lab Name: SEVERN TRENT LABORATORIES  
Address : 55 SOUTH PARK DR  
COLCHESTER VT 05446-3500

*is hereby APPROVED as an Environmental Laboratory for the category*

**CONTRACT LABORATORY PROTOCOL (CLP)**

*All approved subcategories and/or analytes are listed below:*

Inorganics

CLP PCB/Pesticides

CLP Semi-Volatile Organics

CLP Volatile Organics

Serial No.: 104875

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## **APPENDIX D**

**ASTM C702-87 “Standard Practice for Reducing Field Samples of  
Aggregate to Testing Size”**



## Standard Practice for Reducing Field Samples of Aggregate to Testing Size<sup>1</sup>

This standard is issued under the fixed designation C 702; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

### 1. Scope

1.1 This practice describes three methods for the reduction of field samples of aggregate to the appropriate size for testing employing techniques that are intended to minimize variations in measured characteristics between the test samples so selected and the field sample.

1.2 The values stated in acceptable metric units are to be regarded as the standard.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

C 128 Test Method for Specific Gravity and Absorption of Fine Aggregate<sup>2</sup>

D 75 Practice for Sampling Aggregates<sup>2</sup>

### 3. Significance and Use

3.1 Specifications for aggregates require sampling portions of the material for testing. Other factors being equal, larger samples will tend to be more representative of the total supply. This practice provides procedures for reducing the large sample obtained in the field to a convenient size for conducting a number of tests to describe the material and measure its quality in a manner that the smaller portion is most likely to be a representation of the field sample, and thus of the total supply. Failure to carefully follow the procedures in this practice could result in providing a nonrepresentative sample to be used in subsequent testing. The individual test methods provide for minimum amount of material to be tested.

3.2 Under certain circumstances, reduction in size of the field sample prior to testing is not recommended. Substantial differences between the selected test samples sometimes cannot be avoided, as for example, in the case of an aggregate having relatively few large size particles in the field sample. The laws of chance dictate that these few particles may be unequally distributed among the reduced size test samples. Similarly, if the test sample is being examined for certain contaminants occurring as a few discrete fragments in only small percentages, caution should be used in interpreting results from the reduced size test sample. Chance inclusion or exclusion of only one or two particles in the selected sample may importantly influence interpretation of the

characteristics of the field sample. In these cases, the entire field sample should be tested.

### 4. Selection of Method

4.1 *Fine Aggregate*—Field samples of fine aggregate that are drier than the saturated-surface-dry condition (Note 1) shall be reduced in size by a mechanical splitter according to Method A. Field samples having free moisture on the particle surfaces may be reduced in size by quartering according to Method B, or by treating as a miniature stockpile as described in Method C.

4.1.1 If the use of Method B or Method C is desired, and the field sample does not have free moisture on the particle surfaces, the sample may be moistened to achieve this condition, thoroughly mixed, and then the sample reduction performed.

4.1.2 If use of Method A is desired and the field sample has free moisture on the particle surfaces, the entire field sample may be dried to at least the surface-dry condition using temperatures that do not exceed those specified for any of the tests contemplated, and then the sample reduction performed. Alternatively, if the moist field sample is very large, a preliminary split may be made using a mechanical splitter having wide chute openings 38 mm (1½ in.) or more to reduce the sample to not less than 5000 g. The portion so obtained is then dried, and reduction to test sample size is completed using Method A.

NOTE 1—The method of determining the saturated-surface-dry condition is described in Test Method C 128. As a quick approximation, if the fine aggregate will retain its shape when molded in the hand, it may be considered to be wetter than saturated-surface-dry.

4.2 *Coarse Aggregates and Mixtures of Coarse and Fine Aggregates*—Reduce the sample using a mechanical splitter in accordance with Method A (preferred method) or by quartering in accordance with Method B. The miniature stockpile Method C is not permitted for coarse aggregates or mixtures of coarse and fine aggregates.

### 5. Sampling

5.1 The field sample of aggregate shall be taken in accordance with Practice D 75, or as required by individual test methods. When tests for sieve analysis only are contemplated, the size of field sample listed in Practice D 75 is usually adequate. When additional tests are to be conducted, the user shall satisfy himself that the initial size of the field sample is adequate to accomplish all intended tests.

#### METHOD A—MECHANICAL SPLITTER

### 6. Apparatus

6.1 *Sample Splitter*—Sample splitters shall have an even number of equal width chutes, but not less than a total of

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee C-9 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.20 on Normal Weight Aggregates. In this edition, 6.1 and Note 2 were revised and the section on precision was deleted.

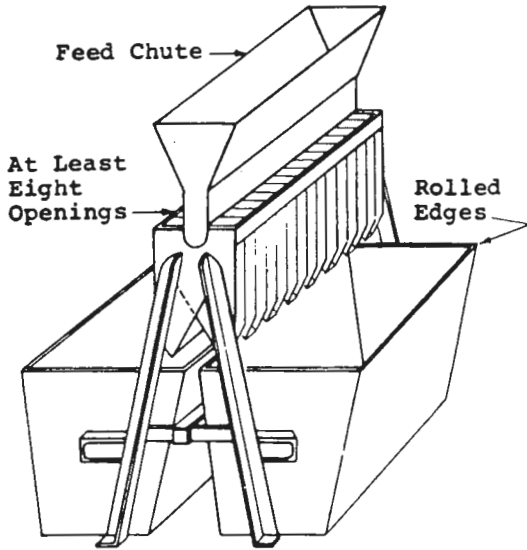
Current edition approved March 27, 1987. Published May 1987. Originally published as C 702 - 71 T. Last previous edition C 702 - 80.

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.02.

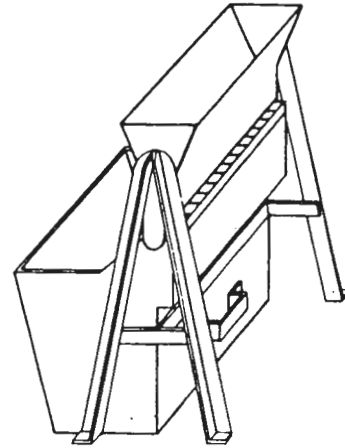
eight for coarse aggregate, or twelve for fine aggregate, which discharge alternately to each side of the splitter. For coarse aggregate and mixed aggregate, the minimum width of the individual chutes shall be approximately 50 % larger than the largest particles in the sample to be split (Note 2). For dry fine aggregate in which the entire sample will pass the 75- $\mu$ m (3/16-in.) sieve, a splitter having chutes 12.5 to 20 mm (1/2 to 3/4 in.) wide shall be used. The splitter shall be equipped with two receptacles to hold the two halves of the sample

following splitting. It shall also be equipped with a hopper or straightedged pan which has a width equal to or slightly less than the over-all width of the assembly of chutes, by which the sample may be fed at a controlled rate to the chutes. The splitter and accessory equipment shall be so designed that the sample will flow smoothly without restriction or loss of material (Fig. 1).

NOTE 2—Mechanical splitters are commonly available in sizes adequate for coarse aggregate having the largest particle not over 37.5 mm (1 1/2 in.).

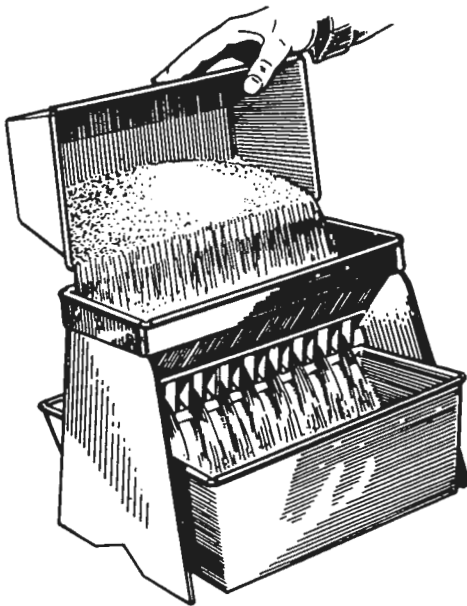


Riffle Sample Splitter

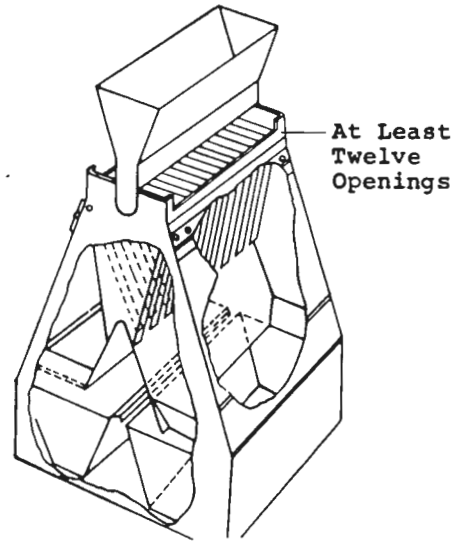


Riffle Bucket and Separate Feed Chute Stand

(a) Large Riffle Samplers for Coarse Aggregate



(b) Small Riffle Samplers for Fine Aggregate



NOTE—May be constructed as either closed or open type. Closed type is preferred.

FIG. 1 Sample Splitters (Riffles)

**7. Procedure**

7.1 Place the field sample in the hopper or pan and uniformly distribute it from edge to edge, so that when it is introduced into the chutes, approximately equal amounts will flow through each chute. The rate at which the sample is introduced shall be such as to allow free flowing through the chutes into the receptacles below. Reintroduce the portion of the sample in one of the receptacles into the splitter as many times as necessary to reduce the sample to the size specified for the intended test. The portion of the material collected in the other receptacle may be reserved for reduction in size for other tests.

**METHOD B—QUARTERING**

**8. Apparatus**

8.1 Apparatus shall consist of a straight-edged scoop, shovel, or trowel; a broom or brush; and a canvas blanket approximately 2 by 2.5 m (6 by 8 ft).

**9. Procedure**

9.1 Use either the procedure described in 9.1.1 or 9.1.2 or a combination of both.

9.1.1 Place the field sample on a hard, clean, level surface where there will be neither loss of material nor the accidental addition of foreign material. Mix the material thoroughly by turning the entire sample over three times. With the last turning, shovel the entire sample into a conical pile by depositing each shovelful on top of the preceding one. Carefully flatten the conical pile to a uniform thickness and diameter by pressing down the apex with a shovel so that each quarter sector of the resulting pile will contain the material originally in it. The diameter should be approximately four to eight times the thickness. Divide the flattened mass into four equal quarters with a shovel or trowel and remove two diagonally opposite quarters, including all fine material, and brush the cleared spaces clean. Successively mix and quarter the remaining material until the sample is reduced to the desired size (Fig. 2).

9.1.2. As an alternative to the procedure described in 9.1.1, when the floor surface is uneven, the field sample may be placed on a canvas blanket and mixed with a shovel as described in 9.1.1, or by alternately lifting each corner of the canvas and pulling it over the sample toward the diagonal opposite corner causing the material to be rolled. Flatten the pile as described in 9.1.1. Divide the sample as described in 9.1.1, or if the surface beneath the blanket is uneven, insert a stick or pipe beneath the blanket and under the center of the pile, then lift both ends of the stick, dividing the sample into two equal parts. Remove the stick leaving a fold of the blanket between the divided portions. Insert the stick under the center of the pile at right angles to the first division and again lift both ends of the stick, dividing the sample into four equal parts. Remove two diagonally opposite quarters, being careful to clean the fines from the blanket. Successively mix and quarter the remaining material until the sample is reduced to the desired size (Fig. 3).

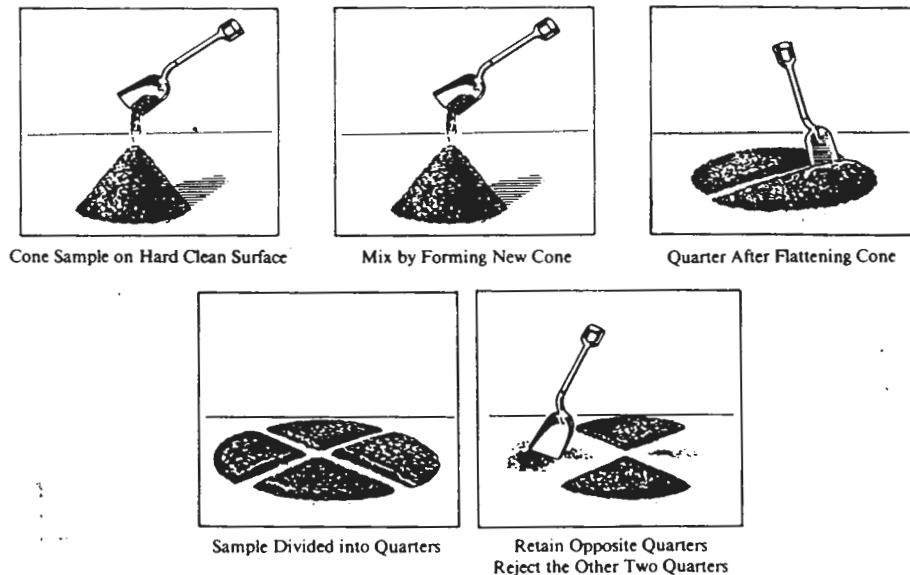
**METHOD C—MINIATURE STOCKPILE SAMPLING (Damp Fine Aggregate Only)**

**10. Apparatus**

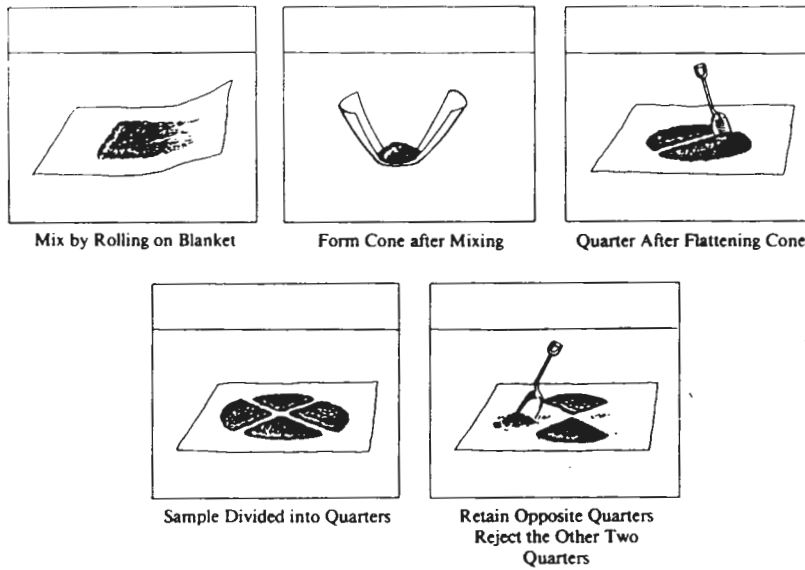
10.1 Apparatus shall consist of a straight-edged scoop, shovel, or trowel for mixing the aggregate, and either a small sampling thief, small scoop, or spoon for sampling.

**11. Procedure**

11.1 Place the field sample of damp fine aggregate on a hard clean, level surface where there will be neither loss of material nor the accidental addition of foreign material. Mix the material thoroughly by turning the entire sample over three times. With the last turning, shovel the entire sample into a conical pile by depositing each shovelful on top of the preceding one. If desired, the conical pile may be flattened to a uniform thickness and diameter by pressing down the apex with a shovel so that each quarter sector of the resulting pile will contain the material originally in it. Obtain a sample for each test by selecting at least five increments of material from random locations from the miniature stockpile, using any of the sampling devices described in 10.1.



**FIG. 2 Quartering on a Hard, Clean Level Surface**



**FIG. 3 Quartering on a Canvas Blanket**

*The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, PA 19103.*

## **Appendix E**

### **Response to Comments**



## **Response to the Comments From New York State Department of Environmental Conservation**

**Subject: Draft LTTD Demonstration Work Plan Seneca Army Depot, Site ID No. 850006**

**Comments Dated:** October 27, 1999

**Date of Comment Response:** February 11, 2000

NYSDEC Comments:

### **Comment:**

**Section I – Introduction:** The performance test goal for contaminated soil should be more developed. To merely achieve “less” contamination in the treated soil is an insufficient treatment goal. Specific treatment levels for the soil should be developed and agreed to in advance of the demonstration. Identifying ultimate disposal options for the treated soil may assist in the development of these specific post-treatment goals. Also, the acceptable particulate emission rate of 0.05 gr/dscf in 6 NYCRR Part 212 applies to this project rather than the proposed 0.08 gr/dscf limit.

### **Response:**

The proposed work is a preliminary treatability study to determine whether the existing, inactive APE 1236 deactivation furnace can be slightly modified and used as a low temperature thermal desorption (LTTD) system in which soils that are contaminated with oil-type compounds and low level chlorinated materials can be successfully treated. Key determinations within this study include:

- whether the existing equipment can physically be used to process soil or whether the existing conveyor and feed/discharge systems require extensive modification to support the processing of soil;
- whether thermal processing of soil results in the generation of high levels of particulate that clog, quench the flame, or damage the afterburner or other system components;
- whether the existing air pollution control system and downstream plumbing can effectively remove the particulate that is generated;
- what amount of heat transfer and volatilization can be obtained in the rotary kiln; and
- whether contaminants in the soil can be volatilized and passed to the afterburner for final combustion.

The Army’s preferred disposal option for soils contaminated with oil-type contaminants is to treat soil on-site and then reuse the treated soil as fill material at SEDA. Alternative disposal options for the treated soil is reuse as cover material at a landfill, or use as a raw material in either an asphalt or concrete batching plant, or as an ingredient in a cold-mix asphalt mix.

The waste feed soil will be considered suitably treated if:

- All listed organic contaminants contained in the soil are shown to exist at a concentration that are less than New York State Department of Environmental Conservation (NYSDEC) listed Technical and Guidance Memorandum (TAGM) Determination of Soil Clean-up Objectives and Clean-up levels (HWR-94-4046, dated January 24, 1994) or at levels that are below conventional analytical detection limits; and

- The concentration of Total Petroleum Hydrocarbons contained in the soil is equivalent to, or less than, 100 milligrams per kilogram (mg/Kg or parts per million).

Additionally, the treatment process will be considered acceptable if the test sequence provides data that indicates that compliance with the following air pollution limitations is achieved:

- the exhaust gases released from the APE 1236 system contain less than 100 parts per million by volume (100 ppm<sub>v</sub>) of carbon monoxide, corrected to a level of 7 percent (%) oxygen, on a rolling hourly average basis;
- the exhaust gases released by the APE 1236 system contain less than 0.05 grains per dry standard cubic foot (dscf) of particulate matter at 7% oxygen;
- the exhaust gases contain less than 0.2 nanograms per dry standard cubic meter of Polychlorinated Dibenzo-p-dioxin and Polychlorinated Dibenzofuran (dioxin/furan) compounds corrected to 7% oxygen;
- Operation of the APE 1236 does not result in excessive fugitive emissions from the process or from associated waste feed or waste residue handling operations;

**Comment:**

**Section 2.1.1 – Fuel and Waste Feed Systems:** It is important that the treated soil volume and mass are recorded accurately. The revised work plan should include a specific, detailed method for the determination and recording of contaminated soil input.

**Response:**

For the purposes of this demonstration, the Army proposes to load all soil to be processed into pre-weighed (i.e., tared) 55-gallons drums and to then reweigh each drum. All weights will be recorded. Each weighed drum will then be emptied into the storage hopper through a screen to removed pieces larger than 2 inches in size and fed to the APE 1236 furnace. All waste feed rejected by the screening processed will be recovered, weighed and removed from the total quantity of soil fed. Soil remaining in the hopper or on the feed conveyors at the conclusion of any test run will also be recovered, weighed and removed from the amount of processed soil.

**Comment:**

**Section 2.2.1 – Measurement Parameters and Methods:** This section states that a thermocouple will be placed at the residue discharge chute to measure exit temperature of the soil. However, this parameter is not included among the various parameters recorded by the system as listed on page 2-18. It is important that exit soil temperature is recorded for future use.

**Response:**

A thermometer will be used to measure the temperature of the discharged treated soil at 15-minute intervals throughout the demonstration test. Each reading will be recorded in the field notes. If the demonstration test indicates that the deactivation furnace can serve as a LTTD, a thermocouple will be

installed in the discharge chute of the APE 1236 Deactivation Furnace (i.e., the "LTTD") to measure the temperature of the treated soil at the time of its discharge from the rotary kiln. This temperature will be recorded at regular intervals during the operation and be tied back into the system's automatic shut-off control.

**Comment:**

**Section 2.3.2 – Operating Procedures:** Routine inspection of the system during operation should include a visual check for visible fugitive emissions from the unit. Necessary actions should be taken to immediately eliminate any observed fugitive emissions.

**Response:**

Personnel participating in the demonstration test at the APE 1236 Deactivation System will maintain a continuing awareness of potential fugitive emissions. The locations where fugitive emissions could occur include the areas of waste feed and treated soil stockpiles, and the areas surrounding the waste soil loading operation and the treated soil discharge area.

Waste and treated soil stockpiles will be kept covered with weighed tarpaulins to the fullest extent possible. Covers will only be removed to allow for the addition/removal of soil to/from the stockpiles.

The areas where waste soil loading and treated soil discharge occur will be shrouded with tarpaulins to minimize the likelihood that dusts from the dumping operations are released to the surrounding environment.

**Comment:**

**Section 3.1 - Soil Selected for Demonstration Study:** A demonstration test should be performed on the most contaminated soil. The operating conditions are recorded to create an operating envelope based upon acceptable soil cleanup and acceptable emissions. Although soil from the SEAD-60 excavation is most conveniently available for this demonstration, SEDA should recognize that if it wishes to treat soils in this unit in the future which are more contaminated than the demonstration soils, or contain different contaminants, then an additional demonstration study will be necessary to create a new acceptable operational envelope. For example, the results of this demonstration cannot be applied to halogen-contaminated soil, and approval for treatment of such soils would require a separate demonstration.

**Response:**

The Army acknowledges that additional demonstration tests will be needed if the system is ultimately modified and used to treat additional soil materials. However, at this time, the primary focus of the proposed demonstration test is to determine whether the deactivation furnace can be practically and economically retrofitted and converted for use as a LTTD. As is indicated in the original text (see page 1-1), this system was not originally designed or intended to serve as a LTTD system; rather it was designed for deactivating and demilitarizing small-to-moderate caliber ammunition and munitions. Thus, the practicality of feeding soil into the system, the level of thermal treatment, and the level of emission control that can be achieved in the system is not well known. Therefore, the Army is proposing this demonstration test sequence to evaluate what soil processing rates, thermal treatment levels, and

pollutant treatment levels may be achieved, as well as what modifications to the existing system may be needed so that the existing furnace can be altered to serve as a LTTD system.

**Comment:**

**Section 3.2 – Feed Soil Limitations:** This section notes that previous analysis of the waste feed soil has indicated levels of TPH exceeding the 20,000 ppm level used by the ITRC guidance as a level of concern while hypothesizing that the actual average concentration of TPH in the soils to be treated will be below the 20,000 ppm threshold. The ITRC document identifies the 20,000 ppm concentration as a threshold at which there may be an explosive hazard during treatment of the soil. Therefore, it may not be sufficient that the average of all soil run through the kiln is below 20,000 ppm TPH. Rather, it may be more accurate to consider the average TPH concentration of any "sub-batch" of soil being processed in the kiln at any one time. Procedures should be developed to ensure that treatment of the contaminated soils will not create an explosive hazard, through either adequate sampling and segregation of the waste feed prior to treatment or through monitoring of the lower explosive level (LEL) within the kiln during operation, or both.

**Response:**

The data provided in the work plan resulted from analysis of samples that were collected during a biased (i.e., directed to the visibly worst locations) sampling of the presumed oil release. Thus, it is reasonable to assume that the results listed probably represent worst-case (i.e., inordinately high) levels of total petroleum hydrocarbons (TPH) that are contained on average throughout the area of the spill.

Nevertheless, to ensure that soils containing levels of TPH in excess of 20,000 parts per million are not fed into the unit, the Army proposes to segregate the soil to be used as the test program waste feed into individual day stockpiles, and to sample and analyze each stockpile prior to its introduction into the deactivation furnace. Only that soil that is shown to contain less than 15,001 ppm of TPH (on average) will be used as waste feed stock for the demonstration test. If any individual stockpile is proven to contain more than 15,000 ppm of TPH, it will be back-blended with additional soil to produce a mixture that contains less than 15,000 ppm of TPH prior to use.

**Comment:**

**Section 3.3 – Soil Handling:** NPDES should read SPDES, and it is not clear how waste water from this waste management unit can be determined to be in compliance with SEDA's SPDES permit. SEDA should ensure that specific approval is obtained from the NYSDEC before discharging any waste water from this demonstration study. Also, a method should be developed to ensure periodic inspection of the pre- and post-treatment soil stockpiles, among other items. A management unit daily inspection checklist should be developed including items and frequency of inspection. The completed checklist should be kept in a daily log.

**Response:**

The Army will change the reference to NPDES to read SPDES.

Water is not used in the LTTD process; thus, the only source of wastewater that is likely to result from

this demonstration test is stormwater that contacts the waste feed and kiln residue stockpiles. If such water is produced, it will be collected and placed into drums or a tank pending sampling and analysis. Results of the sampling and analysis will be used to determine how the water will be discharged or treated.

The Army will develop and include a copy of the proposed inspection form in the revised work plan. The inspection form will be completed each day that soil is stockpiled in the area of the deactivation furnace/LTTD pending treatment/final disposal. This inspection form will be kept with the operational record of the facility.

**Comment:**

**Section 5.1 – Sampling and Analysis Plan Introduction:** Stack sampling for volatiles and semi-volatiles is required. A VOST train is typically used for volatiles and a modified Method 5 (method 0010) is typically used for semivolatiles.

**Response:**

Stack sampling will be conducted to obtain samples for determination of dioxin/furans, semi-volatile and volatile organic compounds.

SW846 Method 0023 will be used to quantify levels of dioxin/furan compounds that are emitted from the process. This test will be run for approximately six hours to ensure that an adequate sample size is collected to document whether these compounds are formed during the treatment process.

Modified Method 5 protocols (SW846 Method 0010) will be used to collect samples for the determination of semi-volatile organic compounds and total particulate emissions. It is expected that the run time for each Modified Method 5 sampling event will be a minimum of six hours (actual sampling time) in length to ensure that adequate sample volume is collected to allow for the determination of semi-volatile organic content in the stack gas. The final sample will be collected by traversing the stack and collecting stack gas from each traverse point for the appropriate length of time. The MM5 sample train will be operated under isokinetic sampling conditions so that a representative sample of particulate and semi-volatile organic compounds are obtained.

VOST sampling procedures (SW846 Method 0030) will be used for the collection of volatile organic compounds. In accordance with this method, six replicate sample collection sequences will be completed within the same sample collection period that is used for the MM5/Method 0023 sample for semivolatile organic and dioxin/furan compounds. Each sample collection sequence will be 20 minutes in duration, and the sampling rate will be set at 1 liter per minute. The sample gas will be pulled from the center of the stack at a point that is upstream of the MM5/Method 0023 sample train collection points.

**Comment:**

**Section 5.3.1 – Sample Location Selection and Cyclonic Flow Check:** The proposal is not clear regarding the number and location of particulate monitoring points. While it is stated on page 5-3 and implied on page 5-6 that the locations to be utilized are displayed on Figure 5-2, the proposal also states

that US EPA Reference Method 1 (40 CFR 60, Appendix A) will be used to verify the suitability of the sampling locations. It is our understanding that the geometry of the stack, as shown in Figure 5-1 and 5-2, already demonstrates that the number and locations of the sampling points shown on Figure 5-2 are not compatible with Reference Method 1 insofar as the distance from the joint of the plenum and the stack to the sampling point, being less than 8 stack diameters, requires additional traverse points. Please clarify. Also, please specify how the cyclonic flow check will be conducted.

**Response:**

Sampling personnel recently re-evaluated access to the sampling ports and found that the sampling ports originally proposed for use during the Reference Method 5 determinations are blocked by supporting structures that are associated with the catwalks. Therefore, two new ports will have to be installed at a height that is 42 inches above the existing sampling ports used for the deactivation systems pitot tube and continuous emission monitor probes. The diameter of the deactivation furnace's exhaust stack is 20 inches.

At this distance, the new ports are slightly more than two stack diameter equivalents downstream, and roughly 6.9 stack diameter equivalents upstream of all flow disturbances. In accordance with procedures outlined in Reference Method 1, this location for the sampling ports means that a minimum of 24 points (i.e., 12 per axis) must be sampled during each Modified Method 5 and Method 0023 traverse. Consistent with additional stipulations of Reference Method 1, none of the 12 sampling points along any access will be closer than 0.5 inches or a distance equivalent to the diameter of the sampling nozzle (whichever is larger) to the wall of the stack. If a sampling nozzle of 0.5 inches or less is used for this test sequence, which is expected, this means that the first and last sampling point on each traverse will be located 0.5 inches away from the wall of the stack.

The required cyclonic flow check will be conducted prior to each series of demonstration runs, with the LTTD system (deactivation furnace and afterburner) operating at conditions that are representative of those that are anticipated to exist during the proposed test sequence. Prior to the test, the manometer will be leveled and zeroed, in accordance with required procedures. The "S-type" pitot tube will then be connected to the manometer, and the tip of the pitot tube will be moved to each of the traverse points and rotated so that the velocity impact and static pressure openings are perpendicular to the stack's cross-sectional plane. At this point, the reading given by the manometer will be checked to determine if it is zero or above or below zero. If the manometer reading is zero, a value of "0" will be recorded for the "yaw" angle in the field log for the traverse point and the tip of the pitot tube assembly will then be moved to the next point for measurement. If the manometer measurement is above or below zero, the pitot tube will be rotated until the manometer reading is zero. The angle of rotation (i.e., "yaw" angle) will be determined with an inclinometer and recorded in the field notes. After the yaw angle for all traverse points are determined, the overall average of the yaw angle will be determined. If the overall yaw angle exceeds 20 degrees, the sampling location is not acceptable for sampling. If the yaw angle is less than 20 degrees, the sampling ports are acceptable for use.

**Comment:**

**Section 5.3.2 – Exhaust Gas Flow Rate:** It's not clear what is meant in this section with regards to repeated determinations of stack gas flow upon significant changes at the front end of the kiln.

Presumably, the S-type pitot will be attached to the stack probe thereby enabling continuous monitoring of the gas flow. The stack testers are required to maintain a constant watch on the pitot manometer and if a change in head is noted, should immediately recalculate the required flow rate on the nomogram and adjust the flow orifice accordingly. Redetermination of stack flow during a certain "run" is not possible, and while stack flow redetermination is possible between runs we are not certain it is necessary and indeed may be inefficient. Collection and notations of required data in the field log should not only be made for all traverse points, but also any changes that may occur between, whether due to known or unknown significant changes. Please clarify this section.

Section 5.3.9 is erroneously identified as Section 5.2.9.

**Response:**

It is typical during stack sampling programs to pre-define the "character" (i.e., flow profile, temperature profile, pressure profile, moisture content, etc.) of the subject stack prior to the actual performance of compliance test runs. This is done by determining the temperature, flow, and pressure profiles while the system is "firing" at conditions that are "equivalent" to those that will exist during the pending test sequence. In this manner, cyclic or variable exhaust gas behavior can be identified prior to committing to the test. This assists with set-up of the sampling nomograph prior to the collection of samples.

As is discussed above, sampling personnel have determined that new sampling ports need to be installed to support the proposed particulate, semi-volatile organic (i.e., Modified Method 5) and dioxin/furan (i.e., Method 0023) sampling. Therefore, based on the proposed installation point (which will be verified once the installation is complete), a minimum of 24 traverse points (i.e., 12 per axis) will be sampled during each MM5/Method 0023 run. During each "compliance" run, the stack gas velocity and temperature will be measured immediately after the sampling probe/assembly is positioned at the sampling point. The sampling rate into the MM5/Method 0023 train will then be adjusted accordingly to upon placement of the sampling probe tip and pitot assembly

The Army will correct the error in the numbering of this subsection.

**Comment:**

**Section 5.3.9 – Waste Soil Feed Sampling:** In accordance with the ITRC guidance, SEDA needs to certify that halogenated organic compounds (including PCBs) are not contained in the soil to be treated. While Section 3.2 of the work plan promises that pre-treated waste feed sampling will verify acceptable levels of pesticides and PCBs, Table 5-1 does not indicate the appropriate analyses for this verification. In accordance with the ITRC guidance, the pre-treated soil must be sampled for total organic halogen (TOX), using EPA SW846 Method 9020.

**Response:**

The Army collected four grab samples of soil from the stockpile that is currently located at SEAD-17 and sent it for analysis via SW846 Method 9020B. Each of the samples was collected from a different portion of the existing stockpile, at locations that were internal to (i.e., not on the surface of the pile) the pile. The results of these analyses indicate that total organic halogen was detected in two samples at

levels of 17.1 and 14.8 milligrams per kilogram (dry basis). The other two samples did not contain total organic halogen at levels above their respective detection limits.

Based on these data, the Army now proposes to collect and analyze waste feed and soil residues for organochlorine pesticides/PCBs as well as volatile and semi-volatile organic compounds. Additionally, sampling in the stack will include determinations of volatile, semi-volatile, and dioxin/furan compounds as well as hydrochloric acid gas.

**Comment:**

**Section 5.5 – Test Schedule:** This section is not clear. A referenced Table 10-1 could not be found in our copy of the work plan, and the statement that a "source test schedule has been planned using one hour sampling times" does not seem to conform with the waste feed sampling time frames contained in Section 5.4.

**Response:**

The reference to Table 10-1 was intended to refer to the information that was provided on Page 10-1 of the draft work plan. The information originally provided on Page 10-1 in the draft now may be found on Page 11-1 of the revised work plan due to the insertion of a new section dealing with community involvement, and the table has been identified as Table 11-1.

The statement "source test schedule has been planned using one hour sampling times" indicated that each Method 5 determination would be completed by performing traverses that included 60 minutes of sampling time. However, this point is now moot, as all particulate, semi-volatile organic compound and dioxin/furan sampling runs have been expanded to encompass at least 6 hours of sample collection time. Thus it is now presumed that each repetition of a set LTTD operating conditions is now expected to require at least six to eight hours to complete. The new schedule presented in Table 11-1 reflects this change in the duration of the tests.

**Comment:**

**Table 5-1 – Soil/Ash Sampling Parameters:** There are several locations within the prose of the document that leave questions regarding the consistency of the proposed sampling for this effort. For example, while page 5-16 states that waste feed material will be sampled for TPH and semivolatile organic compounds only, Table 5-1 indicates that metals analysis will be performed on this materials also. Because of the ease of review of a table format, Table 5-1, when modified by the comments contained in this letter, should hold supremacy on any inconsistency in the document involving proposed analytical parameters. Also, it is not clear what is meant by Footnote (1); "one sample will be collected per 20 samples."

**Response:**

The soil feed, kiln residue, and collected flyash (i.e., from the cyclone, hi- and low-temperature gas-coolers, and baghouse) will be analyzed for metal content. The appropriate text will be modified.

The referenced footnote has been removed and replaced with a more descriptive footnote.



**Comment:**

**Section 6.0 – Operations Recordkeeping:** All calibration data for the sampling train should be compiled and submitted with the final report. The proposed recordkeeping should be reviewed to ensure inclusion, at a minimum, of each item detailed in Section 9.0 of the ITRC document.

**Response:**

Calibration records from all stack sampling and continuous monitoring equipment will be compiled and included in the final report for the performance test. Section 9.0 of the ITRC document will be reviewed to ensure that all necessary records are collected and kept.

**Comment:**

**Section 8 – Cost and Performance Test Report:** The final report should include pre- and post-treatment costs including soil excavation, transportation of soil to incinerator, re-transportation of treated soil to a final dump site (if necessary), etc.... System operating costs should be reasonably detailed including fuel, staff, bag house filter replacement, stack testing, cyclone maintenance and operation, possible second passes of the treated soil through the kiln if analysis show the TPH to be above standards, etc. Sufficient cost details will be necessary to analyze the economic feasibility of future soil treatment in this unit versus other remedial alternatives.

**Response:**

The necessary data will be collected, presented and discussed in the final report for this project.

**Comment:**

**Section 10 – Schedule:** The schedule needs revision.

**Response:**

The schedule has been revised and updated. The new schedule is presented in Table 11-1.

**Comment:**

**Other:** Please either include or reference within the demonstration study work plan procedures for public participation in this project.

**Response:**

Appropriate material describing public participation has been added as Section 10 within the revised work plan.



**Response to the Comments From New York State Department of Environmental Conservation**

**Subject: Draft Final Low Temperature Thermal Desorption (LTTD) Demonstration Workplan  
Seneca Army Depot, Site ID No. 850006**

**Comments Dated: April 28,2000**

**Date of Comment Response: June 16, 2000**

NYSDEC Comments:

The New York State Department of Environmental Conservation (NYSDEC) has reviewed the February 2000 Workplan and offers the following comments/suggestions:

Other than the responses listed below, the Army has satisfactorily addressed the NYSDEC comments as listed in Appendix D of the treatability study workplan.

**NYSDEC Original Comment – Section 2.2.1 -Measurement Parameters and Methods:**

This section states that a thermocouple will be placed at the residue discharge chute to measure exit temperature of the soil. However, this parameter is not included among the various parameters recorded by the system as listed on page 2-18. It is important that exit soil temperature is recorded for future use.

**Army Original Response:**

A thermometer will be used to measure the temperature of the discharged treated soil at 15-minute intervals throughout the demonstration test. Each reading will be recorded in the field notes. If the demonstration test indicates that the deactivation furnace can serve as a LTTD, a thermocouple will be installed in the discharge chute of the APE 1236 Deactivation Furnace (i.e., the "LTTD") to measure the temperature of the treated soil at the time of its discharge from the rotary kiln. This temperature will be recorded at regular intervals during the operation and be tied back into the system's automatic shut-off control.

**NYSDEC Follow-up Comment:**

**The second paragraph in section 2.2.1 does not agree with the Army's response. The paragraph states that a thermocouple will be installed prior to the demonstration test and used to measure the exit temperature of the soil. Use of a thermocouple dictating "automatic shut-off" would be more desirable than relying on an operator using a thermometer and deciding whether or not to manually shut down the system.**

**Army's New Response (June 16, 2000):**

The APE 1236 deactivation furnace currently does not have a temperature sensor or control circuit located in the area of the discharge chute from the rotary kiln. Even though the existing unit does not contain the discharge temperature sensor and controller for the treated soil, the Army believes it has include all needed assurances in the proposed performance test protocol to ensure that the proposed waste feed stock will not improperly handled during the treatability series. Please consider the following items:

1. The existing deactivation furnace system is equipped with a thermocouple that is positioned in the exhaust duct located between the rotary kiln and the afterburner. This thermocouple is an integral component of the existing automatic waste feed shut-off system for the deactivation furnace and it is not one that is required by ITRC guidance. The ITRC guidance specifies that the thermocouple in this location is only needed to monitor discharge and afterburner inlet temperatures. This thermocouple is extremely responsive to systematic operational condition upsets as it senses combustion gas temperature, which changes quickly when combustion conditions are lost due to poor system operation. Unlike soil that acts as a heat sink and, once heated will continue to exhibit elevated temperatures that gradually drop off over extended periods of time, combustion gases rapidly cool whenever their source of heat is removed.
2. The rotary kiln is equipped with the required flame out interlock that will shut down feed operations if the flame in the rotary kiln is lost.
3. The soil will be stockpile, and sampled and analyzed subsequent to treatment to ensure that it is suitably treated prior to disposal on or off-site. If the “treated” soil is still found to contain chemicals at inappropriate concentrations, it will either be treated again in the LTTD or via other methods, or disposed as appropriate.

Given these existing interlocks and procedures, the Army proposes to use the existing thermocouple in the rotary kiln’s exhaust duct as the automatic indicator of poor combustion chamber performance, and the device that shuts down the system when undesirable conditions are present in the kiln.

Additionally, the Army will install a thermocouple in the area of the discharge chute to monitor soil discharge temperature and record the temperature at this point throughout the proposed performance test series. This new thermocouple will not be connected to the LTTD system’s AWFSO as part of this test, as the accuracy and representativeness of measurements obtained via this thermocouple have not yet been assessed. To install this thermocouple, the Army is going to have to design and orient a new mounting bracket to hold the thermocouple in a location where it will continuously be impacted by treated soil as it falls from the rotary kiln. As the system is currently configured, the ash chute also is used for the introduction of combustion/dilution air into the rotary kiln and this action will tend to produce a “wind chill” effect on the thermocouple and the proposed supporting bracket. Further, although the Army plans to select rugged equipment for this measurement, the probable lifetime of any thermocouple being impacted by heavy, hot soil must be questioned until such time as its long-term durability can be assessed, as would be the case in the proposed performance test period. Data collected from this new thermocouple assembly will be compared with direct readings made on the treated soil collected from the ash conveyor using a thermometer.

If the treatability test series indicates that the deactivation furnace represents a viable treatment technology for SEDA contaminated soils, a thermocouple and controller combination will be designed and integrated into the system’s control logic system prior to use on other contaminated soil feeds from the base. As has been indicated in prior communications, the Army acknowledges that subsequent system test series will be needed to verify the ability of the APE-1236/LTTD system to treat soils containing differing mixture of volatile and semi-volatile organic compounds. This issue is also discussed in the last comment within this letter.

**NYSDEC Original Comment – Section 3.2 – Feed Soil Limitations:**

This section notes that previous analysis of the waste feed soil has indicated levels of TPH exceeding the 20,000 ppm level used by the ITRC guidance as a level of concern while hypothesizing that the actual average concentration of TPH in the soils to be treated will be below the 20,000 ppm threshold. The ITRC document identifies the 20,000 ppm concentration as a threshold at which there may be an explosive hazard during treatment of the soil. Therefore, it may not be sufficient that the average of all soil run through the kiln is below 20,000 ppm TPH. Rather, it may be more accurate to consider the average TPH concentration of any "sub-batch " of soil being processed in the kiln at anyone time. Procedures should be developed to ensure that treatment of the contaminated soils will not create an explosive hazard, through either adequate sampling and segregation of the waste feed prior to treatment or through monitoring of the lower explosive level (LEL) within the kiln during operation, or both.

**Army Original Response:**

The data provided in the work plan resulted from analysis of samples that were collected during a biased (i.e., directed to the visibly worst locations) sampling of the presumed oil release. Thus, it is reasonable to assume that the results listed probably represent worst-case (i.e., inordinately high) levels of total petroleum hydrocarbons (TPH) that are contained on average throughout the area of the spill.

Nevertheless, to ensure that soils containing levels of TPH in excess of 20,000 parts per million are not fed into the unit, the Army proposes to segregate the soil to be used as the test program waste feed into individual day stockpiles, and to sample and analyze each stockpile prior to its introduction into the deactivation furnace. Only that soil that is shown to contain less than 15,001 ppm of TPH (on average) will be used as waste feed stock for the demonstration test. If any individual stockpile is proven to contain more than 15,000 ppm of TPH, it will be back-blended with additional soil to produce a mixture that contains less than 15,000 ppm of TPH prior to use.

**NYSDEC Follow-up Comment – Section 5.4.1. Page 5-30:**

**The last paragraph states that soils with Total Petroleum Hydrocarbons (TPH) in excess of 10,000 ppm will not be loaded into the system. If the 10,000 ppm is not a clerical error then please clarify.**

**Army's New Response (June 16, 2000):**

The 10,000 ppm value used in the first sentence of the last paragraph of **Section 5.4.1** (page 5-30) of the draft final workplan is a typographical error. The value should be 15,001 ppm as has been discussed in **Section 3.2** (page 3-5) and in the last sentence of the last paragraph of **Section 5.4.1** of the draft final workplan.

**NYSDEC Original Comment – Table 5-1 – Soil /Ash Sampling Parameters:**

There are several locations within the prose of the document that leave questions regarding the consistency of the proposed sampling for this effort. For example, while page 5-16 states that waste feed material will be sampled for TPH and semivolatile organic compounds only, Table 5-1 indicates that metals analysis will be performed on this materials also. Because of the ease of review of a table format, Table 5-1, when modified by the comments contained in this letter, should hold supremacy on any inconsistency in the document involving proposed analytical parameters. Also, it is not clear what is meant by Footnote (1); "one sample will be collected per 20 samples."

**Army Original Response:**

The soil feed, kiln residue, and collected flyash (i.e., from the cyclone, hi- and low-temperature gas-coolers, and baghouse) will be analyzed for metal content. The appropriate text will be modified.

The referenced footnote has been removed and replaced with a more descriptive footnote.

**NYSDEC Follow-up Comment – Section 5.1. p5-5:**

**The first three paragraphs discuss obtaining grab samples from the waste soil feed, rotary kiln residue (i.e. bottom ash) and bag house fly ash. Comparing these paragraphs with the discussion in section 5.4 is confusing. Will grab samples (from each test run) be composited to yield one single sample to be submitted for analysis or will they be composited to generate samples, specific to each test run, to be submitted for analysis?**

**Referring to the rotary kiln residue and bag house fly ash. The soil to be treated has metals which may be concentrated in the residue and ash possibly making it a characteristic hazardous waste. What provisions have been made for storage of this material pending analysis? Will these materials be drummed as they are emptied from their respective hoppers or will they be stockpiled on site?**

**A site plan delineating present soil stock piles and holding areas for treated soils pending analysis should be included in the workplan.**

**Army's New Response (June 16, 2000):**

The combined flyash collected in the hi- and low-temperature gas coolers, the cyclone, and the baghouse will be composited at the completion of each test run to yield one analytical sample for each of the test runs. The combined flyash sample will be a discrete and separate sample from the bottom ash sample that is characterized for each of the test runs. Six flyash samples (exclusive of duplicates and QA/QC sample) and six separate bottom ash samples (exclusive of duplicates and QA/QC checks) will be submitted for analysis if all six test runs are completed during the proposed performance test sequence.

Each individual bottom ash sample will be prepared by grabbing sample aliquots at set time intervals (e.g., every 45 minutes during a demonstration test run) throughout the test. Each flyash sample will be prepared by recovering and compositing all of the combined flyash collected in any component of the air pollution control train (hi- and low-temperature gas coolers, cyclone, and baghouse) at the conclusion of each run.

Flyash accumulated from each individual test run will be collected in 55-gallon drums that are covered and placed within the support building at the end of each test run. At the end of all of the performance tests, the contents of all of the accumulated drums containing flyash will be composited, and a single sample of flyash will be collected and sent for the determination of leachable RCRA metals via SW-846 1310/1311 and Method 6010 at the conclusion of the performance test sequence

Bottom ash will be transferred from the rotary kiln to a pad located exterior of the system via conveyor belt where it will be accumulated in a pile pending transfer to the temporary storage pile. The treated soil will be hot at the time of discharge and will need to cool prior to handling and covering. Once the

material is cool, it will be transferred from the area of the accumulation pad to temporary storage pile that will be located to the southwest of the existing deactivation furnace.

**NYSDEC Original Comment – Section 5.3.9 -Waste Soil Feed Sampling:**

In accordance with the ITRC guidance, SEDA needs to certify that halogenated organic compounds (including PCBs) are not contained in the soil to be treated. While Section 3.2 of the work plan promises that pre-treated waste feed sampling will verify acceptable levels of pesticides and PCBs, Table 5-1 does not indicate the appropriate analyses for this verification. In accordance with the ITRC guidance, the pre-treated soil must be sampled for total organic halogen (TOX), using EPA SW846 Method 9020.

**Army Original Response:**

The Army collected four grab samples of soil from the stockpile that is currently located at SEAD-17 and sent it for analysis via SW846 Method 9020B. Each of the samples was collected from a different portion of the existing stockpile, at locations that were internal to (i.e., not on the surface of the pile) the pile. The results of these analyses indicate that total organic halogen was detected in two samples at levels of 17.1 and 14.8 milligrams per kilogram (dry basis). The other two samples did not contain total organic halogen at levels above their respective detection limits.

Based on these data, the Army now proposes to collect and analyze waste feed and soil residues for organochlorine pesticides/PCBs as well as volatile and semi-volatile organic compounds. Additionally, sampling in the stack will include determinations of volatile, semi-volatile, and dioxin/furan compounds as well as hydrochloric acid gas.

**NYSDEC Follow-up Comment:**

**The NYSDEC understands that SEDA wants to run the treatability study to obtain operational data, monitoring data and other information regarding the deactivation system. The December 1997 Interstate Technology Regulatory Cooperation (ITRC) document, referenced in Section 12 of the workplan, states in Section 3.0 Feed soil Limitations "[T]he generator of the soil shall certify, based upon site history or previous sampling/characterization, that halogenated organic compounds (including PCB's) are not contained in the soil to be treated". The September 1997 (should be 1998) ITRC document, referenced in Section 12 of the workplan, discusses soil containing more than 50 mg/kg PCB's. The last Paragraph on page 12 of the ITRC document states, "For federal NPL sites, no TSCA permit is required, however, substantive compliance is required". If the treatability study indicates the possible application of the deactivation furnace as a LTTD unit, SEDA will need to identify whether the unit will be used to treat only petroleum contaminated soil or soil containing hazardous chlorinated organics. The requirements for each are significantly different.**

**Army's New Response (June 16, 2000):**

Typically, soil that is contaminated at the Seneca Army Depot contains mixtures of chlorinated and non-chlorinated organic compounds. Normally, soil contamination is predominated by gasoline and oil type constituents including benzene, toluene, xylene, naphthalene, and other polynuclear aromatic hydrocarbons (PAHs), but occasionally identified soil does also contain varying amounts of degreasing type solvents, other chlorinated materials and polychlorinated chlorinated biphenyls.

The goal of the proposed treatability study is to determine if the APE 1236 deactivation furnace can be used to feed and treat contaminated soil in an economical and environmentally acceptable manner. Soil from SEAD-60 was initially selected for use during the demonstration treatability study because it was believed to contain very low to no chlorinated organic material based on the existing analytical data in hand at the time. Use of this soil as the waste feed for the demonstration test would minimize the amount of environmental emissions and the likelihood of chemical conversion of chlorinated organics to hydrochloric acid and dioxins/dibenzofurans during the preliminary shakedown tests.

If the proposed treatability tests indicate that soil can reliably be fed into the APE 1236 deactivation furnace, and that the entire APE system (i.e., rotary kiln, afterburner, and the existing air pollution control system train) can effectively treat and contain the organic and inorganic contaminants, then the Army may propose capital improvements to the system and the use of the system for treatment of other soil feed stocks. If this is the case, the Army will be prepared to conduct and provide the results of additional testing to overseeing regulatory agencies for review and approval prior to the application of the APE-1236 system on a long-term basis. The additional testing will include all determinations required by the state or the federal government to grant a long-term use operational permit for the system.





## **Response to the Comments From United States Environmental Protection Agency, Region 2**

**Subject: Draft Final Low Temperature Thermal Desorption (LTTD) Demonstration Workplan  
Seneca Army Depot, Site ID No. 850006**

**Comments Dated: April 7,2000**

**Date of Comment Response: June 16, 2000**

Dated 4/7/2000

*Re: Draft Final Low Temperature Thermal Desorption (LITD) Demonstration Study Workplan Seneca Army Depot, Romulus, New York*

This is in reference to the above subject document dated February 2000. EPA reviewed the subject document together with the Draft Workplan dated July 1999, and offer the following comments for your consideration.

### ***General Comments:***

The Work Plan details a plan for using an apparently effective incinerator. The unit being discussed (1) is direct fired and (2) has an afterburner. These two issues make this a unit that must meet the regulatory requirements of 40 CFR Part 264 Subpart O incinerator regulations. If a thermal desorber (TD) is desired to meet the regulatory requirements in Subpart X, some equipment modification is required. The primary-chamber burner needs to be backed out of the chamber until it is determined that the flame is "indirect." And the afterburner needs to be converted to a collector/condenser unit. All affected systems will also need to be reviewed for this new configuration.

More detailed schematics are needed to show the solid, liquid, and gas streams so the design can be fully evaluated. Just one example is the baghouse bypass valve. I can not find it on a drawing, so I don't know where the valve is, and consequently I don't know where the gas stream goes when the valve is activated.

### **Response:**

The Army does not intend to modify the existing deactivation furnace at this time. If the results of the proposed treatability test indicate that the system is a viable option for the treatment of soil that is contaminated with volatile or semivolatile organic compounds, the Army may modify the system in the future to expand its use. The Army acknowledges that if the system is continued to be used for treating contaminated soil, additional performance tests will be needed to document the system's ability to treat soils containing volatile and semivolatile organic compounds.

The Army's decision not to modify the existing system is based on the following information. First, the purpose of this treatability test sequence is to obtain information that can be used to determine whether the existing unused system has the potential to be used as a low temperature thermal desorption (LTTD) system. The existing deactivation furnace system resembles commercially available direct-fired LTTD systems that are regularly used to process contaminated soil at other sites, with the sole. A few of the key difference between the existing APE-1236 and commercially available LTTD systems related to size, potential throughput, and the existing waste feed system. Therefore, some of the primary goals of the proposed tests include determining if significant modifications are needed for the waste feed and residue removal systems, what throughputs/soil treatment rates can be accommodated in the existing system, and

whether particulate carryover from the thermal processing of soil in the kiln will adversely affect downstream components of the air pollution control system.

In designing the proposed treatability test sequence, the Army purposefully selected soil that contains relatively low concentrations of toxic organic compounds and moderate levels of total organic compounds. The reason for this decision was to minimize potential environmental impacts if the system does not perform sufficiently, while providing a feedstock that was somewhat representative of the types of contamination that are known to exist at the Seneca Army Depot.

Within the workplan, the Army has defined a comprehensive series of sampling and analysis events that will be completed to document the degree of treatment and pollution control achieved by the system during the performance test. Results from these evaluations will be key in the subsequent determination of whether this system represents a viable treatment alternative for contaminated soil. Included in the proposed testing are triplicate determinations for volatile and semivolatile organic compounds, dioxins and dibenzofurans, total particulate matter, hydrochloric acid, oxygen, carbon monoxide, carbon dioxide, and total hydrocarbons determinations which are equivalent to the requirements of a Subpart O determination for a hazardous waste incinerator. Furthermore, with the hopes of being able to document the system's destruction and removal efficiency for target organic compounds, the Army has also extended the duration of the proposed stack sampling events for volatile, semi-volatile and dioxin/dibenzofuran compounds. This is consistent with ITRC guidance which acknowledges that this determination is a common difficulty for many LTTD demonstrations.

Additional process flow and instrumentation diagrams are included as Appendix A of the final workplan.

When the baghouse bypass valve is opened, flue gas bypasses the baghouse and is discharged to the atmosphere through the id fan and the stack. The bypass valve is only open during system start-up when waste feed is not present in the deactivation furnace, and in an emergency situation when the integrity of the baghouse bags is threatened due to temperature excursions. During emergency situations, the waste feed is also stopped, but residual feed material may remain in the kiln and air pollution control train for a short period of time.

***Specific Comments:***

- 1) For Bullet 4 on page 1-3, "excess fugitive emissions" needs to be quantified.

**Response:**

The reviewer has referenced the statement contained in the draft workplan; however, this same phrase was used in the draft final workplan but exists as Bullet 7 on page 1-3.

The Army does not expect excessive fugitive emissions to occur near the APE-1236 deactivation furnace and the goal of this treatability test is to verify this expectation. Ultimately, the goal of this test is to verify that fugitive emissions do not exceed the national primary and secondary 24-hour ambient air quality standards for particulate matter of 150 ug/m<sup>3</sup>. If excessive fugitive emissions are measured, this data will be used as part of subsequent system redesign assessments to define appropriate controls.

As is discussed in the text of Section 2, the rotary kiln, including the soil feed and discharge chutes are enclosed in a shroud that is maintained under negative pressure to minimize fugitive emissions. Given

this configuration, the most likely locations of fugitive emissions are from the soil loading operations and from the point where the treated soil is discharged into a pile to cool. However, as the LTTD facility is located at least one-half mile away from the nearest facility fenceline, it is unlikely that any fugitive emission will impact the community beyond the base during this treatability test.

**Comment:**

- 2) Are the "sonic horns" used in the High Temperature (HT) gas cooler and The Low Temperature (LT) gas cooler likely to be hearing hazards? If so, this needs to be taken into account in operations design and the health and safety plan.

**Response:**

The sonic horns are encased within protective housings to control noise. Therefore, the presence of the sonic horns is not considered to be a hearing hazard and no additional hearing protection is needed.

**Comment:**

- 3) The gas-cooling equipment includes the HT gas cooler, the LT gas cooler, the cyclone and the baghouse. If chlorine will be present in any of the wastes or contaminated soil to be processed, the potential formation of dioxins must be considered. The gas-cooling equipment as configured may not cool quickly enough to prevent/minimize the *de novo* formation of dioxin. A fast-cooling quench is generally effective in that effort. The temperatures of the gas-cooling units also need to be controlled carefully to avoid the *de novo* dioxin-formation temperature range -180 to 400 °C – for the particulate that is captured in the gas coolers, the cyclones, and the baghouse. The baghouse upset temperature is 600 °F, right in the dioxin *de novo*-formation range. The residues from the gas coolers, the cyclones, and the baghouse need to be checked for contamination.

Similar design considerations need to be given to metals as contaminants of concern and as co-contaminants. The work plan needs to address how metals (e.g., lead, mercury, cadmium) will be managed in the gas stream and in solid residues. Design and testing should focus on the worst case feed material and should account for the additional gas stream concern if the material contains both metals and chlorinated compounds.

**Response:**

It appears that the reviewer has only reviewed the draft workplan and not the draft final workplan. Based on comments received from NYSDEC, additional testing has been included and discussed in the draft final workplan, which is not referenced by the reviewer.

With respect to the last issue in this comment (i.e., "*Design and testing should focus on the worst case feed material ....*") the Army offers the following additional information. As has been indicated in the introduction of the draft final workplan, the goal of this treatability test is to determine whether an existing, inactive piece of equipment can be reactivated and converted for service as a low temperature thermal desorption (LTTD) system. Key to this determination is collecting preliminary data that determines whether the existing design can be modified to heat between 2 and 5 tons of soil to the point where contaminating volatile and semivolatile organic compounds are volatilized and stripped from the soil. If organic contaminants are liberated from the soil they are channeled to an afterburner where they

are combusted in an afterburner prior to passage through an air pollution control train and the exhaust stack.

In proposing the treatability test, the Army knowingly decided not to use worst-case soil for the demonstration, as it was uncertain as to the degree to which the system would work. Therefore, a relatively innocuous soil feed, containing primarily semivolatile organic compounds that are difficult to volatilized was selected as the proposed feedstock. In making this decision, the Army understood that if the treatability analysis suggested that the system had potential to serve as a LTDD system, additional performance tests would be subsequently required to validate its full utility and acceptability.

Primary considerations in the proposed treatability tests were to determine what types of modifications would be needed to allow for the introduction and discharge of between 2 and 5 tons of soil from the rotary kiln furnace chamber. At present, the rotary kiln's design is predicated on the introduction of relatively small amounts (100 to 500 pounds per hour) of small-to-moderate sized munitions into the kiln for deactivation. Obviously, this difference in feed rate quantity requires a significantly different type of solids handling than does 2 to 5 tons of soil. Additionally, while calculations indicate that adequate heat transfer is possible within the system, the degree to which soil will be uniformly heated is also of interest. Finally, the effects of possible particulate transfer from the kiln into the afterburner, and its potential impact on the operation of the afterburner are all of concern and are the subject of the proposed test sequence.

Data and information gathered during the proposed treatability test would be used by the Army to determine if the system can be retrofitted to overcome some of these potential problems. Key to this determination obviously is the overall projected economics of any required renovations and the degree to which the soil is treated.

The combined flyash collected in the High and Low Temperature Gas Coolers, the Cyclone and the Baghouse will be composited at the conclusion of each performance test and one sample of the composited materials from each run will be collected and analyzed for dioxin/dibenzofuran content. A similar sample will also be collected and characterized for metal content contained in the combined flyash from the air pollution control train.

Hydrochloric acid determinations will be conducted on the gas stream via Reference Method 26. Samples for the hydrochloric acid determination will be collected in the same train that is being used to quantify dioxin/dibenzofuran emissions in the stack via SW846 Method 0023A.

US EPA Reference Method 29 sampling will be added to the proposed stack sampling suite to document the quantity of metal emissions contained in the exhaust gases. The Method 29 determination will be included as part of the proposed SW846 Method 0010 and Reference Method 5 sampling system. Additional impingers will be added to the condensor train to support this determination.

**Comment:**

- 4) Where does the gas stream go when the baghouse bypass valve is activated? (2.1.7) It is important to capture the gas stream if the valve is activated for a high-temperature condition during a processing run.

**Response:**

The baghouse bypass valve is a safety device added to protect the collection bags from catching on fire and being destroyed in the event of a high temperature excursion. When the valve is opened, the exhaust gas flows around the baghouse and discharges to the atmosphere through the existing ID fan and stack. When the valve is activated, feed to the rotary kiln is shut off.

**Comment:**

- 5) The temperature *range* for the ID fan should be provided in the work plan, not just the nominal 300° F. (2.1).

**Response:**

The upper temperature limit for the ID fan is 500 °F. Therefore, the operating range for the ID fan is from ambient to 500 °F.

**Comment:**

- 6) When the automatic waste feed shut off (AWFSO) system is activated, the feed stops and the conveyer continues operation. The work plan also needs to indicate what happens to the ID fan during automatic shut off. Tables 2-2 and 2-3 are not fully consistent or complete. For example, there is a "low alarm" on the HT Gas Cooler (table 2-2), but no low value at which it activates the AWFSO (table 2-3). The soil exit temperature is a better indicator of the target kiln temperature and should be considered an AWFSO item rather than the "Kiln Temperature." Other AWFSO parameters that should be considered for addition to the list are: Soil Feed Rate, Baghouse Temperature and Stack Gas O<sub>2</sub> Concentration. Time dependencies are given for two operating conditions that activate the AWFSO. Table 2-3 should indicate that the other activating conditions are instantaneous or list the time dependencies.

**Response:**

When the AWFSO activates the ID fan continues to operate.

Table 2-3 has been corrected to indicate maximum and minimum values for all necessary parameters.

No new sensors or control circuitry will be added to the existing system's control panel at this time to activate the AWFWO. If the results of the proposed treatability test indicate that the system is a viable alternative for treating contaminated soil, new AWFSO interlocks, controllers and sensors will be considered during the system redesign and retrofit.

Time dependency information has been added to Table 2-3.

**Comment:**

- 7) Is the test soil representative of the soil that is to be remediated? Trial Bums or Proof of Performance Tests are generally conducted on worst-case scenarios, i.e., the most contaminated material with the most difficult to remediate compounds and the most interferences (volatile

metals, chlorine-containing compounds. etc.). The trial burn or proof-of-performance *tests* are generally used to set upper limits on feed material parameters. If potentially worse materials are considered for processing later, additional testing is often required.

**Response:**

The purpose of the proposed treatability test is to determine whether a piece of existing equipment that is currently inactive has the potential to be used as a low temperature thermal desorption unit that can be used to treat soils that are contaminated with volatile and semivolatile organic compounds. In selecting the proposed a feedstock for the test, the Army specifically stayed away from the worst-case scenario of possible soil feed materials, choosing rather to use soil that was contaminated with less toxic (e.g., primarily TPH and semivolatile organics) until such time as the system's potential was evaluated. If this test sequence suggests that the system is a viable treatment option for soils, the Army has indicated that it is prepared to conduct additional test sequences that more rigorously challenge the system.

**Comment:**

- 8) The sampling locations for feed soil and kiln residues need to be identified. (5 and 5.4.1)

**Response:**

Two sampling locations will be used for the feed soil and one will be used for the kiln residues. As is discussed in **Section 3.2** of the draft final workplan, screening samples will be collected prior to testing for each of the day piles, and the results of these analyses will be used to demonstrate that projected TPH concentrations in the pile are below the proposed 15,000 ppm threshold.

Samples of the feed actually entering the LTTD system will be collected from the conveyor belt system that is used to transfer the soil from the screening hopper assembly to the rotary kiln. Three conveyor belts are used in this system; the hopper conveyor which connects the hopper to the waste loading conveyor; the waste loading conveyor which connects the hopper conveyor to the kiln feed conveyor; and the kiln feed conveyor that connects the waste loading conveyor and the rotary kiln. Samples of the waste feed will at the point where the hopper conveyor drops soil onto the waste loading conveyor.

Samples of the treated soil or the kiln residue will be collected at the point where the treated soil drops off the transfer conveyor into the accumulation pile.

**Comment:**

- 9) If this unit remains an incinerator, the Trial-Burn requirements will need to address the attendant requirements. One of which requirements is demonstration of the Destruction and Removal Efficiencies (DREs) for the contaminants of concern. Stack-gas sampling, such as using EPA SW.846 Methods 0010 and 0030 (semivolatiles and volatiles, respectively) and possibly Method 0023 for dioxins/furans, will need to be added to the test protocol. Analysis for stack-gas concentrations of critical contaminants is usually performed for thermal desorbers also. Determination of stack gas emissions would likely be a State or EPA requirement.

**Response:**

It appears that the reviewer has focused on the draft copy of the workplan instead of the draft final workplan. The draft final workplan includes stack sampling for dioxins/furans (See **Section 5.3.7**), and the use of SW-846 Methods 0010 (see **Section 5.3.5**) and 0030 (see **Section 5.3.6**) for semivolatiles and volatiles. The proposed stack sampling time proposed for dioxins/furans and semivolatile organic compounds has also been extended such that both determinations will last a minimum of six hours as opposed to the time that is needed to collect 106 dry, standard cubic feet of gas. The Army made this concession to enhance its ability to calculate DREs given the low total throughput of organic compounds that are expected to be resident in the processed soil. This approach is consistent with the guidance provided in the two ITRC manuals that have been used as the basis of the proposed treatability demonstration.

**Comment:**

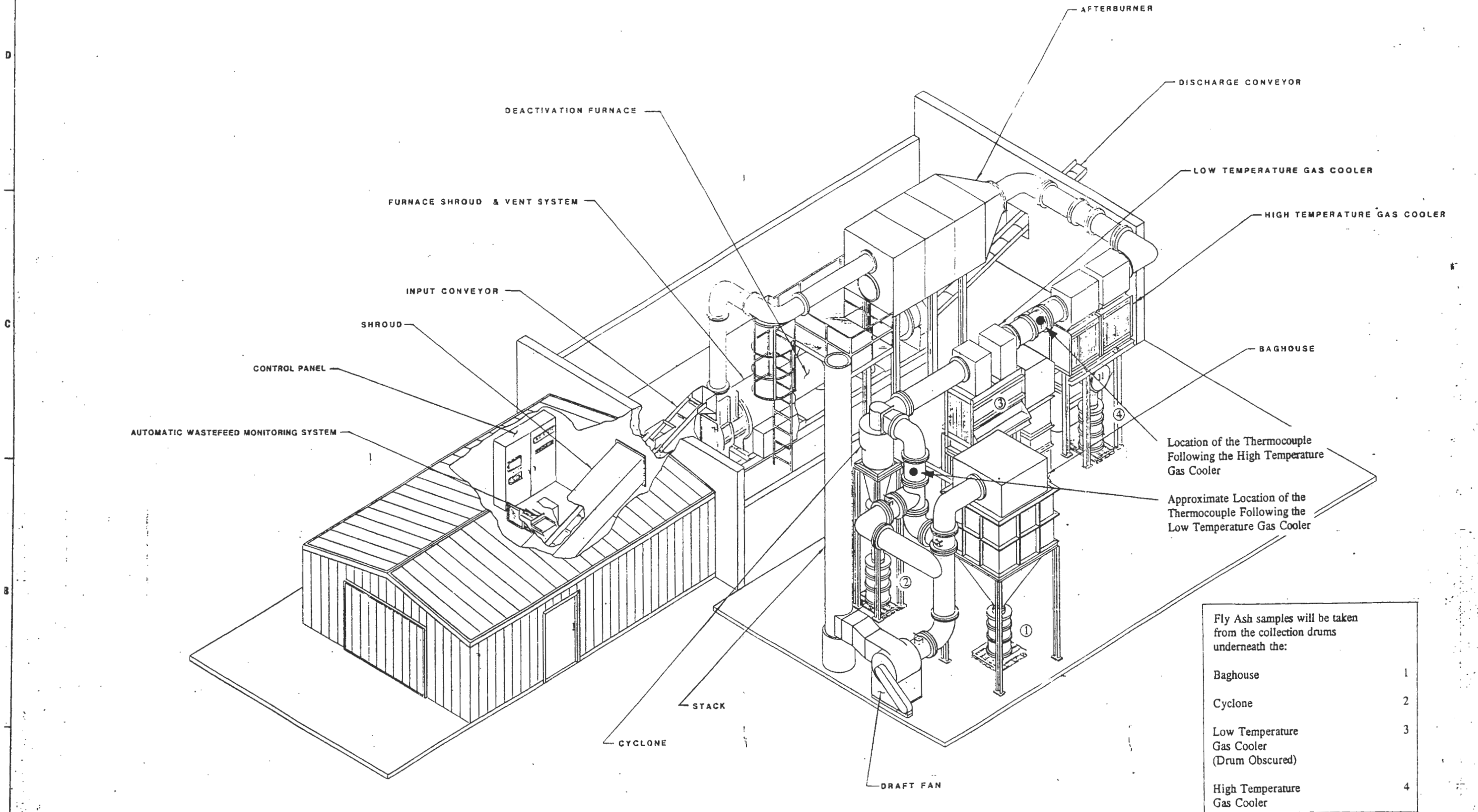
- 10) A project specific Health and Safety Plan needs to be developed. See comment number two above.

**Response:**

A site-specific health and safety plan will be developed for the LTTD program and will be available at the site during the performance test.



PARTS LIST						
FIG. NO.	QTY	UNIT	NOMENCLATURE	MANUF. CODE NO.	PART NO.	SPEC.



Location of the Thermocouple Following the High Temperature Gas Cooler

Approximate Location of the Thermocouple Following the Low Temperature Gas Cooler

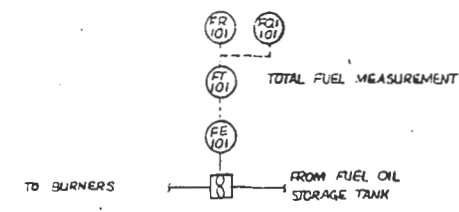
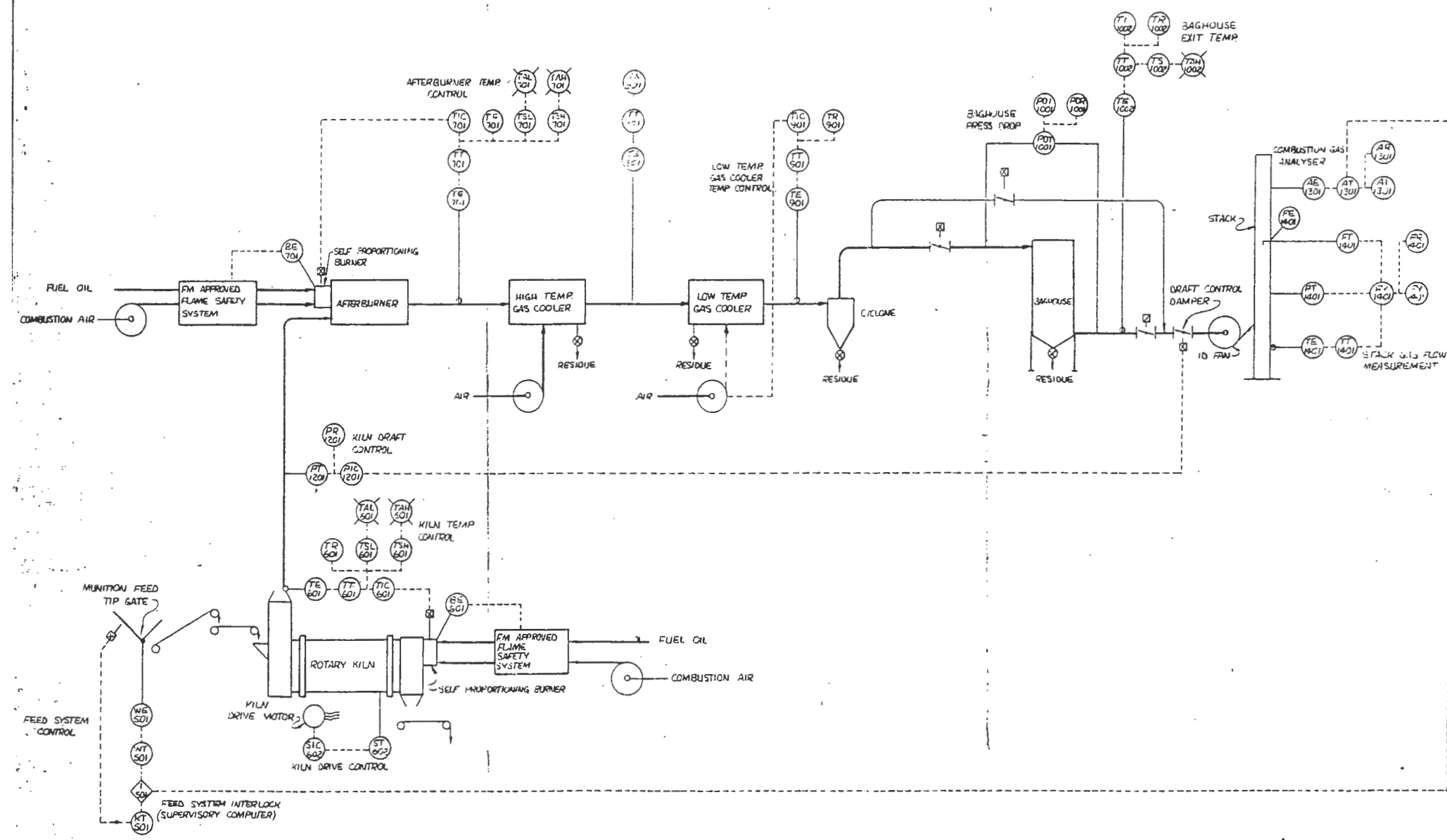
Fly Ash samples will be taken from the collection drums underneath the:	
Baghouse	1
Cyclone	2
Low Temperature Gas Cooler (Drum Obscured)	3
High Temperature Gas Cooler	4

NEXT ASSEMBLY	TOLERANCES EXCEPT AS NOTED	REV.	DATE	BY	DESCRIPTION	ZONE	CHKD	APVD
	DECIMAL TWO PLACES ± THREE PLACES ± FRACTIONAL ± ANGULAR ± DIMENSIONS & LOCATIONS DIMENSION STURNER TS & D DRG TRACER PROJ ENGR.							
USED ON	D/TO CHECK ENGR. DV.				FINAL APPROVAL			
	PROJECT COORD. RT & M DRG.				DRSAR-MAD US ARMY ARCOM			
	DESIGN APPL. APPROVALS				US ARMY ARCOM			
SUBMITTED TO: TOOLE ARMY DEPOT, SORTE-AND, SAFETY APPROVED, DARCOM FIELD SAFETY ACTIVITY						US ARMY ARMAMENT MATERIEL READINESS COMMAND, ARMAMENT PECULIAR EQUIPMENT		
THERMOCOUPLE AND FLY ASH SAMPLING LOCATIONS						CODE IDENT. NO. SIZE: 21624 F - AC 5K 87-12		
DATE:						1 OF 1		

PARTS LIST					
FIG. NO.	QTY	UNIT	NOMENCLATURE	MARK. CODE NO.	SPEC.

LEGEND FOR INSTRUMENT SYMBOLS

FIRST LETTER	SECOND LETTER	THIRD LETTER
A	ANALYSIS	ALARM
B	BURNER FLAME	
C	CONDUCTIVITY	CONTROL
D	DENSITY	DIFFERENTIAL
E	VOLTAGE (EMF)	PRIMARY ELEMENT
F	FLOW RATE	RATIO (FRACTION)
G	GAGING	GLASS
H	HAND	HIGH
I	CURRENT	INDICATE
J	POWER	SCAN
K	TIME	
L	LEVEL	LIGHT (PILOT)
M	MOISTURE	
O		ORIFICE
P	PRESSURE OR VACUUM	POINT
Q	QUANTITY OR EVENT	INTEGRATE OR TOTALIZE
R		RECORD OR PRINT
S	SPEED OR FREQUENCY	SAFETY SWITCH
T	TEMPERATURE	TRANSMIT
U	MULTIVARIABLE	MULTIFUNCTION
V	VISCOSITY	VALVE
W	WEIGHT OR FORCE	WELL
Y	USER'S CHOICE	RELAY OR COMPUTER
Z	POSITION	DRIVE



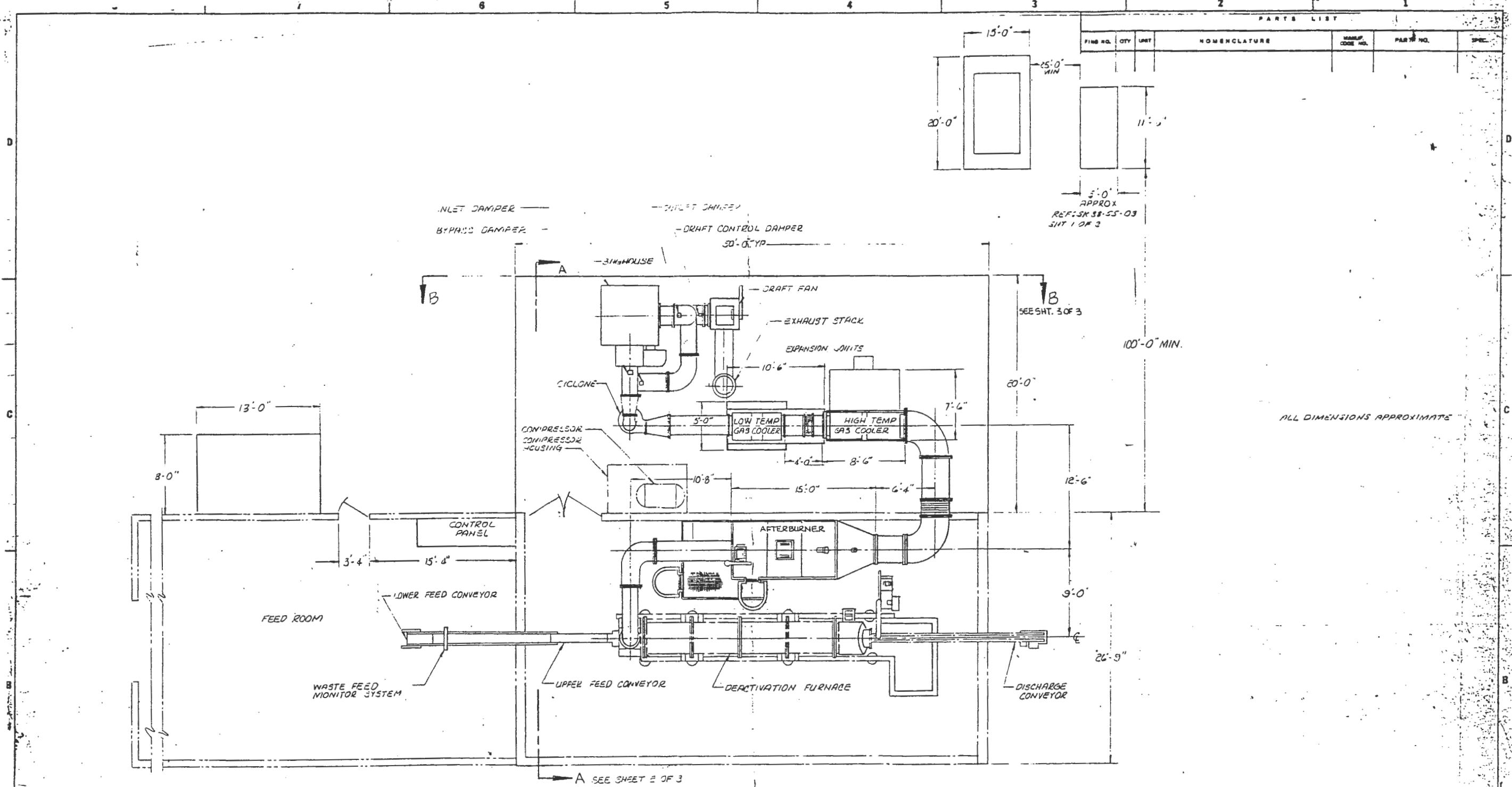
REV	DATE	BY	DESCRIPTION	ZONE	CHD	APVD

DECIMAL TWO PLACES ± THREE PLACES ± FRACTIONAL ± ANGULAR ±	TOLERANCES EXCEPT AS NOTED
DRAFTING TRACER	TS & D DIV. PROJ ENGR.
USED ON DFTO CHECK PROJECT COORD DESIGN APPLY	CHORD. DIV. RT & M DIV. APPROVALS

SUBMITTED TO: ARMY DEPOT - SOSTE-AR SAFETY APPROVED BARCOM FIELD SAFETY ACTIVITY	US ARMY ARMAMENT MATERIEL READINESS COMMAND AMMUNITION PECULIAR EQUIPMENT
FINAL APPROVAL ORSAR - MAD US ARMY AMCOM	FUNCTIONAL PROCESS CONTROL DIAGRAM APE 1236 UPGRADE
CODE IDENT. NO. SIZE 21624 F	SR88-07
DATE 31 MAY 88	SCALE: NONE EXCEPT AS NOTED

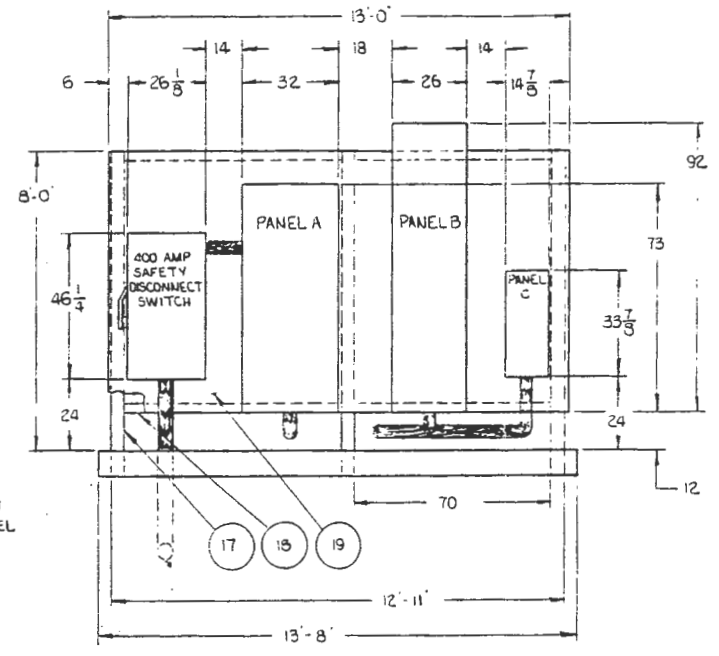
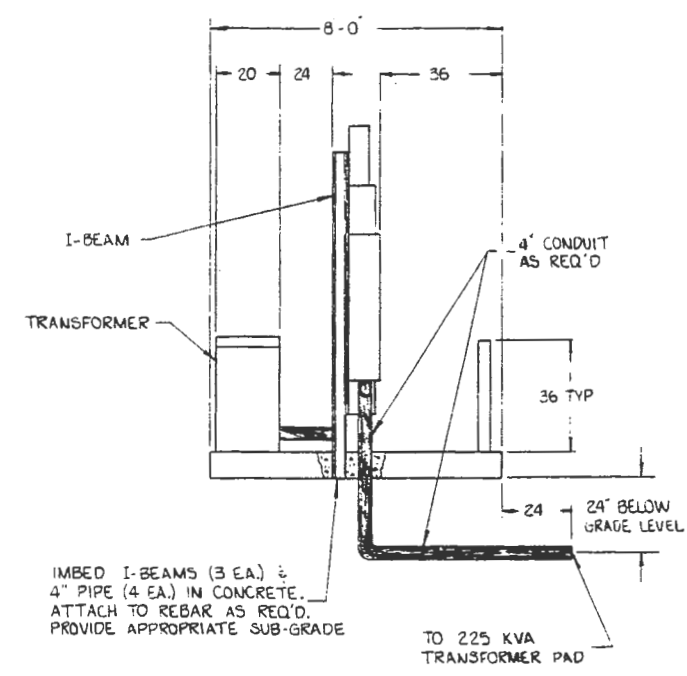
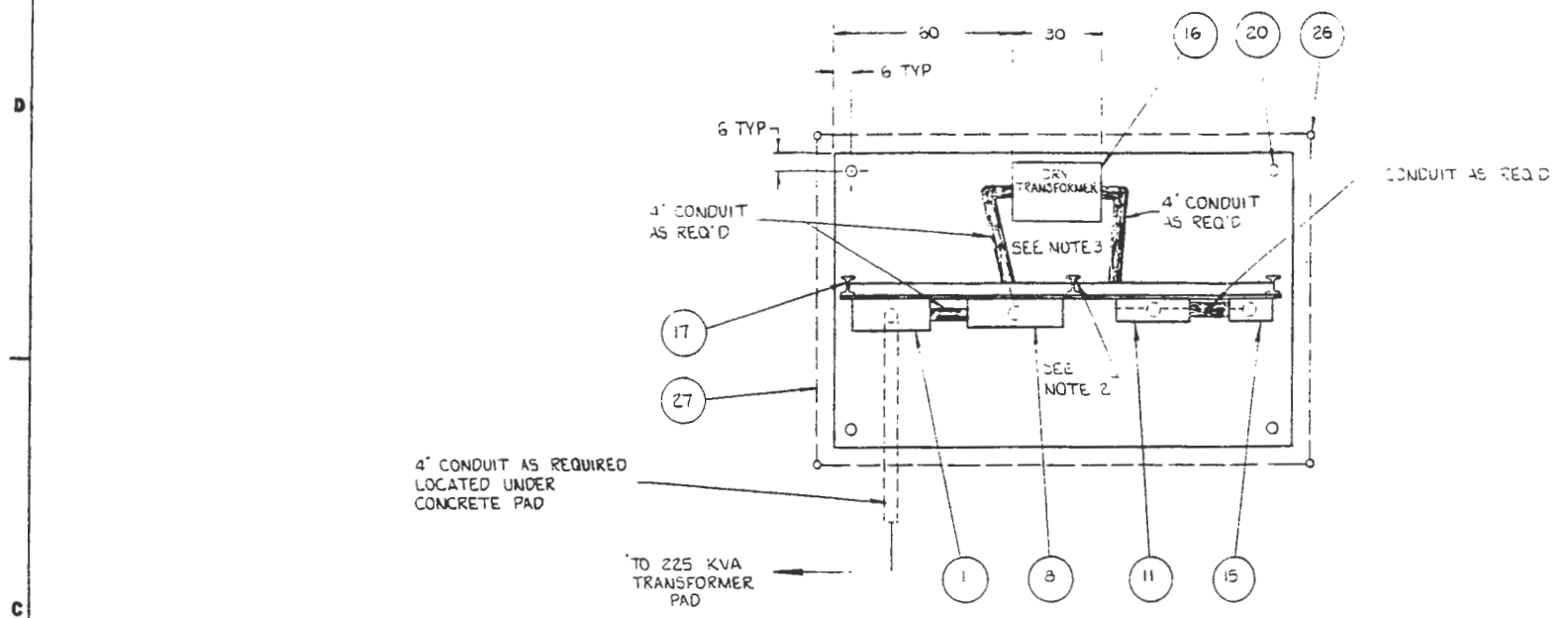


PARTS LIST						
FIG. NO.	QTY	UNIT	NOMENCLATURE	MANUF. CODE NO.	PART NO.	SPEC.

SITE LAYOUT

TOLERANCES EXCEPT AS NOTED DECIMAL ± TWO PLACES ± THREE PLACES ± FRACTIONAL ± ANGULAR ± SHOP CORNER & RISE SHOWN DRAFTER R. SPEER TRACER PROJ. ENGR.	REV. DATE BY DESCRIPTION ZONE OK'D APVD
	SUBMITTED TO: US ARMY TO: ARMY DEPOT, SENeca ARMY DEPOT, ARMAMENT MATERIEL READINESS COMMAND, SENeca ARMY DEPOT, NY SAFETY APPROVED BY: DARCOM FIELD SAFETY ACTIVITY FINAL APPROVAL: DESAR-MSB, US ARMY ARCOM CODE IDENT. NO. / SIZE: 21624 F / AC SK-88-55-02 DATE: 21 OCT 88 SCALE: AS SHOWN SHEET 1 OF 3
USED OR DFTG CHECK PROJECT CLORD DESIGN APPVL	SHORD. DIV. ST & M DIV. APPROVALS

PARTS LIST				
PNQ	QTY	UNIT	NOMENCLATURE	PART NUMBER



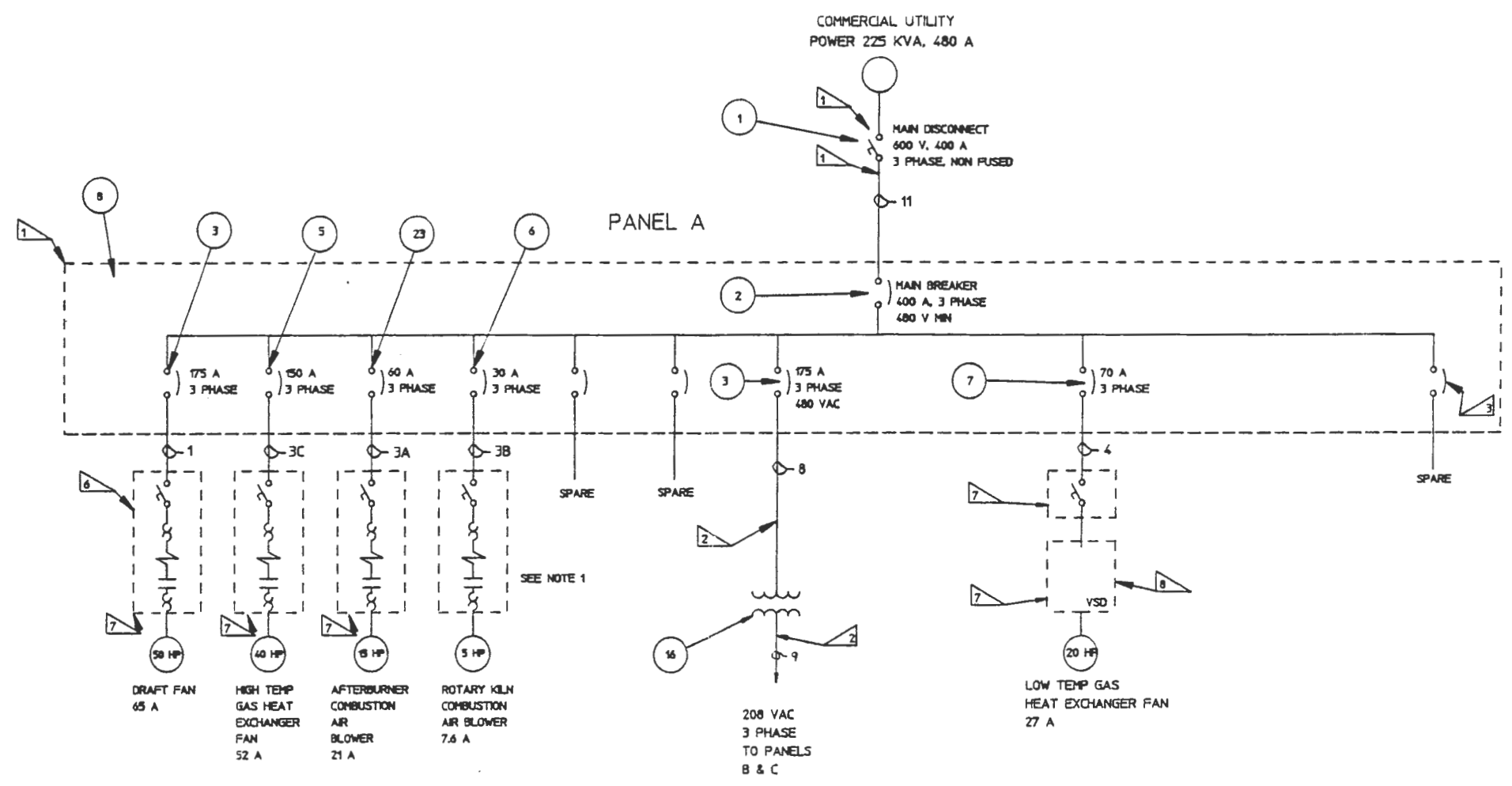
VIEW A-A

NOTES:

1. DIMENSIONS SHOWN FOR CIRCUIT BREAKER ENCLOSURES AND DRY TYPE TRANSFORMER ARE FOR GENERAL REFERENCE ONLY.
2. THE CONCRETE PAD AND STEEL SUPPORT STRUCTURE SHALL BE SIZED ACCORDING TO THE COMPONENTS CHOSEN.
3. MAY BE LOCATED UNDER THE CONCRETE PAD.

NEXT ASSEMBLY	TOLERANCES EXCEPT AS NOTED	2	5/1/89	T.T.	UPDATED CONFIGURATION			KDH
DECIMAL		REV	DATE	BY	DESCRIPTION	ZONE	CHKD	APVD
TWO PLACES ±		R E V I S I O N S						
THREE PLACES ±		SUBMITTED						
FRACTIONAL ±		TOOLES ARMY DEPOT-SRSTE-ARL						
ANGULAR ±		ARMAMENT, MUNITIONS & CHEMICAL COMMAND						
SHARP CORNERS & EDGES BROWNE		ARMORIED PECULIAR EQUIPMENT						
DRAFTER	TS & D ONE	CARCON FIELD SAFETY ACTIVITY						
TATE		FINAL APPROVAL						
TRACER	PROJ. ENGR.	U.S. ARMY AMCGCOM						
USED ON								
DFTG CHECK	ENGRG. DIV							
PROJECT COORD	RT & M DIV							
DESIGN APPVL	APPROVALS							
		CODE IDENT. NO.   SIZE		ARMAMENT, MUNITIONS & CHEMICAL COMMAND				
		21624   F		APE 1236 UPGRADE POWER DISTRIBUTION EQUIPMENT LOCATION & DETAILS SENECA ARMY DEPOT				
		DATE 5/2/89		SCALE: 1/2" = 1'-0"		SHT 3 OF 9		
				EXCEPT AS NOTED				

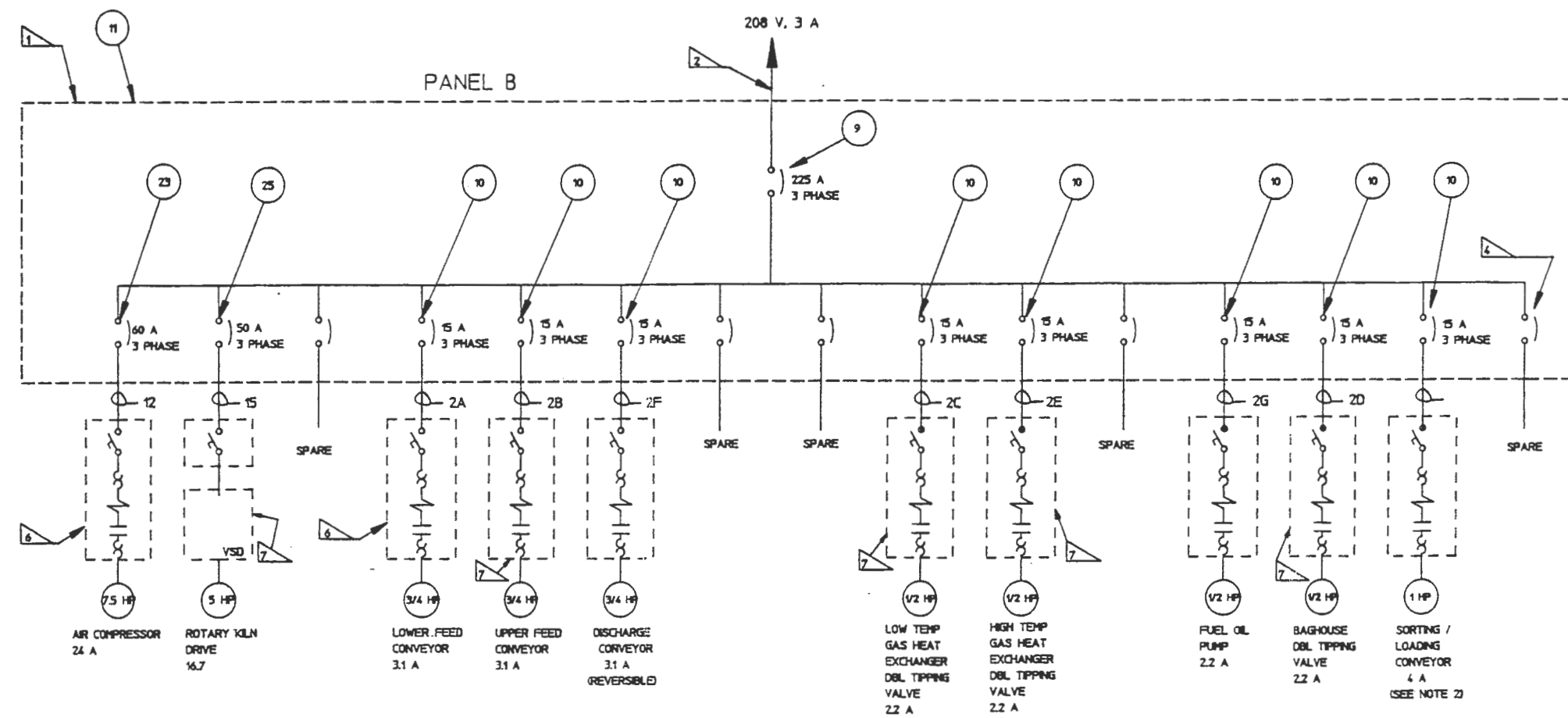
PARTS LIST				
FIND NO.	QTY	UNIT	NOMENCLATURE	PART NUMBER



NOTE:  
 1 FOR FLAG NOTES SEE DRAWING NO. SK88-55-04 SHT. 1 OF 9.

NEXT ASSEMBLY	TOLERANCES EXCEPT AS NOTED	2	5/1/89	KDH	UPDATED CONFIGURATION	ALL	KDH
DECIMAL	TWO PLACES ±	REV.	DATE	BY	DESCRIPTION	ZONE	CHGD
FRACTIONAL ±	THREE PLACES ±	REVISIONS					
ANGULAR ±	THREE PLACES ±	SUBMITTED					
		TOSEL ARMY DEPOT 30515-ARL					
		ARMAMENT, MUNITIONS & CHEMICAL COMMAND					
		AMMUNITION PECULIAR EQUIPMENT					
		APE 1236 UPGRADE					
		POWER DISTRIBUTION					
		480 V SINGLE DIAGRAM					
		SENECA ARMY DEPOT					
		CODE IDENT. NO. SIZE					
		21624 F SK88-55-04					
		SCALE: 1" = 1'-0"					
		DATE: 5/1/89					
		SHEET 4 OF 9					

PARTS LIST				
FIND NO.	QTY	UNIT	NOMENCLATURE	PART NUMBER

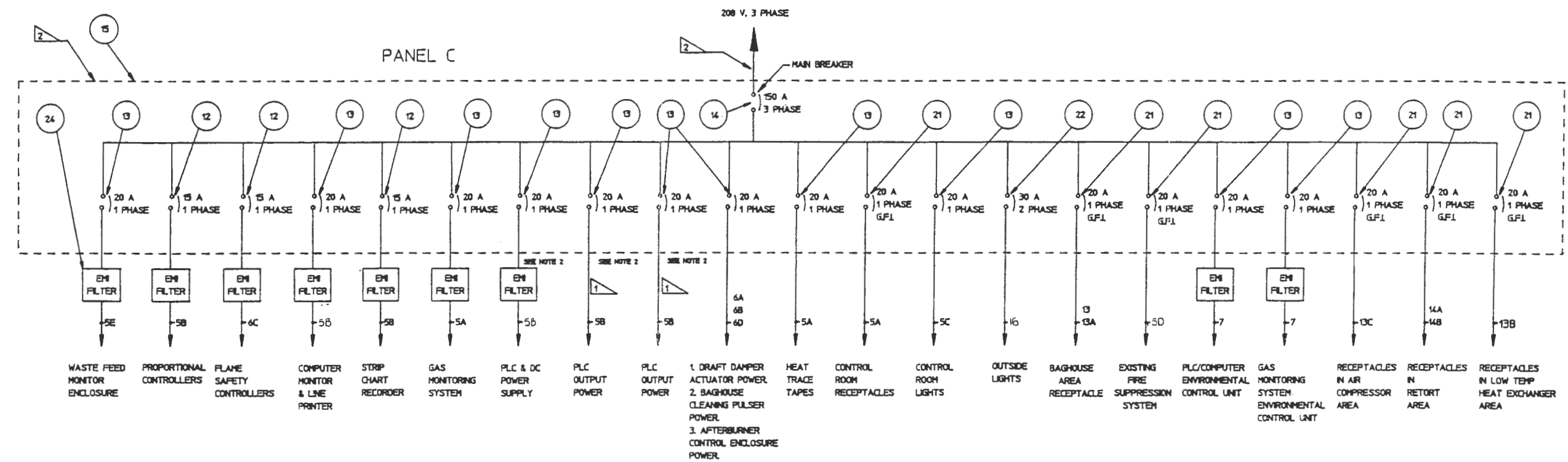


**NOTE:**

- FOR FLAG NOTES SEE DRAWING NO. SK88-55-04 SHT. 1 OF 3.
- THIS IS AN EXISTING PIECE OF EQUIPMENT. RUN CONDUIT AND WIRE AS REQUIRED.

NEXT ASSEMBLY	TOLERANCES EXCEPT AS NOTED	2	5/1/89	KCH	UPDATED CONFIGURATION	ALL	KCH	
DECIMAL	TWO PLACES ±	REV	DATE	BY	DESCRIPTION	ZONE	CHD	
FRACTIONAL	THREE PLACES ±	REVISIONS						APVD
ANGULAR	±	SUBMITTED						
SHARP CORNERS & EDGES BROKEN IN		TOOLES ARMY DEPOT 3087C-AEG						
DRAWN BY	R VIGIL	US ARMY						
TRACER	PROL ENGR.	ARMAMENT, MUNITIONS & CHEMICAL COMMAND						
USED ON		ARMOR FIELD SAFETY ACTIVITY						
DFTG CHECK	ENGRS. DIV.	FINAL APPROVAL						
PROJECT COORD	HT & M DIV.	US ARMY AMCCOM						
DESIGN APPL.	APPROVALS	APE 1236 UPGRADE						
		208V SINGLE LINE DIAGRAM						
		SENECA ARMY DEPOT						
		CODE IDENT. NO. & SIZE						
		21624 F SK88-55-04						
		DATE						
		SCALE: EXCEPT AS NOTED						
		SHT 5 OF 3						

PARTS LIST				
FIG. NO.	QTY	UNIT	NOMENCLATURE	PART NUMBER



- NOTES:**
- FOR FLAG NOTES SEE DRAWING SK88-55-04 SHT.1 OF 9.
  - MUST BE THE SAME PHASE.

NEXT ASSEMBLY	TOLERANCES EXCEPT AS NOTED	2	5/1/89	KDH	UPDATED CONFIGURATION	ALL	KDH
DECIMAL TWO PLACES ±	FRACTIONAL ±	REVISIONS					
AMBIAR ±	DRAPPER	SUBMITTED					
SHARP CORNERS & RIBS SHOWN	TATE	TOOLE ARMY DEPOT - WEST-ACG					
DRAPPER	TRACER	ARMAMENT, MUNITIONS & CHEMICAL COMMAND					
PROJECT COORD	APPROVALS	ARMOURY REGULAR EQUIPMENT					
DESIGN APPL.		APE 1236 UPGRADE					
		POWER DISTRIBUTION					
		120V SINGLE LINE DIAGRAM					
		SENECA ARMY DEPOT					
		CODE IDENT. NO. SIZE	SK88-55-04				
		DATE	SCALE: EXCEPT AS NOTED				
			SHT 6 OF 9				