



**Systech
Environmental
Corporation**

RCRA PERMIT APPLICATION

SYSTECH ENVIRONMENTAL CORPORATION

11397 County Road 176

Paulding, Ohio

EPA ID No. OHD005048947

REVISION 2

February 2013

Revision #1 June 2013

Revision #2 November 2013

Systech Environmental Corporation

RECEIVED

FEB 06 2014

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Drawing Name	Drawing Number	Rev # in Current Permit	Rev #	Notes
Figure 2.1 Process Flow Schematic	11-06P01	R1	R1	
Figure 2.2 USGS Topographic Map				Downloaded newer Quadrangle (1977)
Figure 2.3 Detailed Topographic Map	11-06G01	R9	R10	Revised office/lab, logo color and permitted future parking lot, container building, direct burn and tanks 7,10,11. Removed heel removal system. Added 2 foam rooms and mcc.
Figure 2.4 Wind Rose				Downloaded newer Wind Rose (2012)
Figure 2.5 Traffic Patterns Map	11-06G05	R6	R8	Revised office/lab and permitted future parking lot, container building, direct burn and tanks 7,10,11. Removed heel removal system. Added 2 foam rooms and mcc.
Figure 4.1 Detailed Site Plan	11-00G01	R11	R12	Revised office/lab, logo color and permitted future parking lot, container building, direct burn and tanks 7. Removed heel removal system. Added 2 foam rooms and mcc.
Figure 4.2 Dimensional Plan	11-06G07	R10	R11	Revised office/lab, logo color and permitted future parking lot, container building, direct burn and tanks 7,10,11. Removed heel removal system. Added 2 foam rooms and mcc.
Figure 4.3 Piping Layout	11-06P02	R17	R18	Revised office/lab, logo color, company address and permitted future parking lot, container building, direct burn and tanks 7,10,11. Removed heel removal system. Added 2 foam rooms and mcc.
Figure 4.3B Blend Tanks Concrete Plan	11-02-20A	R6		Removed drawing 11-02-20A Fig. 4.3B and replaced with 11-02-20 Fig. 4.8
Figure 4.4 Process Flow Diagram	11-06P05	R10	R11	Revised piping in container area and rerouted piping from tank 5 and 6 to container area
Figure 4.4B Process Flow Diagram	11-00P02	R7	R10	Revised drawing name, address, logo, future tank 7 and added figure number
Figure 4.4C Proposed Burn Tank Piping Plans	11-05P10	R3	R5	Revised address and logo color
Figure 4.5 Tank Plan, Elevation & Details	Removed			Removed fig. 4.5 11-05T13 and replaced with 4.5(1) 11-05T16 and 4.5(2) 11-05T17 new tank 1-4 clawson drawings
Figure 4.5(1) Tank 1-4, Tank Plan	11-05T16	R5	R5	
Figure 4.5(2) Tank 1-4, Tank Plan	11-05T17	R5	R5	
Figure 4.5A Tank 5 & 6, Tank Plan	TC-862-D-201	C	C	
Figure 4.6 Plan, Elevation & Details	F14876-G	R1	R1	
Figure 4.6A Proposed Burn Tank Foundation Plans	11-05C03	R3	R5	Revised address
Figure 4.6B Proposed Burn Tank Foundation Details	11-05C04	R4	R5	Revised address and logo color
Figure 4.6C Proposed Burn Tank Intermediate Foundation Plans	11-05C05	R5	R6	Revised drawing name, address, figure number and logo
Figure 4.7 Plan, Tank Elevation & Details	Remove 11-02-21	R3		Current information now found on new drawings 11-05T16(4.5(1)), 11-05R17(4.5(2)) and 11-05C12R1.dwg(4.9A)
Figure 4.8 Plan and Sections - Concrete	11-02-20	R5	R6	Removed drawing 11-02-20A Fig. 4.3B and replaced with 11-02-20 Fig. 4.8, added stormwater tank, crane rails and moved agitator storage
Figure 4.9 Secondary Containment Detail	E-14788G	R4	R4	
Figure 4.9A	11-05C12	R1	R2	Revised drawing name, figure number and logo
Figure 4.10 Tank Foundation Details	11-05P30	R0	R2	
Figure 4.11 Secondary Containment Details	E-14789-G	R4	R4	
Figure 4.12 Secondary Containment Detail	F-14C77-G	R2	R2	
Figure 4.13 Tank Foundation Detail	F-14C79-G	R0	R0	
Figure 4.14 Secondary Containment	F-14C78-G	R2	R2	

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Drawing Name	Drawing Number	Rev # in Current Permit	Rev #	Notes
Figure 4.15 Plan, Sections, Details, Truck Unloading	11-02-16	R2	R4	Revised drawing name, address, figure number and logo
Figure 4.16 Secondary Containment	11-02-17	R3	R5	Revised drawing name, address, figure number and logo
Figure 4.17 Aboveground Pipe Detail	11-02-22	R1	R1	
Figure 4.18 General Arrangement/Organic Storage	11-02-23	R2	R3	Revised drawing name, address, figure number and logo
Figure 4.19 Container Handling Facility Processing Equipment	11-01-M05	R3	R5	Removed knockout box, added pump, figure number and revised logo
Figure 4.20 Plan, Concrete Layout/Organic Area	11-02-12	R2	R2	
Figure 4.21				There is no Figure 4.21 in the application.
Figure 4.22 Sections & Details/Container Storage	11-06C02	R2	R3	Revised address and logo
Figure 4.23 Sections, Tank Containment	11-02-05	R2	R3	Revised address and logo
Figure 4.25 Shed - Plan & Elevation	11-12S01	R1		Removed from the permit in previous modification
Figure 4.26 Truck Heel Loading Rack	LR-0362-0			Removed from the permit in previous modification
Figure 4.27 VOC Control System P & ID	11-VOC1	R9	R12	Revised labeling, logo, drawing
Figure 4.28 Trench Plan and Elevation	11-05C01	R4	R5	Added figure number, revised address and logo
Figure 4.28A VOC Trench Design	11-05C02	R4	R5	Added figure number, revised address and logo
Figure 4.30 Railcar Agitator Plan	11-02M01	R1	R2	Revised address and logo
Figure 4.31A Railcar Agitator Design pg 1	COPY	R0	R0	
Figure 4.31B Railcar Agitator Design pg 2	COPY	R0	R0	
Figure 4.32 Railcar Agitator Design Specifications	COPY	R0	R0	
Figure 4.33 General Notes, Tank 8-11	TC 1045-0			
Figure 4.34 Tank Details, Tank 8-11	TC 1045-1	R0	R0	
Figure 4.35 Leak Detection, Anchor System, Tanks 8-11	TC 1045-2			
Figure 4.36 Walkway, Handrails, Tanks 8-11	TC 1045-3			
Figure 4.37 Foundation Details, Tanks 8-11	TC-1045-D-200	RB	RF	
Figure 4.38 Truck Agitation Plan	11-02M02	R0	R1	Revised drawing name, address and logo
Figure 4.39 Direct Burn Layout	11-06C10	R0	R1	Revised logo
Figure 4.40 Trailer Containment Layout	11-06C11	R0	R1	Revised logo
Figure 4.41 Direct Burn Plan and Elevation	11-05-C10		R1	
Figure 4.42 Trailer Containment Plan and Elevation	11-05-C11		R5	Revised logo and added figure number
Figure 4.43 Direct Burn Process Flow Diagram	11-00P05	R2	R3	Revised logo
Figure 4.44 Direct Burn Pipe Details	11-05P50	R0	R1	Revised logo
Figure 4.45 Pipe Bridge Plan, Sections & Details	11-05M-2	R0	R1	Revised drawing name, figure number and logo
Figure 5.1 Security Features Base Map	11-06G09	R8	R9	Removed heel removal system
Figure 6.1 Site Plan	11-06G03	R7	R9	Revised office/lab and permitted future parking lot, container building, direct burn and tanks 7,10,11. Removed heel removal system. Added 2 foam rooms and mcc.
Figure 6.2 Evacuation Routes	11-06G15	R6	R8	Revised office/lab and permitted future parking lot, container building, direct burn. Removed heel removal system. Added 2 foam rooms and mcc. Revision 8 changed the alternate rally point.
Figure 6.3 Location of Emergency Equipment	11-06G06	R6	R7	
Figure 8.1 Topographic Map	11-06G10	R8	R10	Revised office/lab and permitted future parking lot, container building, direct burn. Added 2 foam rooms and mcc.
Figure 8.2 Soil Sampling Map	11-06P03	R14	R16	Revised office/lab and permitted future parking lot, container building, direct burn and tanks 7,10,11. Added 2 foam rooms and mcc.

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Systech Environmental Corporation

Paulding Systech Facility

USEPA ID No.: OHD 005048947

Ohio Permit No.: 03-63-0595

SECTION I INTRODUCTION

1.1 Purpose

This application document requests a renewal to the existing hazardous waste storage permit (# OHD 005-048-947). The existing permit addresses the tank and container storage of fuel-quality organic liquid wastes. This application to renew the existing permit describes Systech Environmental Corporation (Systech) as the owner/operator of the facility and addresses the requirements for tank systems and container management facilities for the following general types of wastes:

Tank Storage Systems:

Organic liquids

Container Storage Facilities:

Organic liquids, solids, and sludges

1.2 Historical Perspective

In 1979, the General Portland Cement Plant in Paulding, Ohio, began using combustible liquid waste materials to supply a portion of the energy required to manufacture Portland cement. Systech was contracted to locate fuel-quality wastes, assure their suitability through extensive chemical analysis, and provide for their safe use through proper management. In 1984 General Portland received a hazardous waste storage permit under the Resource Recovery Conservation Act (RCRA), which authorized and placed controls on the storage of these recycled waste materials.

1.3 New Facility Owner/Operator

In December of 1986, Systech was acquired by and became a wholly-owned subsidiary of Lafarge North American, Inc., fka Lafarge Corporation (Lafarge), the parent company of General Portland. On January 29, 1988, the assets of General Portland Inc. were legally merged into Lafarge Corporation. An application to change the legal name of the owner/operator from General Portland Inc. to Lafarge Corporation was also filed on January 29, 1988. All of the Lafarge properties and assets associated with hazardous waste storage activities and responsibilities were transferred to Systech Environmental Corporation on November 9, 1992. Lafarge remains the Parent Company of Systech Environmental Corporation. In this request for a permit renewal, Systech Environmental Corporation is named as the owner and operator of the existing waste management facility.

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Systech Environmental Corporation

Paulding Systech Facility

USEPA ID No.: OHD 005048947
Ohio Permit No.: 03-63-0595**1.4 Certification**

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."



David Cheney
President
Systech Environmental Corporation

Signed this 21th day of JANUARY, 2013

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Systech Environmental Corporation

USEPA ID No.: OHD005048947

Ohio Permit No.: 03-63-0595

SECTION II FACILITY DESCRIPTION

2.1 Introduction

The purpose of this section of the application is to provide general information about Systech Environmental Corporation. A general description of the facility is required by 40 CFR §270.14(b)(1) and Rule 3745-50-44(A)(1) of the Ohio Administrative Code. Other general information about the facility is required as follows:

Location Information	§270.14(b)(11) and 3745-50-44(A)(11);
Topographic Maps	§270.14(b)(19) and 3745-50-44(A)(19);
Traffic Information	§270.14(b)(10) and 3745-50-44(A)(10).

2.2 General Facility Description

Systech Environmental Corporation is an existing, off-site, hazardous waste management facility. The facility's primary components are the analytical laboratory, the storage and processing tank systems, and the container storage and processing areas. Waste materials are analyzed, unloaded, temporarily stored, and then processed so that they can be safely used in the manufacture of Portland cement. Figure 2.1 illustrates the material flow through the waste management facility and how those streams are introduced into the cement manufacturing process and the cement kiln.

2.2.1 Waste Types and Quantities

Table 2.1 provides a brief overview of the general types of waste materials which will be used in the manufacture of Portland cement. This table also illustrates the maximum amount of each waste type which may be in storage at any one time.

Table 2.1		
Waste Types and Quantities		
	Types of Wastes Managed	Maximum in
Storage	<u>Tank Storage Systems</u>	
	Organic Liquids (OL)	910,000 gallons
	<u>Container Storage Facilities</u>	
	Organic Liquids, Solids, and Sludges	228,000 gallons

In 1995, Systech obtained a permit modification from the Hazardous Waste Facility Board that increased the maximum annual throughput for Systech to 138,150 metric tons per

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year. This authorization to increase throughput, coupled with Lafarge's authorization to increase fuel substitution to 100% necessitated the need for additional storage capacity.

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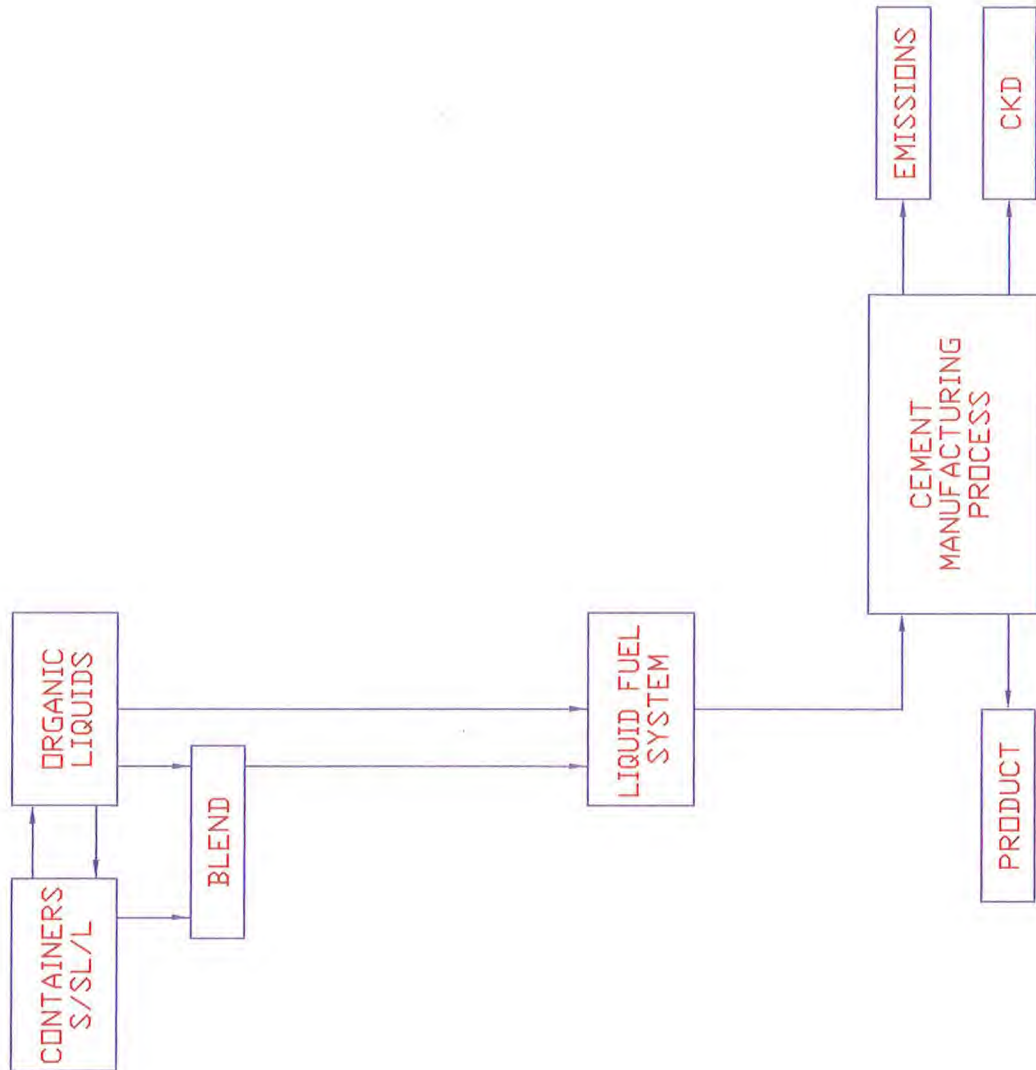
ORGANIC

FIGURE NO. 2.1
PROCESS FLOW SCHEMATIC
6/12/96 REVISION 1 11-06P01

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2.2.2 Organic Wastes Used As Fuels

Approximately 2.6 trillion Btus per year are required to heat large volumes of limestone to the high temperatures required by the cement manufacturing process. In this process, liquid, solid and semi-solid organic waste materials are used as fuel supplements. The ignitable or toxic characteristics which make these wastes hazardous are completely destroyed in the high-temperature combustion zone of the industrial furnace. Extensive testing, by the United States Environmental Protection Agency (USEPA) and others, clearly indicates that cement kilns are one of the most effective thermal destruction mechanisms available for these organic wastes.

2.3 Facility Location Information

The facility is located on land owned by Systech and is adjacent to the Paulding Cement Plant. It is three miles north of Paulding, on County Road 176, in Crane Township, Paulding County, Ohio.

The mailing address is:

Systech Environmental Corporation

P.O. Box 266

Paulding, Ohio 45879

2.6 Appendix 1 contains the legal property descriptions and maps of the facility.

2.4 Topographic Maps

In order to adequately illustrate the numerous items of information required by 40 CFR §270.14(b)(19) and Rule 3745-50-44(A)(19), two topographic maps of different scales and a separate wind rose have been prepared. The topographic maps are in 2.6 Appendix 2.

2.4.1 Paulding Quadrangle Map

Figure 2.2, the Paulding Quadrangle Map was prepared by the United States Geological Society (USGS) in 1960 (photo revised in 1973 and again in 1977). The facility is in the western half of Sector 26 between the long kiln building and the pipelines. The rail spurs provide good reference points.

The Paulding Quadrangle map has a scale of 1" = 2000' and a contour interval of 5 feet. This map best illustrates the surrounding area and the proximity to Bull Creek in sector 23, the nearest area affected by 100-year floods. This map also indicates the proximity of other surface waters, including intermittent streams and drainage ditches. Agriculture is the predominant land use for several miles in any direction.

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2.4.1.1 Flood Plain Standards

No part of the facility is located within the 100-year flood plain. Thus, there is an extremely low probability of an uncontrolled release of waste materials due to a major flood. The requirements of 40 CFR §264.18(b) and Ohio Administrative Code (OAC) 3745-54-18(B) therefore do not apply.

In 1983 E.C. Gerken & Associates, consulting engineers and surveyors, of Defiance, Ohio, identified the area nearest the facility which might be affected by a 100-year flood. They used the procedures of Bulletin No. 45, "Floods in Ohio--Magnitude and Frequency," published by the Ohio Department of Natural Resources. The results indicate that the 100-year flood level for Bull Creek, approximately 1 mile north of the facility, is 719 feet above sea level. The elevation at the facility is nominally 727 feet above sea level. This study can be found in 2.6 Appendix 3.

The USGS Paulding Quadrangle Map illustrates that the area of Bull Creek affected by a 719-foot flood is logically confined to the area within the 720-foot contour lines in the southern part of sectors 22 and 23.

2.4.1.2 Seismic Standards

Ohio is not listed in Part 264, Appendix VI. Therefore, the special regulatory requirements of 40 CFR §264.18(a) and OAC 3745-54-18(A) for locations subject to seismic disturbances are not applicable.

2.4.2 Detailed Topographic Map

Figure 2.3, a more detailed topographic map was specifically prepared for this application; its scale is 1" = 50'. This map best illustrates the boundaries and the details of the area within 1000 feet around the facility, including a well and the septic system. It also shows the access roads, security fence and gate, buildings, tanks, and unloading areas. Fire control facilities are described in the Contingency Plan.

2.4.3 Wind Rose

Figure 2.4 is a wind rose derived from meteorological data collected at a Toledo area weather station. This figure presents a summary of typical wind speeds and directions for the Paulding County area.

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2.5 Facility Traffic Information

2.5.1 Traffic Patterns, Volume and Control

Trucks approach the facility on State Highway 127 and then go west one mile on County Road 176 to the plant entrance. These roads are both low volume, rural roadways, conveying predominantly local traffic. Figure 2.5 indicates access roads, traffic patterns, traffic signs, truck scales, and sampling and unloading areas. Facilities for weighing, sampling and unloading railcars are also indicated.

Trucks enter the facility at the west plant entrance and check in at the sampling area. Bulk shipments are then sampled and weighed; the trucks are sent to the staging area to await authorization to unload. After unloading at the designated area, tank trucks are returned to the scales for a tare weight and leave the facility by the route they entered.

Table 2.2 summarizes the number and type of waste transport vehicles expected to make deliveries each day. The volume of traffic is not sufficient to warrant the use of electronic signals.

Table 2.2			
Type and Number of Waste Transport Vehicles			
Type of Vehicle	Vehicle Capacity	Number/Day	Description of Waste
Bulk Tanker	6,000 gallons	25	Pumpable liquids/sludges
Container truck	5,000 gallons	6	Liquids/sludges/solids
Rail tanker	20,000 gallons	4	Bulk liquids or solids
Container railcar	10,000 gallons	1	Liquids/sludges/solids

2.5.2 Road Surfaces and Load-Bearing Capacity

Access and in-plant roads are surfaced with crushed stone or concrete. These roads were designed with a load-bearing capacity sufficient to support a 90,000-pound truckload of cement. The waste transport trucks have gross weights of less than 80,000 pounds and therefore will not exceed the load-bearing capacity of these roads.

The rail access to the Systech site is from the east. After entering the Systech property, the rail line divides into two parallel lines that run approximately 200 feet and then enter the rail car processing area. Rail cars are transported within the facility by Systech personnel.

The rail processing area was designed for live loads of Cooper E-72 for rail car only. This is the design for this type of rail car traffic.



**Systech
Environmental
Corporation**

Byproducts into Resources

December 18, 2017
Doc. #11-2017-12-1

OHIO ENVIRONMENTAL PROTECTION AGENCY
Craig Butler, Executive Director
P.O. Box 1049
Columbus, OH 43216-1049

Re. Systech Environmental Corporation (Lafarge North America to Geocycle LLC)
Holding Corporation Change
Systech Environmental Corporation: EPA ID # OHD005048947

Dear Mr. Thompson:

Systech Environmental Corporation (Systech) is currently a wholly owned subsidiary of Lafarge North America. Due to the 2015 merger of Lafarge and Holcim Systech's corporate holding entity will be changing to Geocycle LLC (See attached Memorandum of Agreement) effective December 31, 2017.

Systech will continue to be a wholly owned corporation with a Chief Operating Officer (COO) and board of directors. Systech does not anticipate any significant permit changes. If the agency is amenable would like this mailing to suffice as formal notice. Systech does expect some minor text changes to permits/applications, simply replacing "Lafarge North America" or "Lafarge NA" with Geocycle LLC. Systech will replace text in applications when other modifications are necessary or at renewal intervals.

If you have any questions please contact me (620) 378-4451 ext. 102.

Sincerely,
SYSTECH ENVIRONMENTAL CORPORATION

A handwritten signature in black ink, appearing to read "Sean K. Rook".

Sean K. Rook, CHMM
Regulatory Affairs Manager

Enc. Memorandum of Agreement
Errata Sheet for permits

cc. via email
Andrea Smoktonowicz, Supervising Attorney
Kara Reynolds - NWDO
Paul Chad - NWDO





**Systech
Environmental
Corporation**

Byproducts into Resources

Errata Sheet

Effective December 31, 2017

For purposes of Systech Environmental Corporation permits and applications where
Lafarge North America,
Lafarge NA, or
Lafarge Midwest
is referred to as the corporate owner it should be replaced with Geocycle LLC.

As an example;

"Systech Environmental Corporation is a wholly owned subsidiary of Geocycle LLC".

Memorandum of Agreement

Between

LAFARGE NORTH AMERICA INC.

And

HOLCIM (US) INC.

And

GEOCYCLE LLC

This Memorandum of Agreement, effective this 31st day of October, 2017, is between Lafarge North America Inc., a Maryland corporation, Holcim (US) Inc., a Delaware corporation, and Geocycle LLC, a Michigan limited liability company. (collectively referenced as the "*Parties*") and is made with reference to the following:

Recitals:

- A. In 2015, Lafarge S.A., organized under the laws of France, and Holcim Ltd., organized under the laws of Switzerland, completed a transaction under which Lafarge S.A. was merged into Holcim Ltd. with the surviving entity renamed LafargeHolcim Ltd. As a result of the merger, Lafarge North America Inc. and Holcim Participation (US) Inc. are now related entities, both operating as direct or indirect subsidiaries of LafargeHolcim Ltd.;
- B. Management of each of the Parties has determined that, in light of the merger of Lafarge S.A. and Holcim Ltd., certain reorganizations and realignments of business assets and their subsidiary companies in the United States is necessary and appropriate for the efficient conduct of their collective business, and the Parties have agreed to a plan of reorganization (the "Plan") to be effective December 31, 2017;
- C. Under the Plan, the Parties have agreed that the shares of Systech Environmental Corporation, a Delaware corporation and a wholly owned subsidiary of Lafarge North America Inc. will be transferred to Geocycle LLC, a subsidiary of Holcim (US) Inc., as of December 31, 2017;

NOW, THEREFORE the Parties are agreed as follows:

- 1. The Parties shall cooperate in the submittal of all applications and any supporting information and in the taking of any other action as may be necessary or required by federal, state or local authorities to relative to any and all permits and licenses held by Systech Environmental Corporation by reason of the change of its ownership under the Plan.
- 2. Implementation of the Plan shall not affect Systech Environmental Corporation's responsibly for compliance with any of its permits and licenses and it shall remain responsible for any and all recordkeeping and reporting obligations under any such permits or licenses. To the extent that the change of ownership of the shares of Systech Environmental Corporation affects any bonding or other financial assurance

requirements for any facility owned or operated by Systech Environmental Corporation, Geocycle LLC and Holcim (US) Inc. shall promptly take all necessary actions to provide such bonding or financial assurance and to relieve Lafarge North America Inc. of any such bonding or financial assurance obligations.

3. This Memorandum of Agreement is executed by the Parties for the purpose of documenting under applicable law the change in ownership of Systech Environmental Corporation in support of any application to transfer, amend or modify any permits or licenses relating to any affected facilities. Accordingly, by executing this Memorandum of Agreement, Lafarge North America Inc. consents to any transfer, amendment or modification of any permit or license to reflect the change in ownership effective December 31, 2017 and to the submittal of a copy of the Memorandum of Agreement to evidence its agreement to transfer ownership.

IN WITNESS WHEREOF, the Parties hereto have caused this Memorandum of Agreement to be duly executed by their respective authorized representatives as of the day and year first above written.

LAFARGE NORTH AMERICA INC.

By: Jodie Earle
Name: Jodie Earle
Title: Assistant Secretary

HOLCIM (US) INC.

By: Brian Smith
Name: Brian M. Smith
Title: Asst. Secretary

GEOCYCLE LLC

By: Lisa Olsen
Name: Lisa Olsen
Title: Secretary

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Systech Environmental Corporation

USEPA ID No.: OHD005048947
Ohio Permit No.: 03-63-0595

2.6 Appendix 1

Property Descriptions

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RUDOLPH H. BASSELMAN
Engineering & Surveying
1108 South Defiance Street
ARCHBOLD, OHIO 43502

Description of Land for
LaFarge Corporation
SW $\frac{1}{4}$, Sec. 26, T-3-N, R-2-E,
Crane Township, Paulding Co., Ohio.
Parcel No. 1.

A parcel of land situated in the Southwest Quarter ($\frac{1}{4}$) of Section 26, T-3-N, R-2-E, Crane Township, Paulding County, Ohio, and is more particularly described as follows:

Commencing at an iron pin marking the Southwest corner of said Section 26; thence S $89^{\circ}-48'-05''$ E along the South line of said Section 26 a distance of 1213.22 feet to a PK Nail; thence N $33^{\circ}-47'-20''$ E a distance of 248.84 feet to an iron pin and the TRUE PLACE OF BEGINNING; thence N $32^{\circ}-56'-10''$ W a distance of 392.32 feet to an iron pin; thence N $46^{\circ}-23'-50''$ E a distance of 746.53 feet to an iron pin; thence S $34^{\circ}-53'-10''$ E a distance of 349.68 feet to an iron pin; thence N $55^{\circ}-06'-50''$ E a distance of 117.74 feet to a "+" chiseled in concrete; thence S $34^{\circ}-53'-10''$ E a distance of 191.82 feet to a "+" chiseled in concrete; thence S $55^{\circ}-10'-45''$ W a distance of 255.73 feet to a "+" chiseled in concrete; thence S $34^{\circ}-49'-15''$ E a distance of 10.79 feet to a point; thence S $55^{\circ}-10'-45''$ W a distance of 350.91 feet to a "+" chiseled in concrete; thence N $34^{\circ}-49'-15''$ W a distance of 37.44 feet to a "+" chiseled in concrete; thence S $57^{\circ}-03'-50''$ W a distance of 262.54 feet to an iron pin and the PLACE OF BEGINNING.

Containing 8.695 acres of land more or less but subject to all easements and restrictions public or private.

Description prepared by,

Rudolph H. Basselman
Rudolph H. Basselman, PS 6379
June 15, 1988

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RUDOLPH H. BASSELMAN
Engineering & Surveying
1108 South Defiance Street
ARCHBOLD, OHIO 43502

Description of Land for
LaFarge Corporation
SW $\frac{1}{4}$, Sec. 26, T-3-N, R-2-E,
Crane Township, Paulding Co., Ohio.
Parcel No. 3.

A parcel of land situated in the Southwest Quarter ($\frac{1}{4}$) of Section 26, T-3-N, R-2-E, Crane Township, Paulding County, Ohio, and is more particularly described as follows:

Commencing at an iron pin marking the Southwest corner of said Section 26; thence S $89^{\circ}-48'-05''$ E along the South line of said Section 26 a distance of 1213.22 feet to a PK Nail; thence N $33^{\circ}-47'-20''$ E a distance of 248.84 feet to an iron pin; thence N $32^{\circ}-56'-10''$ W a distance of 392.32 feet to an iron pin; thence N $46^{\circ}-23'-50''$ E a distance of 221.06 feet to an iron pin and the TRUE PLACE OF BEGINNING; thence N $4^{\circ}-03'-50''$ W a distance of 80.00 feet to an iron pin; thence N $13^{\circ}-24'-05''$ W a distance of 432.21 feet to a point; thence N $76^{\circ}-35'-55''$ E a distance of 315.44 feet to a point; thence S $13^{\circ}-24'-05''$ E a distance of 320.00 feet to an iron pin; thence S $46^{\circ}-23'-50''$ W a distance of 380.00 feet to an iron pin and the PLACE OF BEGINNING.

Containing 2.993 acres of land more or less but subject to all easements and restrictions public or private.

Description prepared by,

Rudolph H. Basselman
Rudolph H. Basselman, PS 6379
June 15, 1988

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RUDOLPH H. BASSELMAN
Engineering & Surveying
1108 South Defiance Street
ARCHBOLD, OHIO 43502


Description of Land for
LaFarge Corporation
SW $\frac{1}{4}$, Sec. 26, T-3-N, R-2-E,
Crane Township, Paulding Co., Ohio.
Parcel No. 4.

A parcel of land situated in the Southwest Quarter ($\frac{1}{4}$) of Section 26, T-3-N, R-2-E, Crane Township, Paulding County, Ohio, and is more particularly described as follows:

Commencing at an iron pin marking the Southwest corner of said Section 26; thence S $89^{\circ}-48'-05''$ E along the South line of said Section 26 a distance of 2105.67 feet to a point; thence N $0^{\circ}-11'-55''$ E a distance of 850.18 feet to a "+" chiseled in concrete and the TRUE PLACE OF BEGINNING; thence S $55^{\circ}-06'-50''$ W a distance of 93.00 feet to an iron pin; thence N $34^{\circ}-53'-10''$ W a distance of 40.00 feet to a "+" chiseled in concrete; thence N $55^{\circ}-06'-50''$ E a distance of 93.00 feet to a "+" chiseled in concrete; thence S $34^{\circ}-53'-10''$ E a distance of 40.00 feet to a "+" chiseled in concrete and the PLACE OF BEGINNING.

Containing 0.085 acres of land more or less but subject to all easements and restrictions public and private.

Description prepared by,


Rudolph H. Basselman, PS 6379
June 15, 1988

AUG 13 2014

Systech Environmental Corporation

USEPA ID No.: OHD005048947
Ohio Permit No.: 03-63-0595

The facility's legal property descriptions are as follows:

Description of Land (Parcel No. 1)

SW3, Sec. 26, T-3-N, R-2-E,
Crane Township, Paulding Co., Ohio.

~~Parcel No. 1~~

A parcel of land situated in the Southwest Quarter (1/43) of Section 26, T-3-N, R-2-E, Crane Township, Paulding County, Ohio, and is more particularly described as follows:

Commencing at an iron pin marking the Southwest corner of said Section 26; thence S 89°-48'-05" E, along the South line of said Section 26 a distance of 1213.22 feet to a PK Nail; thence N 33°-47'-20" E, a distance of 248.84 feet to an iron pin and the TRUE PLACE OF BEGINNING; thence N 32°-56'-10" W a distance of 392.32 feet to an iron pin; thence N 46°-23'-50" E a distance of 746.53 feet to an iron pin; thence S 34°-53'-10" E distance of 349.68 feet to an iron pin; thence N 55°-06'-50" E a distance of 117.74 feet to a "+" chiseled in concrete; thence S 34°-53'-10" E a distance of 191.82 feet to a "+" chiseled in concrete; then S 55°-10'-45" W a distance of 255.73 feet to a "+" chiseled in concrete; thence S 34°-49'-15" E a distance of 10.79 feet to a point; thence S 55°-10'-45" W a distance of 161.00350.91 feet to a point "+" ~~chiseled in concrete~~; thence N 34°-49'-15" W a distance of 5.1637.44 feet to a point "+" ~~chiseled in concrete~~; thence S 57°-1003'-4550" W, a distance of 262.5423.50 feet to a point an iron pin; ~~thence S 34°-49'-15" E, a distance of 5.16 feet to a point; thence S 55°-10'-45" W a distance of 166.41 feet to a "+" chiseled in concrete; thence N 34°-49'-15" W, a distance of 37.44 feet to a "+" chiseled in concrete; thence S 57°-3'50" W a distance of 262.54 feet to a point and the~~ PLACE OF BEGINNING.

Containing 8.6925 acres of land more or less but subject to all easements and restrictions public or private.

Description of Land (Parcel No. 3)

SW33, Sec. 26, T-3-N, R-2-E
Crane Township, Paulding Co., Ohio

~~Parcel No. 3~~

A parcel of land situated in the Southwest Quarter (1/43) of Section 26, T-3-N, R-2-E, Crane Township, Paulding County, Ohio, and is more particularly described as follows:

Commencing at an iron pin marking the Southwest corner of said Section 26; thence S 89°-48'-05" E along the South line of said Section 26 a distance of 1213.22 feet to a PK Nail; thence N 33°-47'-20" E a distance of 248.84 feet to a point an iron pin; thence N 32°-56'-10" W a distance of 392.32 feet to an iron pin; thence N 46°-23'-50" E a distance of 251.9521.06 feet to an iron pin and the TRUE PLACE OF BEGINNING; thence N 4°-03'-50" W a distance of

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Systech Environmental Corporation

USEPA ID No.: OHD005048947

Ohio Permit No.: 03-63-0595

~~75.2680.00~~ feet to a ~~pointn iron pin~~; thence N 13°-24'-05" W a distance of ~~260.59432.21~~ feet to an ~~iron pin-point~~; thence N ~~5176°-2835'-3555"~~ E a distance of 3195.7744 feet to an ~~iron pin-point~~; thence S 13°-24'-05" E a distance of ~~295.00320.00~~ feet to an iron pin; thence S 46°-23'-50" W a distance of ~~380359.11.00~~ feet to an iron pin; ~~thence S 33°-47'-20" W, 32.66 feet to a railroad spike~~ and the PLACE OF BEGINNING.

Containing 2.~~079993~~ acres of land more or less but subject to all easements and restrictions public and private.

Description of Land (Parcel No. 4)

SW~~33~~, Sec. 26, T-3-N, R-2-E

Crane Township, Paulding Co., Ohio

~~Parcel No. 4~~

A parcel of land situated in the Southwest Quarter (~~1/43~~) of Section 26, T-3-N, R-2-E, Crane Township, Paulding County, Ohio, and is more particularly described as follows:

Commencing at an iron pin marking the Southwest corner of said Section 26; thence S 89°-48'-05" E along the South line of said Section 26 a distance of 2105.67 feet to a point; thence N 0°-11'-~~2055~~" E a distance of 850.18 feet to a "+" chiseled in concrete and the TRUE PLACE OF BEGINNING; thence S 55°-06'-50" W a distance of 93.00 feet to an iron pin; thence N 34°-53'-10" W a distance of 40.00 feet to a "+" chiseled in concrete; thence N 55°-06'-50" E a distance of 93.00 feet to a "+" chiseled in concrete; thence S 34°-53'-10" E a distance of 40.00 feet to a "+" chiseled in concrete and the PLACE OF BEGINNING.

Containing 0.085 acres of land more or less but subject to all easements and restrictions public and private.

Description of Land

SW3, Sec. 26, T-3-N, R-2-E

Crane Township, Paulding Co., Ohio

A parcel of land situated in the Southwest Quarter (1/4) of Section 26, T-3-N, R-2-E, Crane Township, Paulding County, Ohio, and is more particularly described as follows:

Commencing at an iron pin marking the Southwest corner of said Section 26; thence S 89°-49'-05" E along the South line of said Section 26 a distance of 1213.22 feet to a PK nail; thence N 33°-47'-20" E a distance of 216.18 feet to a railroad spike and the TRUE PLACE OF BEGINNING; thence N 32°-56'-10" W a distance of 399.57 feet to an iron pin; thence N 46°-23'-50" E a distance of 30.53 feet to an iron pin; thence S 32°-56'-10" E a distance of 392.32 feet to an iron pin; thence S 33°-47'-20" W a distance of 32.66 feet to a railroad spike and the PLACE OF BEGINNING.

February 2013
Revision 1-June 2013

FACILITY DESCRIPTION

Section II, Page 9

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AUG 13 2014

Systech Environmental Corporation

USEPA ID No.: OHD005048947

Ohio Permit No.: 03-63-0595

Containing 0.273 acres of land more or less but subject to all easements and restrictions
public and private.

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Systech Environmental Corporation

USEPA ID No.: OHD005048947
Ohio Permit No.: 03-63-0595

2.6 Appendix 2

Figures

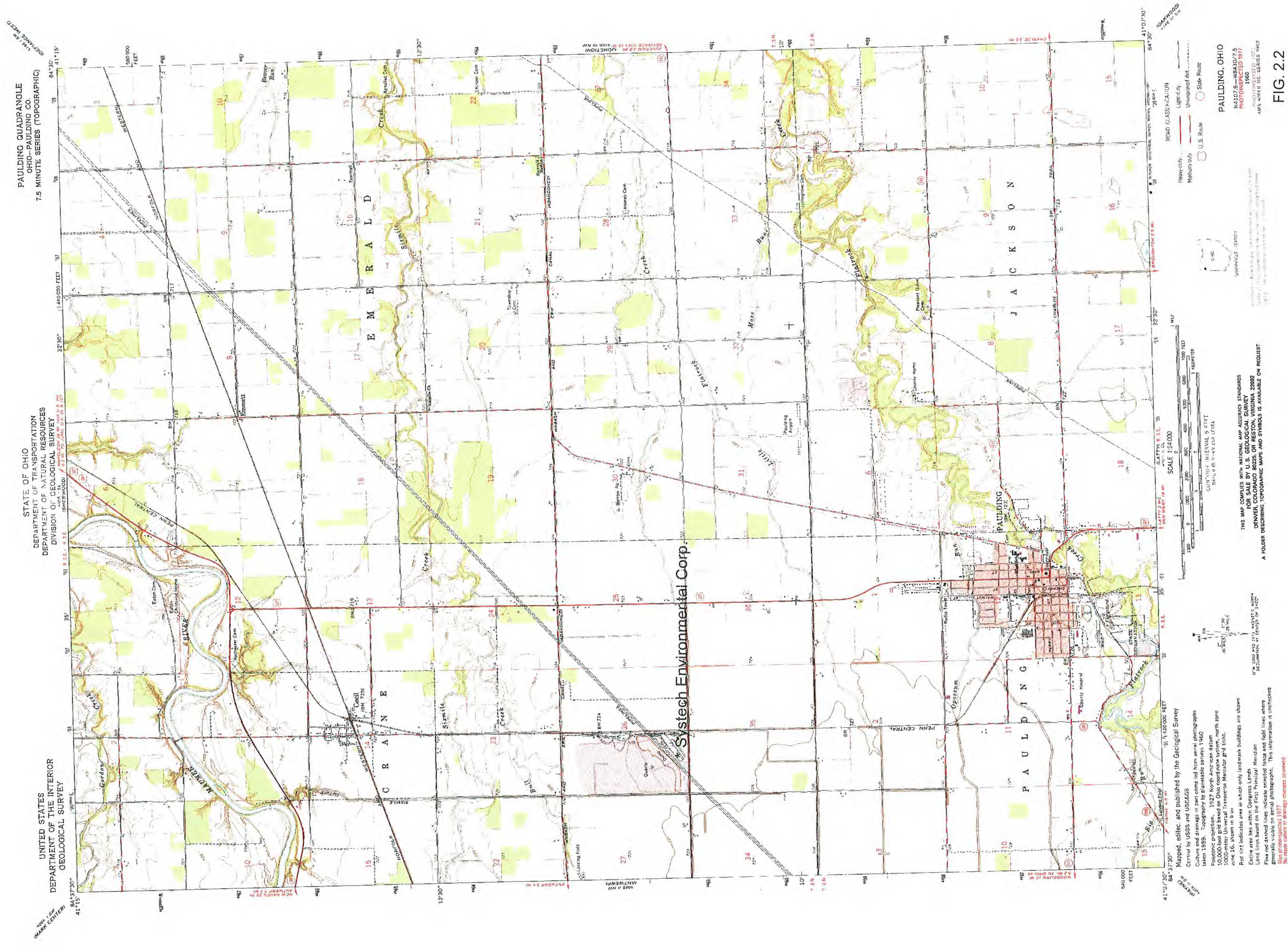


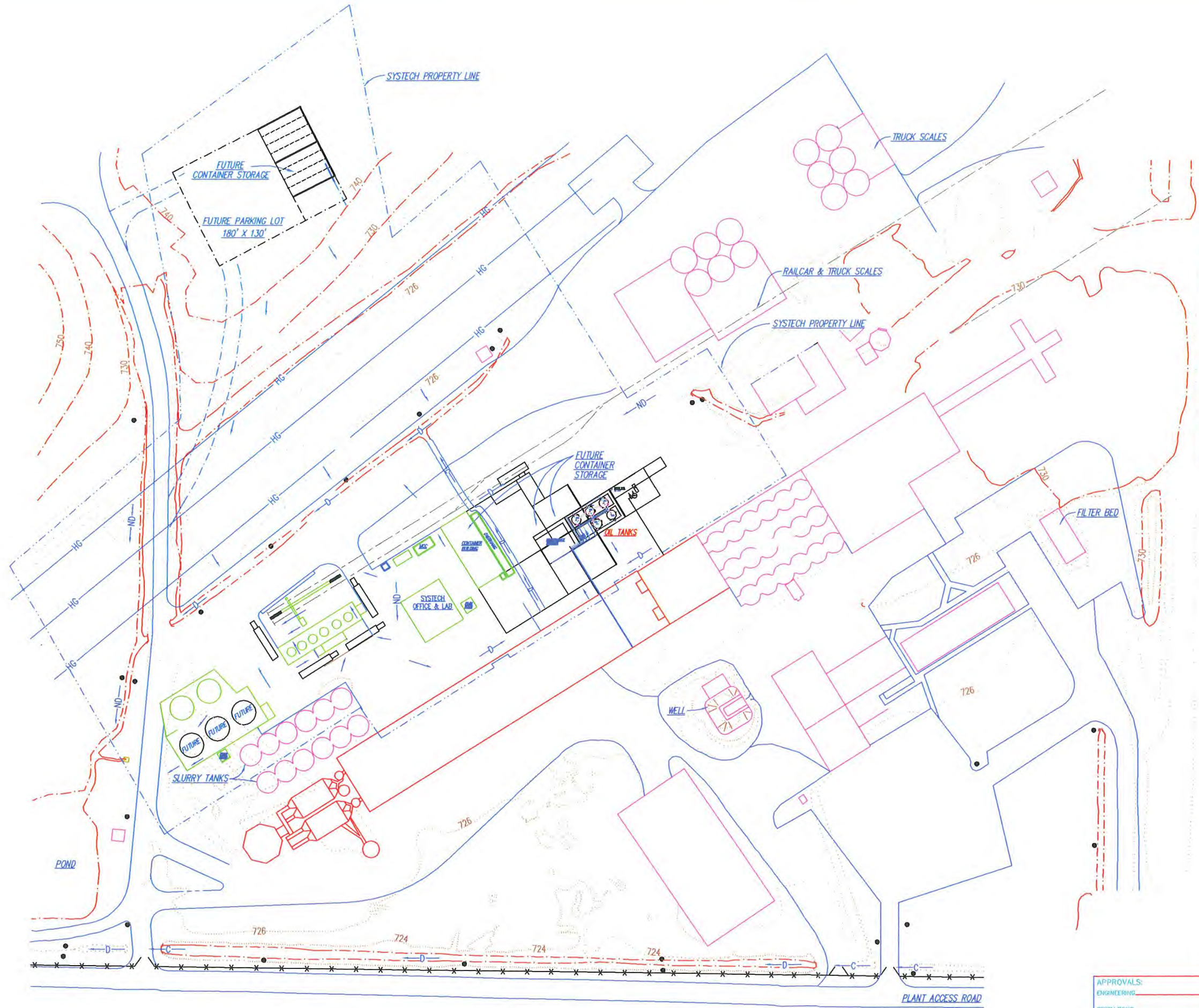
FIG. 2.2

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LEGEND	
---	PROPERTY LINE
---	GRAVEL
---	APPROVED CAPITAL
---	TANK FARM
---	CONTAINER PROCESSING
---	DRY WASTE FUELS
---	PYROLYZER
---	NATURAL DRAINAGE
---	STORM CULVERT
---	STORM DITCH
---	CITY WATER SUPPLY
---	PROCESS WATER SUPPLY
---	FENCE
---	POWER POLE



SYMB	DATE	BY	DESCRIPTION
10/18/12	DLD	REVISED FOR PERMIT	
9/7/03	NW	ADDED DIRECT BURN AND CONTAINER STORAGE	
8/12/02	NW	REVISED FOR PERMIT	
7/6/97	JW	RELEASED FOR PERMIT	
6/12/96	BS	RELEASED	
5/7/96	BS	RELEASED	
4/6/93	DK	ADDED TRUCK HEE REMOVAL SYSTEM	
3/4/93	DK	MINOR REVISION PER G.H.	
2/13/92	DK	MODIFIED ROAD LOCATION	
1/11/92	TC	MODIFIED PER PROPERTY LINE CHANGE FOR PART B	

CHANGES			
DRWN BY:	T. CABRAL	DATE:	10/16/91
CHKD BY:		DATE:	

APPROVALS:	
ENGINEERING	
OPERATIONS	
SAFETY	
Unless Otherwise Specified, all units are in feet and inches (1/2" = 1')	
Tolerances are: Feet / Inches	
Feet	1/8" inches
Feet-Inch	1/2 inch
Fraction	1/4 inch
Angles	10.0'

FIGURE NO. 2.3
PAULDING WASTE MANAGEMENT
DETAILED TOPOGRAPHIC MAP
ENVIRONMENT AND ENERGY
SYSTECH ENVIRONMENTAL CORPORATION
3085 WOODMAN DRIVE DAYTON, OHIO 45420 937/643-1240

SCALE: 1"=60'-0"

SHEET OF: 11-06G01

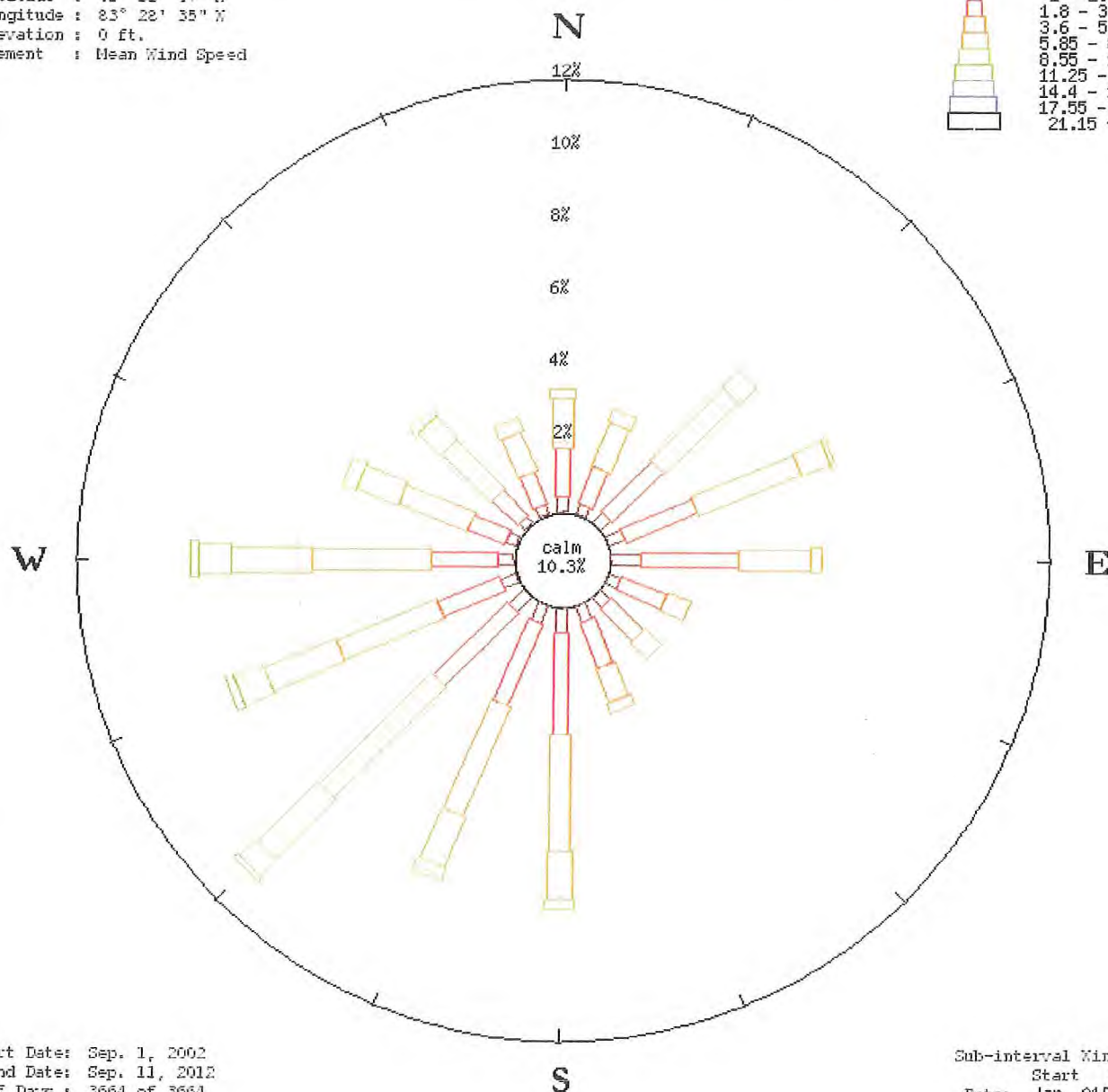
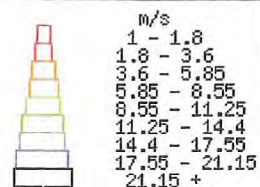
DWG. NO. 11-06G01

REV. NO. 10



AUG 13 2014

Station : TOLEDO OH
 Latitude : 41° 33' 47" N
 Longitude : 83° 22' 35" W
 Elevation : 0 ft.
 Element : Mean Wind Speed



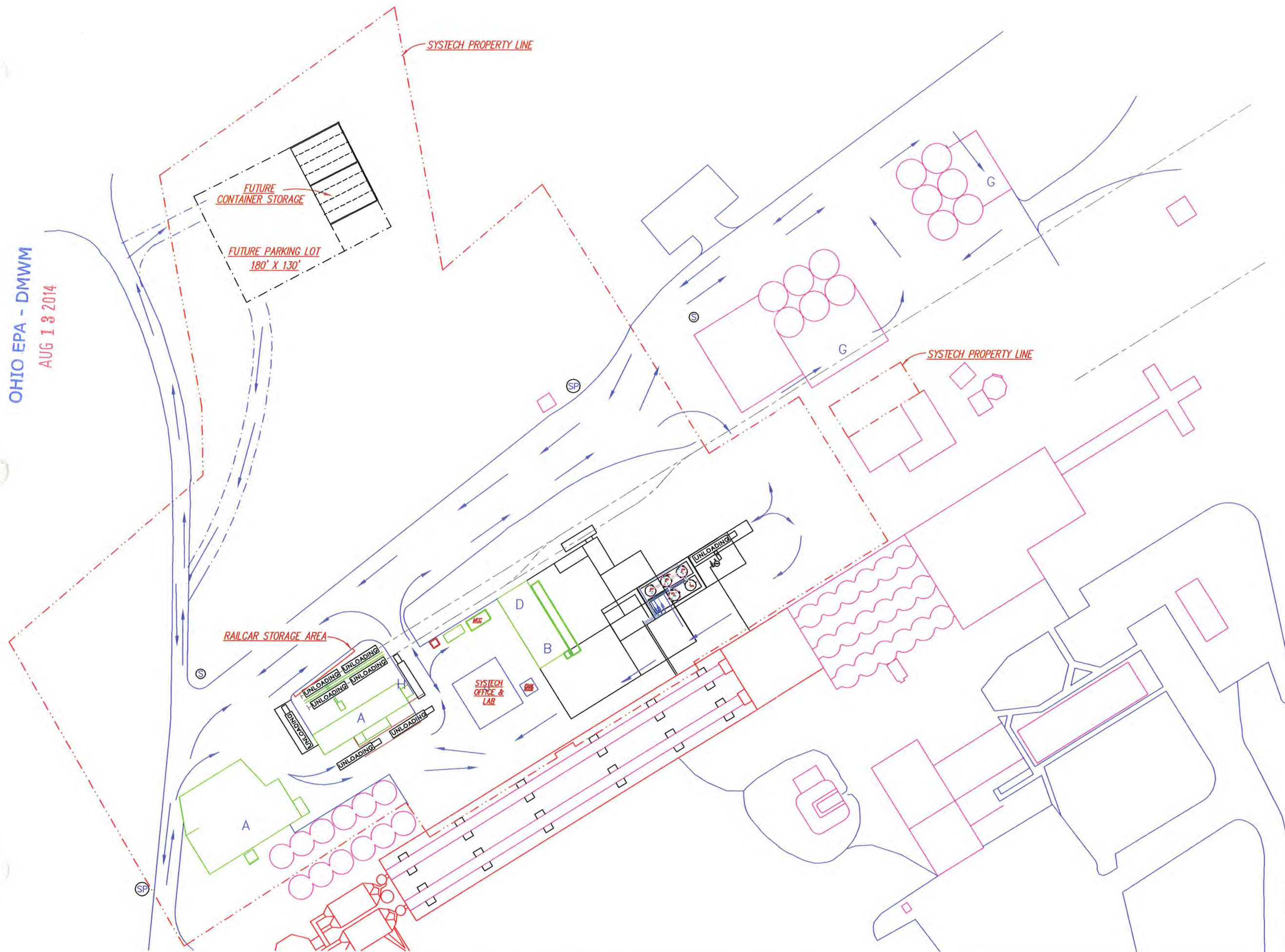
Start Date: Sep. 1, 2002
 End Date: Sep. 11, 2012
 # of Days : 3664 of 3664
 # obs:poss: 80148 of 87936
 © Western Regional Climate Center

Sub-interval Windows
 Start End
 Date: Jan. 01 Dec. 31
 Hour: 00 23

Figure 2.4

00022

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LEGEND	
A	ORGANIC STORAGE TANKS
B	ORGANIC CONTAINER STORAGE
D	ORGANIC CONTAINER PROCESSING
G	SCALE
H	SAMPLING AREA
J	LABORATORY & OFFICES
⊙	STOP SIGNS
⊙ SP	10MPH SPEED SIGNS
UNLOADING	TRUCK UNLOADING AREA
UNLOADING	RAIL UNLOADING AREA

FIGURE NO. 2.5
TRAFFIC PATTERNS

REVISION 4 RELEASED 12/96 11-06G05
 REVISION 5 RELEASED FOR PERMIT 6/97
 REVISION 6 ADDED DIRECT BURN AND
 CONTAINER STORAGE 7/03
 REVISION 7 REVISED FOR PERMIT 4/18/12
 REVISION 8 REVISED FOR PERMIT 1/15/13

Systech Environmental Corporation

USEPA ID No.: OHD005048947
Ohio Permit No.: 03-63-0595

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2.6 Appendix 3

E.C. GERKEN & ASSOCIATES, INC.

CONSULTING ENGINEERS & SURVEYORS
1933 E. Second Street, Defiance, Ohio 43512

419-784-0332

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AUG 13 2014

S.F.
Paulding

July 18, 1983

Dr. John Chadbourne
Director of Environmental Affairs
General Portland, Inc.
P.O. Box 324
Dallas, Texas 75221

Re: General Portland
100 Year Flood

Dear Mr. Chadbourne:

As per your request of July 1, 1983 we are providing a brief outline of our flood study. The report includes a brief description of the procedure used in the analysis to determine the hydraulic grade line for a 100 year storm frequency.

100 YEAR FLOOD

In accord with the procedure of Bulletin No. 45 "Floods in Ohio - Magnitude and Frequency" published by the Ohio Department of Natural Resources the 100 Year Flood level for this area adjacent to Bull Creek upstream (West) of the Township Road 105 culvert is 719.0.

BACKGROUND

Bull Creek, the subject watershed, discharges into Six Mile Creek which in turn discharges into the Auglaize River. The computation method used for this report is as outlined in the State of Ohio Department of Natural Resources Division of Water "Floods in Ohio - Magnitude and Frequency", Bulletin No. 45 published May 1977. This bulletin was provided to engineers and planners summarizing the latest hydraulic information for the design of hydraulic structures and to be used in the preparation of flood plain and flood insurance studies. Therefore the accuracy of our study is based on the accuracy and limitations of the methodology used in Bulletin No. 45.

OBSTRUCTIONS

Any foreign objects obstructing the water flow-way through the culvert crossing of Township Road 105 or downstream of that point in Six Mile Creek could cause an artifical 100 year or 150 year flood.

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OVERFLOW

Also bearing an influence on this drainage area is an excavated ditch known as Six Mile Cut-Off. The Six Mile Cut-Off is a ditch which was constructed to provide drainage relief to Six Mile Creek. Six Mile Creek is the outlet for Bull Creek and the Bull Creek branch extending to the General Portland Cement plant. The Six Mile Cut-Off discharges directly into the Maumee River.

FLOWS

The culvert under Township Road 105 in the center of Section 23, Crane Township, Paulding County has an end area opening on the upstream (West) side of 50 square feet. The flow line of the culvert is 708.98, the inside top of the opening is 715.84 and the centerline of the road at the culvert is 718.14.

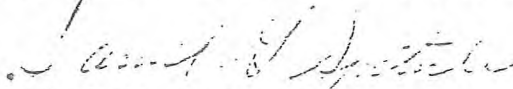
The dry stream flow is approximately 18 inches wide and 4 inches in depth. The channel of Bull Creek is 6 feet wide at the bottom and between top of banks 32 feet. The depth of the creek is 5.3 feet. When the water rises to 714.7 the water would overflow the creek's banks. The water would then continue to build up in the water way to an elevation of 718.14 at which elevation the water would top Township Road 105 and rising to 719.00 which has been determined to be the 100 Year Flood elevation by Bulletin No. 45.

Enclosed herein are copies of data used in preparation of this flood elevation. Exhibit No. 1 is the west end of the culvert under Township Road 105 which is the inlet (upstream) side of the culvert pipe. Exhibit No. 2 is the outlet (downstream) side of the culvert pipe under Township Road 105. Exhibit No. 3 is an upstream cross-section west of Township Road 105. Exhibit No. 4 is a downstream cross-section of Bull Creek east of Township Road 105. Exhibit No. 5 is a USGS map showing the location of Bull Creek, Township Road 105 and the General Portland Cement Plant.

If you have any questions or we can be of any further assistance, please advise.

Sincerely yours,


Eugene C. Gerken, P.E., P.S.


Daniel G. Spitnale

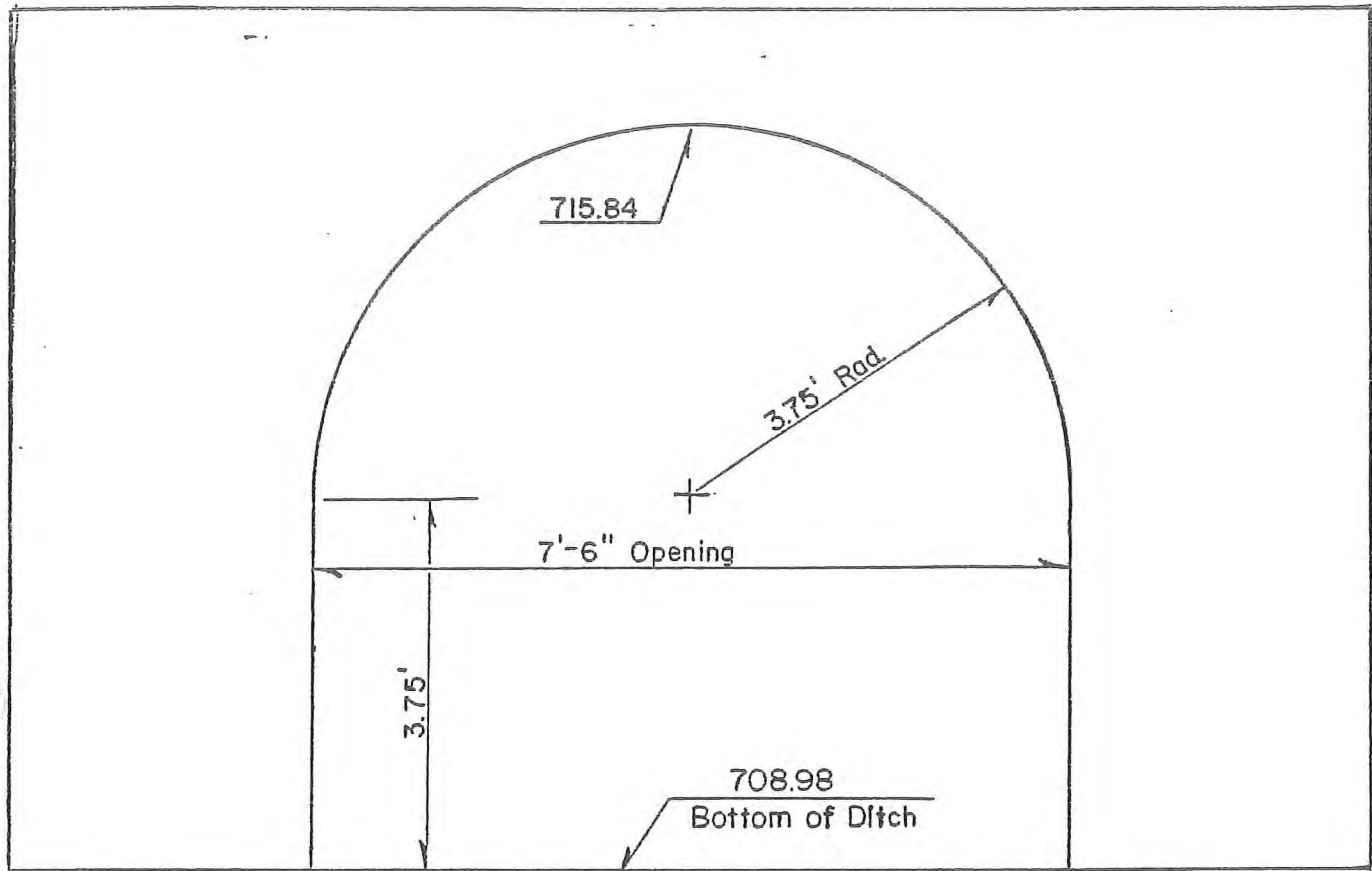
ECG:DGS:es
Enclosures

cc026

718.14 ϕ
Of Twp. Rd. 105

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WEST END OF CULVERT UNDER TOWNSHIP ROAD 105
THIS IS THE INLET SIDE
(UP STREAM)

100 Year Flood Level Study

General Portland, Inc.
Paulding, Ohio Plant

July 1983

EXHIBIT #1 00027

717.61 Top of Headwall

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715.49

East End of Culvert Opening
7'-6" x 7'-6"

There is approximately 12" of
earth sediment in the bottom.

708.54

Bottom of Box Culvert

EAST END OF CULVERT UNDER TOWNSHIP ROAD 105
THIS IS THE OUTLET SIDE
(DOWNSTREAM)

100 Year Flood Level Study

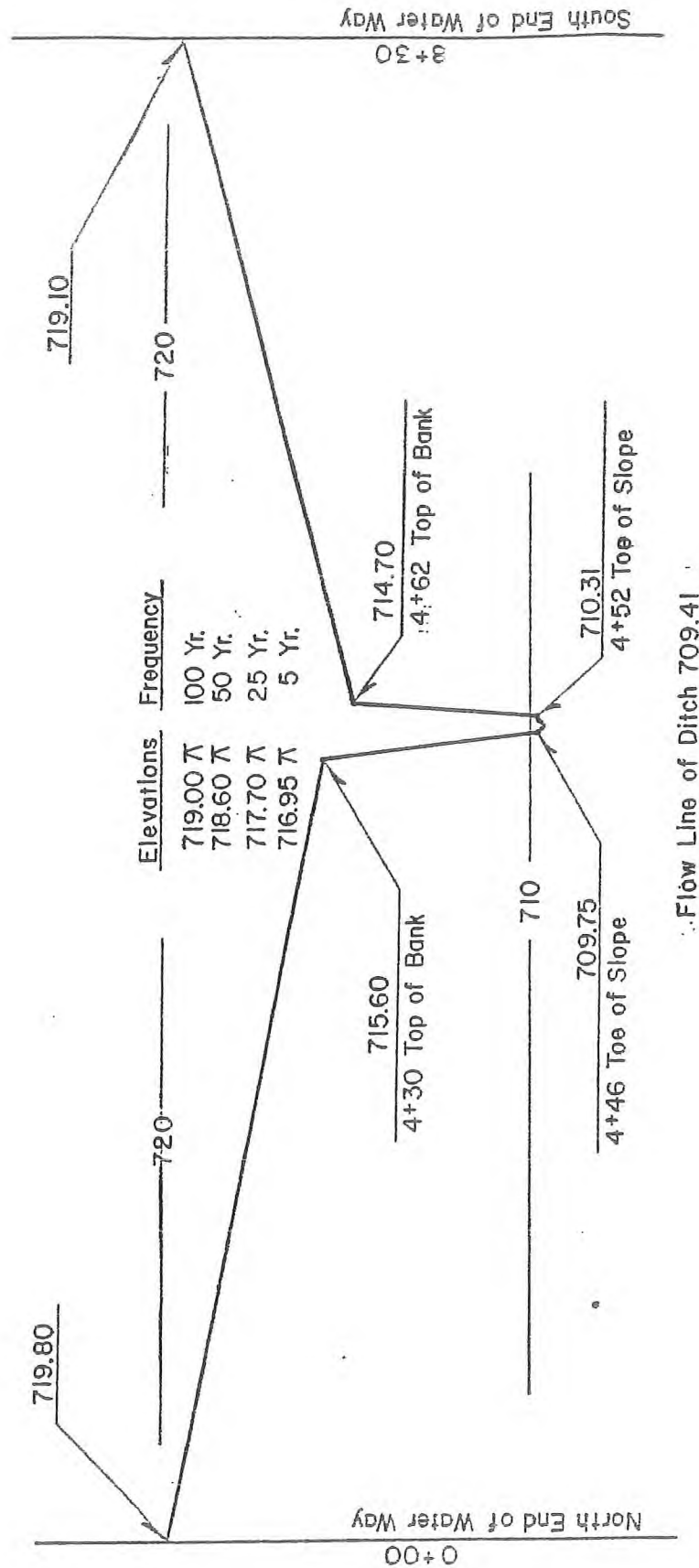
General Portland, Inc.
Paulding, Ohio Plant

00028

July 1983

EXHIBIT #2

AUG 13 2014



UPSTREAM OF THE WEST HEADWALL

SCALES:

1" = 100' HORIZONTAL
 1" = 5' VERTICAL

100 Year Flood Level Study

General Portland, Inc.
 Paulding, Ohio Plant

00029

EXHIBIT #3

July 1983

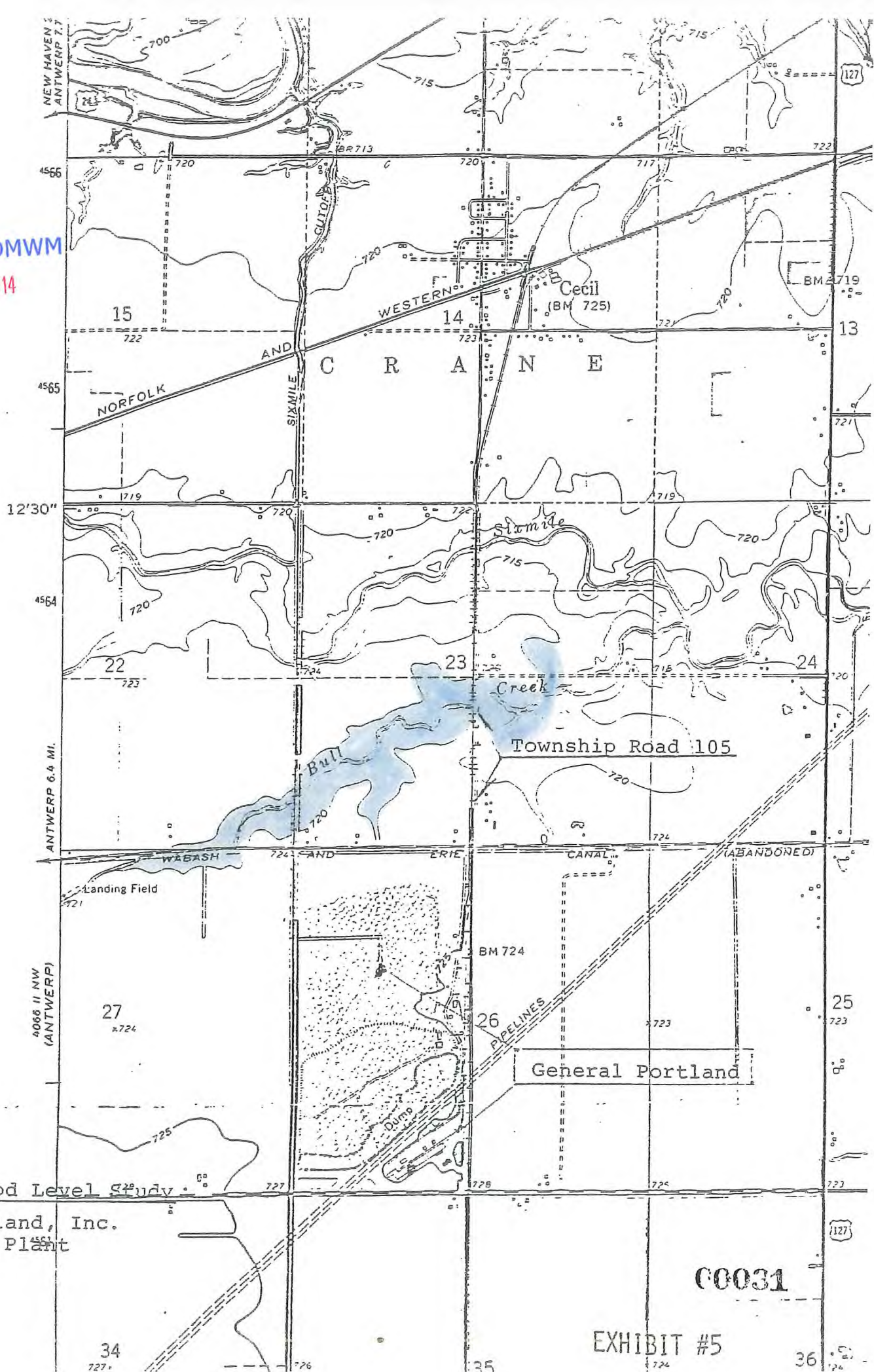


1" = 60' HORIZONTAL
1" = 5' VERTICAL

July 1983

OHIO EPA - DMWM

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100 Year Flood Level Study

General Portland, Inc.
a.s. Lang, OH Plant

00031

July 1983

EXHIBIT #5

AUG 13 2014

SECTION III

WASTE ANALYSIS PLAN

3.1 Introduction

The purpose of this section, the Waste Analysis Plan, is to outline the manner in which a detailed chemical and physical analysis of the hazardous waste materials will be obtained. Waste analysis is essential, as set forth in OAC 3745-54-13 and 40 CFR §264.13, to provide all the information needed to blend, store, and dispose of the waste in accordance with applicable regulations and permit conditions.

The waste management capabilities at this facility require the need to accurately identify and assess important physical characteristics and chemical constituents or constituent levels of the various waste streams. Certain critical parameters define the storage and handling requirements or restrictions for each waste stream received. In some cases such parameters define the basis for acceptance or rejection of a candidate waste stream; this is the case with TSCA regulated PCBs, which are always rejected. In nearly every case these parameters define the appropriateness for the waste to be used as a fuel, and identify potential incompatibilities with wastes already in storage.

The following discussions describe how the Waste Analysis Plan is designed to identify and evaluate the important physical and chemical parameters which are critical to selecting and controlling the appropriate waste management processes. These parameters will guide the decision-making which controls the movement of materials through the various receiving, storage, blending, and use options available at the facility.

Systech will review and maintain, for a period of 5 years, all land disposal restriction notifications and certifications for all hazardous waste to be stored and treated on-site. Systech will follow all land disposal restriction regulations for hazardous wastes produced on-site.

3.2 Types of Waste Handled

The hazardous wastes accepted for handling and use at this facility are organic wastes, which are suitable for blending into usable fuels. All waste materials received are blended to the degree necessary so that they become compatible with the requirements of the cement-manufacturing process.

Off-site hazardous waste received at the facility must meet the following criteria:

1. They can be accepted in accordance with current environmental regulations or permit conditions.
2. They can be handled safely by trained facility employees using appropriate personal protective devices and health and safety procedures.

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3. They can be used directly or blended to make a predictable quality cement kiln fuel by using the facility's standard operating procedures and equipment.

3.2.1 Excluded Waste Types

Candidate waste materials that are not safe or suitable for handling or use must be excluded from operations. The RCRA Waste Code list in the Part A application provides a listing of the EPA Waste ID Codes suitable for use at the proposed facility. Estimates of the annual quantities of each waste code to be handled are also provided. Those waste codes not included on this list will not be managed at the facility because they represent waste streams that are:

- a) known to contain or suspected of containing extremely toxic constituents which pose unacceptable risks to the health and well-being of employees,
- b) highly controversial waste materials such as regulated (TSCA) PCBs, FIFRA regulated pesticides, and dioxins, or
- c) in some other way assumed to pose significant or unwarranted risk to the personnel or the process.

3.3 General Description of Waste Materials

3.3.1 Organic Wastes

The organic wastes managed at the facility include liquids, sludges, and solids. Organic liquids wastes are typically composed of waste solvents from different industries. These wastes are often ignitable, depending on the type and level of organic constituents present, and may contain metals or organic contaminants. Organic wastes as received have adequate heat value for the production of cement clinker.

Organic sludges managed at the facility vary considerably in terms of physical and chemical properties. Organic sludges are obtained primarily from the paint and ink industries or as residues from the processing of raw materials, such as coal or oil, into commodity chemicals. These wastes can range from those containing considerable free liquid to those with essentially no free liquid at all. They may also be ignitable and contain metals or organic contaminants. Water and ash content of these wastes are also quite variable.

Organic solids managed at the facility are typically residuals from fuel or chemical production or certain select industrial waste products, such as granulated carbon, used tires, or other carbonaceous materials. They may range from powders or granules to large monolithic materials requiring size reduction prior to use, and they may be ignitable and contain metals or organic contaminants. Organic solids vary considerably in ash content and fuel value.

Even though Systech accepts organic wastes having adequate energy value, many

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of the wastes identified by the waste codes listed in Section 11 of this Part B Permit Application are either not organic in nature and/or do not have any fuel value. Systech is able to accept such codes in the wastes because of a regulatory artifact known as "waste code carry through". The concept of "waste code carry through" comes from the application of the "derived from" and mixture rules in OAC 3745-51 and 40 CFR 261(Subpart A). All solid wastes derived from, mixed with, or containing a listed hazardous waste retain the hazardous waste listing of the hazardous waste from which it was mixed, or with which it came into contact. The waste code(s) remains associated with the solid waste even if the listed hazardous waste constituents cannot be identified in the solid waste.

3.3.2 Organic Wastes Generated On-Site

Organic waste residuals may be generated on-site when organic sludges and debris are filtered from the liquid wastes or as a result of cleaning up minor spills which have been treated with absorbent materials. These intermediate residuals can usually be blended further by size reduction or by mixing with other waste streams so that there are no organic residuals for disposal off-site; however, storage and off-site disposal may be required in some instances.

Filter sludge is generated when debris is separated from delivered waste materials by screens and filters during the off-loading process. The incoming waste streams commonly contain small pieces of rubber gaskets, plastic bags, gloves, rags, broken glass, and other inert, gritty materials which have been shredded through a series of inline shredders (discussed in more detail in **Section IV**) as they pass through pumps during material transfers. This filterable fraction of the incoming waste stream (predominantly rubber gasket material) is segregated for special handling as a means of enhancing the reliability of the liquid waste injection systems. Particles trapped by the filters are thoroughly covered with wastes and are considered to have the same hazardous characteristics as the incoming waste materials.

Another type of organic-contaminated waste generated on-site is used absorbent material, most commonly kiln dust, which has been used in the clean-up of minor spills. These minor spills are very effectively controlled by immediately covering them with an ample quantity of absorbent kiln dust which is kept on hand specifically for this purpose. The hazardous nature of this clean-up material is considered to be the same as the original waste material.

3.4 Waste Analysis Plan

3.4.1 Waste Sampling and Analysis

Knowledge of the chemical and physical properties of the hazardous waste materials received or generated at this facility is essential. This knowledge ensures that the materials can be handled in compliance with all applicable regulatory requirements

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and with minimal risk to the health and safety of personnel and to the surrounding environment. Knowledge of the waste properties is also essential to ensure that the materials can be utilized effectively as fuels in the manufacture of Portland cement.

The Waste Analysis Plan described in this section is designed specifically to address these information requirements. The required information is derived from engineering knowledge of the waste generating process, from a generator questionnaire regarding the probable waste constituents, and from analyzing at least three separate samples. A detailed analysis of each candidate waste stream characterizes the waste; a sample of each incoming shipment of waste is analyzed to verify its identity. Also, one or more samples are analyzed during or after handling to verify effective treatment and suitability for use in the cement-manufacturing process.

3.4.1.1 Qualification of Waste Streams

Each source of waste considered for use will be qualified. Qualification will begin with the identification of generators of candidate waste material. Candidate generators are required to fill out a waste profile form and submit a sample to Systech for qualification prior to sending any waste shipments. A copy of the waste profile form is included in [3.7](#) Appendix [3-1](#).¹

This profile form asks the generator to answer questions about the waste, including the activity producing the waste, a listing of its constituents, and unacceptable compounds (such as dioxins, and regulated PCBs/pesticides) that may be present in the waste. If the generator notifies the facility that the waste contains any of these unacceptable compounds, the waste stream will not be accepted. The data submitted by the generator on this application will be used to assist in further analysis of the candidate waste stream to determine its suitability for use in cement manufacturing. This application will become part of the permanent record in the generator's file.

The qualification sampling at the generator site will be conducted either by a representative from Systech or by the generator. Qualification sampling may involve sampling from bulk tanks, barrel storage, waste piles, or lagoons. A summary of applicable sampling techniques, as indicated by OAC 3745-51-20(c)), Appendix I, and 40 CFR §261, Appendix I, is shown in Table 3.1. These techniques are designed to provide randomly selected, representative samples from diverse sources of waste.

Bulk tanks will be sampled either by taking a core sample from the tank or by sampling from ports located at different levels of the tank. This ensures a representative sample from the bulk tank.

¹ This form is periodically updated to reflect changing requirements.

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The method for barrel storage sampling will be based on the degree of heterogeneity of the waste material. If the generator knows that the material has been generated by the same process, randomly selected core samples from 10 percent of the barrels will be taken and combined for analysis. If the materials stored in the barrels are from different waste streams being generated within the plant, the generator will be asked to provide data on each waste stream and prepare a composite sample from the different waste streams for analysis. This composite sample will then be used for the qualification analysis.

Waste piles and lagoons will be sampled by a simple or stratified sampling plan, depending of the nature of the storage process. These individual samples will be collected and then combined to form a representative sample. If size reduction of the material is required, it will be accomplished by cone and quartering down to a usable sample size.

Table 3.1
Sampling Methods

Waste Type	Tank Truck	Containers	Closed Truck
Liquid	Modified* coliwasas	Modified coliwasas	--
Sludge Low solids High Solids	Modified* coliwasas Trier	Modified coliwasas Trier	--
Solids Dry Wet	Thief Trier	Thief Trier	Thief --

* Ball Valve Closure Mechanism

3.4.1.2 Qualification Analysis

The purpose of the qualification analysis is to assemble a detailed profile of the chemical and physical characteristics of the waste material. This profile is used to determine whether the material can be handled in the cement kiln process, and, if so, how to handle it safely and efficiently. The criteria for this decision include a set of key parameters which focus on materials handling, compatibility, process control,

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health, safety, and emissions considerations.

Table 3.2 shows the key parameters which can be included in the qualification analysis. The specific parameters required will depend on the waste stream, but in all cases will provide a full characterization of the waste stream. Also shown in this table are reference methods for the individual parameters, as well as reasons for including these parameters in the analysis plan. These methods, in modified form, are used to measure the waste characteristics. A brief discussion of each of these parameters can be found Section 3.4.1.3.

A specific subset of the analysis parameters is designed to provide information necessary to determine the handling mode for the wastes. This subset includes the following analysis parameters: organic composition, heating value, and pH.

The remaining parameters specified in Table 3.2 are designed to address materials handling, process control, and health/safety/emissions characteristics. Materials handling parameters include size distribution and consistency, as well as a direct characterization of the physical nature of the material. These parameters determine how the material can be physically handled through the systems. They will be used to develop specific modes of handling for liquids, solids, and sludges.

Process control parameters must be monitored to ensure that conditions in the kiln remain suitable for clinker production. These parameters include heat content, ash content, volatiles, moisture content, halogens, and metals. Analytical tests for these parameters are used to monitor inputs of specific process streams so that they can be balanced to protect the clinker quality. For example, heat content of fuel materials must be balanced to ensure adequate heat input to the kiln.

Other process control parameters are essential to the proper handling and storage of the waste materials. These include compatibility testing and pH. Compatibility testing is essential to ensure that materials are not mixed improperly.

Health/safety/emissions parameters include halogens, organic constituents, PCBs, metals and other toxic materials. These parameters must be accurately characterized to protect the health of employees and the surrounding community and to prevent environmental damage.

For wastes with potential cyanide compounds, a general spot test for cyanides is conducted on all wastes that carry waste codes indicating specific cyanide compounds (P106, for example) or the D003 waste code. Since Systech only accepts these waste codes as carry through, if the spot test indicates that cyanide compounds may be present additional analysis is done to determine if there are any measurable levels of amenable cyanides. This additional test is either done by Systech's laboratory or sent to an off-site laboratory. If the waste has no levels of amenable cyanides (e.g.

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<500 ppm), the waste may be accepted and the initial spot test intensity is used as the basis for incoming loads.

The Qualification Analysis will be repeated whenever any of the following situations occur:

- whenever a discrepancy shows up in the shipment analysis,
- whenever a change is made to the process which generates the waste.
- whenever a commercial marketer adds another hazardous waste code.

In addition, the qualification analysis will be repeated when a generator has not sent a shipment of waste to the facility for a year. This analysis would determine whether the generator's waste stream has changed.

Systech will require generators to recertify annually to verify any changes in the waste streams

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Table 3.2
Qualification Analysis Parameters

Parameter		Reference Method(s)	Reason for Analysis
Heat content (Btu/lb)		ASTM D240	Process stability and control
Ash content		Standard methods	Process stability and control Product quality control
Moisture		Standard methods	Process stability and control Material handling
Halogens:		ASTM 407A or oxygen bomb	Process stability and control Product quality control
pH:	Acidity Alkalinity	SW-846 9040	Tank/waste compatibility Processing requirements
Organic composition analysis		Modified SW-846 Method 8000 and ASTM D 5830 *	Personnel exposure risk assessment Identification of restricted wastes Tank/waste compatibility
Sulfur		Standard methods	Air emissions Process Control
PCBs		SW846 8080	Restricted material
Metals:	As, Cd Pb Cr Hg	SW846-6010B 6010B 6010B 7471	Air emissions Air emissions Air emissions Air emissions
Compatibility/Reactivity		ASTM D-34 P168	Materials Handling Process control
Cyanide: (For D003 or cyanide specific waste codes)	Spot Test Amenable	ASTM D5049 SW846-9010B	Waste compatibility Materials Handling Process Control

* Systech's Method for determining organics references SW-846 Method 8000 (general chromatography) and ASTM D 5830 (Standard Test Method for Solvent Analysis in Hazardous Waste Using Gas Chromatography). This combination is best suited for detecting organics in a high background matrix. We chose not to reference any EPA method because most SW-846 organic methods (including Method 8260) were designed for trace level analysis as opposed to macroanalysis. Additionally, Method 8260 does not employ an FID and is specifically intended for the analysis of volatiles only.

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3.4.1.3 Shipment analysis

In addition to the qualification analysis, each waste shipment entering the facility will be sampled and analyzed to verify that the material received is substantially the same as that which was qualified. Systech also verifies that the manifest is properly filled out. Therefore, when a waste shipment arrives at the facility, Systech personnel will compare the original qualification information to the analysis of the material in the shipment. If the waste fails to meet any of the receiving specifications, it will not be accepted at the site. The following are reasons for rejecting a shipment:

- PCBs (at greater than 50 ppm);
- Waste codes not included in the permit;
- Verification of unacceptable compounds (such as dioxin or other compounds that Systech has chosen to exclude from the waste fuels program).

If the waste does not meet these specifications, the facility would notify the customer that Systech could not accept the material and would work with the customer to find an alternative solution.

The specific analytical parameters and procedures the Facility Manager (or the Facility Manager's designated alternate) uses to verify the waste identity are shown in Table 3.3. Additional parameters from Table 3.2 may be added, as required, to ensure that the waste can be handled properly. The selection of additional parameters will be based on such criteria as waste code listings, waste and system compatibility, cement process sensitivity, probable contaminants, and other factors which are most relevant to the proper management of each specific waste stream.

A representative sample will be collected using the appropriate method from Table 3.1, as each waste shipment is delivered to the facility. The sampling equipment is thoroughly purged with material from the shipment being sampled.

While taking the sample for the shipment analysis, personnel examine the material's size distribution, consistency, and physical description to determine the best method for handling the material.

Tank truck samples will be taken using a modified coliwasa. The modification consists of a ball valve closing device with an extended handle which reaches the bottom of the tank. When collecting a sample, the handle will be pushed to the closed position, sealing the sampled material in a pipe. The advantage of this sampler is that it will provide a more positive seal and will be more durable than the standard, specified unit. However, the difference in the sealing process does not change the basic nature of the sampling mechanism.

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Containers, barrels, and closed trucks will be sampled using one of three sample collection devices. Liquids and dilute sludges will be sampled using a glass rod. Thick sludges and moist solids will be sampled using a sampling trier. Dry granular solids will be collected using a sampling thief.

Railcars containing liquids are sampled in the same manner (single, central core sample) and with the same modified coliwasa as tank trucks. Railcars with wastes in containers would be unloaded and then the containers would be sampled with modified coliwasa, trier or thief, as appropriate.

For thick sludges and solids, a one-inch tube is inserted into the material, and the sample is then pushed out into a sample container. One sample is collected per vessel (railcar, tank, or container). A core sample is taken from each truck and railcar delivering waste to the facility. Each bulk shipment is analyzed separately. For container shipments, all containers with the same waste type from the same generator are composited into one sample.

The manifest is inspected for completeness along with the corresponding paperwork for each inbound shipment. This information is entered into the computer system and the load is approved for sampling. The sample extracted from the waste shipment will be placed in a compatible container, typically a 500 ml or 1000 ml bottle, typically polyethylene. The sample is labeled with the sample ID and the date. From there, Aa portion of the sample will be used for analysis, while another aliquot will be poured into a smaller bottle, labeled with the same sample ID and date and retained for a period of 60 days after the initial analysis has been completed. This retained sample will not ordinarily be analyzed unless quality assurance procedures are being verified.

The laboratory analyzes the sample and approves the shipment for off-loading. The lab personnel approving the shipment for off-loading place their initials along with that of the sampler on the lab documents. The analyst then designates the tank number where the contents are to be offloaded. This is entered into the computer system and acknowledged by the operator prior to off-loading the material.

Subsequent movements of material from tank to tank are documented on the transfer log sheets and the tank levels are recorded on a daily basis.

Current records containing the results of analyses and quantities of materials inventoried will be maintained as part of the facility's Operating Record and will be readily available for agency review as well as for use by the Emergency Coordinator when responding to an emergency.

The laboratory is housed within the same building as the office and is located at the east end of the building (see Figure 2.3). The lab area occupies

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approximately 12' x 60' footprint. Testing services typically employ the following techniques: gas chromatography (FID/ECD), microwave-assisted acid digestion, cold vapor atomic absorption/emission spectrophotometry, inductively-coupled argon plasma spectrophotometry, bomb calorimetry, compatibility, radioactivity screening, pH, titrations and miscellaneous chemical/physical methods.

~~and contains the following equipment: GCMS, GC's equipped with eed/fid, pH meter, radiation meter, ICP, HgCVA, microwave digester, hot plates, stir plates, burettes, bomb calorimeters, fume hoods, viscometer, drying ovens, dessicators, and miscellaneous glassware to aid in the analysis.~~

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Table 3.3
Shipment Analysis Parameters

Parameter	Organic Waste
Heat content (Btu/lb)	X
Ash content	X
Halogens	X
pH	X
Organic composition analysis	X
PCBs	X
Metals Pb	X
Organic content	X
Compatibility/Reactivity	X
Water	X
Specific gravity	X
Radioactivity Screening	X

Heat Content

Heat content is evaluated to aid in producing a consistent quality fuel. This information allows personnel to selectively schedule and mix incoming shipments so that the blended fuel meets the target fuel heating value. Consistent heating values indicate that the waste and the waste-generating process are consistent with those originally qualified. From a regulatory stand point, those materials that arrive at the site with heat values below what has been established as being appropriate for energy recovery are not accepted by Systech for use in its operation.

Ash Content

Ash content is also evaluated because of its effect on the cement manufacturing process; its level can affect the quality of the cement product, clinker. This parameter is wholly a production issue and has no bearing on the regulatory issues concerning the material's acceptability.

Halogens

Halogens are an important factor in cement kiln process control. In order to control the chemistry of the cement manufacturing process, target values for chloride content in the fuel are developed by the cement plant. Due to the unique chemistry of the cement manufacturing process, there is an optimum level of chlorides required for best overall operation and product quality. Inorganic chlorides have traditionally been

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used in some cement plants; these chlorides can now be replaced by the chlorides in the fuel. Excessive chloride levels in a cement kiln, however, result in process problems that affect efficiency and product quality. These levels can also be used sometimes as a source identification parameter to verify waste type information. Regulatorily there is no limit on the level of halogens an incoming waste stream can have. The limiting issue is on the facility's ability to properly blend the material into a fuel with a target level of halogen content.

pH

pH is evaluated to identify any waste that might corrode the tank system or containers. The tank system and containers are constructed of mild steel and are subject to corrosion from waste materials that exhibit a high or low pH. A waste with a very high or low pH might also have a tendency to generate heat when mixed with other wastes. Wastes with high or low pH values are therefore checked for waste-to-waste compatibility. The facility does not accept wastes that have the characteristic of corrosivity (D002).

Organic Composition Analysis

Organic composition identifies waste that might contain concentrations of organic compounds that are conditionally acceptable or are prohibited from the facility for health and safety reasons. Screening levels for organic compounds are established to determine when additional safety precautions may be required or when the shipment must be rejected. Authorization to receive any shipment with concentrations of conditionally acceptable compounds that exceed the acceptable level will be contingent on the use of appropriate personnel protection measures. The organic analysis from the waste profile is also used to identify the waste. This organic composition analysis allows personnel to confirm that the waste received is consistent with the waste originally qualified.

PCBs

PCBs are regulated under the Toxic Substance Control Act (TSCA) and are prohibited at the facility at levels greater than 50 ppm.

Metals

Metals are normally monitored during the cement manufacturing process; they are naturally occurring elements that can affect the quality of the product. Therefore, limits have been established on the acceptable metal content of the fuel delivered to the kiln. Metal concentrations are screened in the qualification analysis to detect levels that might need to be blended to meet the fuel limits. A waste stream known to have a high metal concentration would be checked again during the receiving analysis to ensure adequate blending control. Samples of the fuel being delivered to the kiln are analyzed to document that metal content limits are satisfied.

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Compatibility/Reactivity

Compatibility is evaluated to ensure that wastes do not react with one another when they are mixed together in the blending tanks. Compatibility is also done on waste that will be handled through the direct-burn process. These wastes will be mixed with samples of the flush solvent, typically kerosene, used to purge the system in order to remove all residues from the piping. Analysts check for generation of heat, gas bubbles, or phase separation of liquid waste fuels. Any material that, when added to other wastes or materials that it may come in contact with when it arrives at the facility will be either deemed unacceptable or rejected if analysis shows:

- 1) An initial measured temperature change, upon mixing of the waste and other wastes/materials, greater than 10 degrees;
- 2) The presence of oxidizers;
- 3) The potential for the evolution of any extremely toxic gas that has the potential to harm human health or the environment. Cyanide spot test (referenced in Section 3.4.1.2) is run on waste streams having cyanide specific waste codes and/or D003;
- 4) The potential of the waste causing polymerization when in contact with other materials; and
- 5) Any other condition, upon testing and confirmation, the facility feels may cause harm to human health and/or the environment.

Water

Water is monitored for cement kiln process control. Water quantity affects the temperature and chemistry in the kiln. It can also affect material flow in the tanks, and other equipment. As long as the waste has adequate heat value, water is strictly a production issue and not the basis for deeming the material unacceptable or rejecting it for regulatory issues.

Specific Gravity

Specific gravity is also monitored for cement kiln process control. It is evaluated because of its effect on the equipment (such as the piping and pumps). The facility also uses the specific gravity to convert waste fuel factors from gallons (storage factor) to pounds/hour (usage factor).

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3.4.1.4 Final Analysis

Representative samples of blended waste materials will be taken prior to their introduction into the kiln to ensure that they can be used safely. To obtain a representative sample from the liquid waste storage tanks, the sampling ports will first be purged with the stored liquid to remove accumulated solids by capturing a small amount of the waste in a separate container. Approximately one pint of sample will be taken from sample ports located on the tank or from the fuel pumps supplying materials directly to the kiln. The waste sample will be collected in a metal, plastic, or glass container, as appropriate, and a portion will be retained for future reference.

Final analytical parameters are shown on Table 3.4. As with the shipment analysis, additional parameters from Table 3.2 may be added, as required.

Table 3.4
Final Analysis Parameters

Parameter	Organic Wastes
Heat content (Btu/lb)	X
Ash content	X
Halogens	X
pH	X
Organic composition analysis	X
PCBs	X
Metals Pb	X

3.4.1.5 Analysis of On-Site Waste

Wastes generated on-site are analyzed, as needed, to verify additional handling requirements or to determine appropriate off-site management options. Wastes or other residuals which cannot be effectively handled on-site will be evaluated, as required, to determine appropriate off-site treatment or disposal options. Systech will comply with the notice and certification requirements applicable to generators under OAC Rule 3745-270-07. Parameters such as flash point and free liquids would be the most common requirements when evaluating disposal options. Any such unblendable residuals will be generated infrequently, if at all. Waste streams which have a tendency to produce unblendable residuals will be screened critically during the receiving analysis and will be excluded from operations if handling difficulties persist.

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3.4.2 Waste Screening Criteria

3.4.2.1 Health and Safety Concerns

There are risks associated with the handling and management of hazardous wastes which can be effectively minimized to acceptable levels through preventive procedures. There are, however, unacceptable levels of risk associated with certain types of very hazardous wastes. One primary objective of this waste analysis plan is to screen out waste streams containing levels of extremely hazardous materials or specific chemicals which require extraordinary handling procedures.

The sample parameters used to determine whether health, safety, or operation problems may develop from use of candidate hazardous waste materials are listed in Table 3.2.

3.4.2.2 Waste Management and Regulatory Concerns

3.4.2.2.1 Acceptance and Rejection Policy

Systech supplies the cement plant with wastes that can be used as a supplemental fuel or process additives in the cement kilns. All incoming shipments are tested and analyzed to ensure that they are indeed acceptable materials. The policy and procedures that Systech will use for the acceptance or rejection of wastes delivered to the cement plant are presented as [3.8](#) Appendix [3-2](#).

3.4.2.2.2 Identification of Reactive and Incompatible Waste

Reactive hazardous wastes are usually designated with the EPA Code of D003 and may be specifically excluded from facility operations. Materials that are strong oxidizing or reducing agents would not commonly be associated with wastes handled at the facility because of their potential for adverse reactions. Generators must indicate if their wastes are reactive in nature on the Qualification Application. In most cases, the prequalification part of the acceptance process will screen out and identify those waste streams that may be reactive and/or be incompatible with Systech's operation.

Wastes may be incompatible with other wastes, with the storage tanks, or handling equipment. The greatest danger associated with waste-to-waste incompatibilities is the potential for chemical reactions which might generate excessive heat or toxic fumes. These types of reactions are most commonly due to the presence of reactive wastes; reactive wastes are excluded from facility operations.

When dealing with the organic solvents and resins typically present in fuel quality wastes, a higher probability waste-to-waste incompatibility is the polymerization of certain resins. There are few environmental or health risks associated with such a reaction, but the operational impact could be extensive and must be avoided. Several sample preparation steps in the qualification and routine

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analyses give preliminary indications that there may be potential compatibility problems. In addition, wastes with a potential for this type of reaction will usually be known in advance from the generator's process description on the Application Form; therefore, an additional compatibility test would be undertaken.

Incompatibility with storage vessels could result in accelerated corrosion and deterioration of the vessel and subsequent leaks or releases to the environment. The storage tanks at the facility which are used for supplemental fuel storage are constructed of mild steel which could be subject to corrosion from waste materials that exhibited a very high or very low pH. These wastes would normally be designated as hazardous by corrosivity characteristic and manifested under the EPA Code of D002.

Corrosive wastes designated as D002 and wastes with an extractable pH less than 2 or greater than 12.5 are restricted from operations. Corrosive wastes are identified by the generator on the Application Form, and waste samples are tested for extractable pH during both the qualification and shipment analyses.

3.5 Revision of the Analysis Plan

This plan will be reviewed by Systech on an as-needed basis, annually at a minimum. The plan will also be reviewed if a change occurs in the applicable regulations, the operating procedures, the facility, or the waste stream characteristics. If necessary, revisions will be made following these reviews and distributed to regulatory agencies and all others who have been issued copies of the Waste Analysis Plan.

3.6 Quality Assurance/Quality Control Plan

A quality assurance/quality control (QA/QC) plan has been developed and included as 3.9 Appendix ~~3~~.3.

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3.7 Appendix 3.1

Sample Application for Waste Generators

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**Systech
Environmental
Corporation**

File No: (Assigned by Systech _____)

ELIGIBILITY QUALIFICATION FORM

Answer all questions to enable us to respond promptly. PLEASE NOTE, GENERATOR MUST SIGN BELOW. WE NOT BEGIN THE APPROVAL PROCESS UNTIL THE APPLICATION IS COMPLETE. A representative sample of waste stream must accompany this application. Please attach MSDS's.

GENERATOR Company Name: _____
 Technical Contact: _____
 Phone: _____ Fax #: _____
 Address: _____
 City: _____ State: _____ Zip: _____
 EPA ID #: (federal) _____ State ID if applicable: _____

CUSTOMER Company (BILL-TO) Name: _____
 Customer Contact Name: _____
 Phone: _____ Fax #: _____
 Address: _____
 City: _____ State: _____ Zip: _____

1. Identification of waste or DOT description: _____
 2. Activity producing waste: _____
 3. The waste is: ☐ nonhazardous ☐ hazardous
 If nonhazardous, does it have >100 ppm organics? ☐ yes ☐ no
 If hazardous, please specify EPA Waste Code(s): _____
 State Waste Code(s) if applicable: _____
 4. Quantity of waste available: _____ per _____ month _____ year _____ other (specify) _____
 5. Physical description (ie. consistency, texture, etc.): _____
 6. Method of shipment: ☐ bulk ☐ portable tank ☐ drum ☐ other (specify) _____
 7. Check the appropriate line if the waste contains any of the following: ☐ PCBs ☐ cyanides
☐ radioactives ☐ reactives ☐ pesticides/herbicides ☐ biologically active material ☐ mercury >260 ppm
 8. Is the material from a CERCLA site? ☐ yes ☐ no
 - 9a. What is the BTU/lb of the material as generated? _____ 9b. What is the flashpoint? _____
 10. What is the pH of the material? _____ <2.0 _____ >2 to <12.5 _____ ≥ 12.5
 11. NESHAP Information: Is this material NESHAP regulated? ☐ yes ☐ no (If no go to question 12.)
 a) total benzene concentration _____ % (or _____ ppm) b) water >10%? ☐ yes ☐ no
 12. List and give approximate concentrations for primary raw material entering the waste or provide a waste analysis, if available. Account for 100 percent of the waste.
- | Material | % | Material | % |
|----------|-------|----------|-------|
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ |
13. Is the sample being submitted to Systech representative of the waste stream? ☐ yes ☐ no
 If no, explain: _____

To the best of my knowledge, I warrant that the materials delivered to Systech will be in conformity with the description herein, all information represented by generator in this profile is accurate and complete, and all questions are answered.

Generator Signature

Title

Date

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3.8 Appendix 2-3.2

Acceptance and Rejection Policy

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ACCEPTANCE AND REJECTION POLICY

Systech and the cement facility have a contract whereby Systech will supply the cement company with combustible liquid wastes that can be used as a supplemental fuel in the cement kilns. The terms of the agreement require that only select materials meeting certain specifications can be delivered to the cement facility. The contract further requires that all incoming shipments be tested and analyzed to insure that they are indeed acceptable materials. The purpose of this document is to set forth the policy and procedures that Systech will use for the acceptance or rejection of supplemental fuels delivered to the cement facility.

1. **Authority.** The Systech Facility Manager and/or the designated alternate has the responsibility for performing the quality assurance testing of each shipment of supplemental fuels and has the authority for acceptance or rejection of each shipment of supplemental fuels.
2. **Safety.** The transporter delivering supplemental fuels to the cement facility will abide by Systech's and the cement company's safety, insurance, and operational rules and regulations and will use trucks equipped with safety items and other necessary equipment. Inadequate or unsafe equipment is reason for rejection of any shipment.
3. **Scheduling.** All shipments of supplemental fuels must be scheduled with the Systech transportation coordinator in advance. A shipment arriving without the necessary prescheduling may be rejected or delayed.
4. **Documentation.** All shipments or supplemental fuels will be accompanied with (a) a manifest that complies with state and federal hazardous waste regulations and (b) any other documentation required for the transport of said materials to the cement facility. A shipment arriving without the necessary documentation or with incomplete, improperly prepared, or otherwise deficient documentation may be rejected.
5. **Analysis of Shipments.** Only materials that have been prequalified will be scheduled for shipment as supplemental fuels. All incoming shipments will be analyzed before the materials will be accepted for delivery as supplemental fuels. Materials that are different from that represented in "The Application for Qualification Form" may be rejected. Normally the analytical screening procedures are accomplished in ~30 minutes. However, if the results indicate that further analysis is required, acceptance or rejection may be delayed. The cost of transporter demurrage caused by this delay will be the responsibility of the broker and/or generator.

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6. **Notification.** In the event that a shipment must be rejected, the Systech on-site personnel will give notification to the generator or broker of the material(s).

7. **Rejection.** A rejected shipment in Systech's possession shall be prepared for lawful transportation and returned to the generator. The shipment shall be returned to the generator within a reasonable time, not to exceed 5 days, after notice of Systech's rejection has been communicated to generator. This shall be done unless within such time the parties agree to some alternative manner for the disposal of the rejected shipment. Generator shall pay Systech its reasonable expenses and charges for handling, loading, demurrage, transporting, storing, and caring for rejected shipments of generator's material in Systech's possession. If generator selects an alternate disposal site versus returning the shipment to the generator's site, generator shall be responsible for all costs relating to transportation, demurrage, disposal, handling, and decontamination of equipment. Title to the material of a rejected shipment shall be and remains with the generator.

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3.9 Appendix ~~33.3~~
Quality Assurance/Quality Control Plan

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3.9.1 Program Objective and Overview

The overall objective of Systech's quality assurance/quality control (QA/QC) program is to ensure that the quality of the data generated in the laboratory is adequate to meet all safety, regulatory, and operational requirements. Data must reliably indicate that waste received:

1. Can be blended to make a predictable quality cement kiln fuel by using the standard operating procedures and equipment described in the operation plan,
2. Can be handled safely by trained facility employees using the appropriate personal protective devices and health and safety procedures, and
3. Can be accepted in accordance with current environmental regulations and permit conditions.

Many factors contribute to overall data quality. The QA/QC program is designed to control and document the variables that could impact data quality. Personnel training and preventive maintenance programs provide the foundations for overall quality assurance. Instrument calibrations and quality control check samples document the performance of individual analytical systems. System audits establish the statistical framework for acceptable system performance and identify possible problems. When problems are identified, corrective actions are implemented to assure continuing data quality.

It is also desirable for the data from one Systech lab to be directly comparable to that produced by any other Systech lab. Therefore QA/QC activities must include cross checks between all the labs as well as checks within each lab.

The QA/QC program is based on the fundamental principles of good laboratory practice.

3.9.2 Key Personnel

Laboratory Manager

The lab manager is responsible for the oversight management of the site laboratory, assists in day-to-day lab analyses during periods of heavy workloads, stays up-to-date on new analytical techniques and instrumentation and monitors the QA/QC program. Reports to the Facility Manager.

Chemists

The Paulding laboratory chemists are responsible for the day-to-day analytical functions. This includes all sample login, analytical techniques, equipment maintenance and troubleshooting, data validation and general lab organization. Reports to the lab manager.

Laboratory Technicians

The Paulding laboratory technicians are responsible for day-to-day "wet lab" analytical

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functions and assist in sampling during periods of heavy workloads. Reports to the lab manager.

Facility Manager

The facility manager manages the overall operations of the site to ensure the safe and efficient operation of the facility. The principle activities of the position are to direct the overall site operation, to assure compliance with health, safety, and regulatory requirements, to coordinate personnel training, evaluate personnel performance, and develop operating and capital budgets. Reports to the Vice President of Fuel Quality Waste.

Technical Training

Initial training of lab personnel consists mainly of on-the-job training using the Systech Analytical Methods Manual (SAMM) and Comprehensive Quality Assurance Plan (CQAP). It is normally done by the chemists and lab manager. This training is supplemented by courses from vendors (e.g. Agilent, Spectro, Varian) and professional organizations (e.g. ACS). As a training tool and means of assessment, each technician, chemist and lab manager is required to successfully complete (>90%) a written Theoretical and Analytical Method Assessment. This is an assessment covering the mechanics of our analytical methods and the theories behind them.

3.9.3 QA/QC Officer

Systech's Technical Manager is the designated QA/QC officer, having overall responsibility for the laboratory QA/QC program. The Technical Manager is located at the corporate office. QA/QC guidelines are established and evaluated through the QC activities and data from each facility. The QA/QC officer prepares and distributes special QC sample splits for the annual inter-laboratory performance audits. The resulting data is analyzed and used to update the quality control charts for each analytical parameter.

3.9.43 Sampling QA/QC

The objective of all sampling activities is to assure that the material sent to the lab for analysis is truly representative of the material being evaluated. In addition, all samples received from off-site or being sent off-site must be processed through a chain of custody procedure. This procedure ensures they are labeled, documented, handled, and stored so that all analytical data can be accurately traced back to a reference sample of known quality and origin. On-site samples are collected, processed, and logged-in at the site by trained personnel and remain under their general custody when stored at the site.

There are two types of samples collected by sampling personnel. Samples obtained from incoming shipments of materials (trucks and containers) and samples of blended fuel. The Waste Analysis Plan (WAP), Standard Operating Procedures (SOPs), and SW-846 provide information on appropriate sampling methods and techniques. These documents are reviewed as part of the training, and on-the-job training (OJT) is then provided to ensure that all sampling personnel are getting representative samples. Finally, samples are taken by the trainer

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and trainee and analytical results for both are compared prior to signing off on the training. Any deviations will initiate corrective action or additional training.

During annual audits of the sampling procedures~~audits~~, all personnel obtain samples from the same delivery vehicle. Analytical results from these samples are then compared to verify that all personnel obtained equivalent samples. Any deviations from standard sampling technique or inconsistent analytical data will initiate corrective action or remedial training.

3.9.43.1 Analytical QA/QC

The objective of all Systech analyses is to provide personnel with reliable information upon which they can make informed decisions. They must be able to consistently identify and reject materials which would pose health risks to the operators, materials that are restricted by permit conditions, and materials which would adversely affect fuel quality or the cement-making process. Analytical QA/QC procedures ensure that the data generated is consistently accurate and precise to identify these unwanted materials.

Three types of samples are generally analyzed: a qualification sample supplied by the waste generator, a shipment or container sample taken from the delivery vehicle or shipping container, and blended fuel samples taken from a tank or directly from the kiln fuel feed line. The qualification analysis characterizes a candidate waste stream and must confirm that it would be safe to handle and acceptable for use as fuel. The shipment analysis quantifies key parameters to confirm that the material delivered is representative of the waste stream originally qualified. The fuel analyses confirm that the blended fuel meets the necessary fuel quality and regulatory compliance criteria.

These analyses rely on trained Systech laboratory personnel. They perform all of the analytical procedures outlined in Table 1. The following sections briefly outline the main elements of the QA/QC program that ensure reliable data.

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USEPA ID No.: OHD 005048947
Ohio Permit No.: 03-63-059

Table 1
Analytical Parameters and Methods

Parameter	Method
Organic constituents	Gas chromatography (FID)
PCBs	Gas chromatography (ECD)
Metals	Inductively Coupled Plasma Spectrophotometer (ICP)
Halogens	Colorimetric titration
Sulfur	Spectrophotometry
Heat content and ash	Bomb calorimeter and gravimetric
Water and solids	Gravimetric or volumetric
pH	Paper or meter
Viscosity	Brookfield viscometer
Specific gravity	Volumetric

3.9.54 Preventive and Corrective Maintenance

Effective preventative and corrective maintenance programs ensure that analytical instruments are operating reliably. Certain system components are cleaned or replaced on a fixed schedule to avoid equipment malfunctions. When QC data monitoring indicates problems, a troubleshooting and maintenance protocol is implemented to identify and remedy the particular problem. Table 2 summarizes the maintenance frequency and troubleshooting and maintenance procedures for each piece of equipment. An equipment maintenance log is maintained to document preventative maintenance, performance problems, and corrective maintenance.

3.9.65 Calibration Procedures and Frequency

Standardization procedures are among the most important methods of controlling day-to-day operations. They ensure an accurate and consistent instrument response to known reference materials. Table 3 outlines the standardization and optimization procedures for different analytical instruments.

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3.9.76 Performance Audits and Quality Control Charts

Systech currently performs annual QA/QC audits at each facility. The QA/QC officer provides each laboratory analyst at each facility with a specially prepared set of QC samples. They analyze the samples and report their results back to the designated QA/QC officer. The results are compiled and evaluated to identify individuals, methods, or laboratories statistically outside the normal range of values. A report is generated that discusses the accuracy and precision of all data generating systems along with recommendations for any necessary corrective actions.

The normal accuracy and precision of each individual analyst is used to establish quality control charts. These charts are prepared annually and the control limits will be updated periodically by pooling the data over time. Corrective action procedures are implemented when daily QC data falls outside designated control limits.

3.9.87 Quality Assurance Reports

Reports summarizing data accuracy, precision, and completeness are generated by the designated QA/QC officer and sent to the Facility Managers. Also discussed in this report will be any problems encountered and subsequent corrective actions undertaken to correct the problem. These reports will be part of the facility's operating record and will be accessible for review by compliance personnel.

3.9.98 Recordkeeping

A key part of the quality control plan is the maintenance of complete records on quality control activities. Records of all analyses and QA/QC activities are maintained at the facility for quick reference and presentation during regulatory inspections.

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Table 2
Routine QC Program Activities: Troubleshooting and Maintenance

Instrument	Troubleshooting Procedures		Maintenance Procedures	
	Symptom	Maintenance Item	Item	Frequency
GC	Peak abnormalities	Sample size, syringe, septa, gas flows, leak check, temperature controls, electronics	Waste vials Autosampler/septas/electronics	Daily Weekly
	Poor baseline	Syringe, septa, gas flows, carrier gas purity, leak check, temperature controls, column conditioning, detector, electronics	Oven & gas control modules Septa & inserts	As necessary
	Extra peaks	Syringe, septa, dirty column, inserts	Standing current	Weekly or as necessary
ICP	Poor resolution	Sample size, septa, gas flows, temperature control, column conditioning	Leak check ECD & FID cleaning	As necessary
	Plasma flicker	Clean torch & spray chamber. Check Nebulizer & sample lines.	Electronics & torch box	As necessary
	Noise	Cleaning mixing chamber, nebulizer	Mixing chamber Drain carboy	As necessary
	Poor signal	Optimize wavelength, check nebulizer settings	Gas box, power supply, torch assembly	As necessary
Bomb	Poor sample flow	Replace sample tubing	Pump tubing	Daily or as necessary
	Pre-period, misfire	Check bucket temp, fuse position, O ₂ content	Controller	As necessary
	Excessive error	Recalibrate or replace	--	--

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Table 3
Optimization and Standardization Procedures

Instrument	Item	Optimization Procedures		Standardization Procedures		
		Frequency	Standard Used	Concentration	Standard Preparation Frequency	Standardization Frequency
GC	Gas flow	With column change	Group mix solvent standards	Qualitative	Semi-annually or as needed	At least one standard daily
	Temperature control	As necessary				
	FID	As necessary	Specific solvents	As required by sample	Each standard	With each quantitative run
	ECD	Bake weekly Clean as necessary	PCB arochlor mix			
ICP	Torch	Each new installation	Pb, As, Cr, Cd, Be	2 point curve(element dependent)	As necessary	Each analysis
	Wavelength Plasma	Daily When torch is changed		Profile instrument	As necessary	As necessary
	Nebulizer	When changed		Optimize gas flow settings	As necessary	As necessary
	Gas flow	As needed				
Bomb	Calibration check	Semi-annually	Benzoic acid	Pure	As needed	Weekly

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SYSTECH ANALYTICAL METHODS**TABLE OF CONTENTS**

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- GC-2 Standard Method for the Determination of PCBs in Solvent-Based Waste (Rev. December 2000)
- GC-3 Standard Method for the Determination of Organochlorine Pesticides in Organic-Based Liquid and Solid Waste (Rev. December 2000)
- GC-4 Standard Procedure for Acid Digesting Sample Preparations for GC Analysis (Rev. December 2000)
- GC-5 Standard Procedure for Florisil Column Clean-Up of Sample Preparations for GC/ECD Analysis (Rev. December 2000)
- GC-6 Standard Procedure for Sulfur Clean-Up of Sample Preparations for GC/ECD Analysis (Rev. December 2000)
- GC-7 Standard Procedure for the Use of a Surrogate in the Gas Chromatographic Analysis of Waste (Rev. December 2000)
- IC-1 Standard Method for the Determination of Inorganic Anions by Ion Chromatography (Rev. December 2000)

SECTION II: SPECTROSCOPIC METHODS

- S-1 Standard Method for Screening Solvent-Based Liquid Waste for Trace Elements (Rev. December 2000)
- S-2 Standard Procedure for the Microwave-Assisted Preparation of Liquid and Solid Waste for Trace Element Analysis (Rev. December 2000)
- S-4 Standard Method for Cold Vapor Mercury Analyses of Industrial Furnace Feedstreams (Analyte 16) (Rev. December 2000)
- S-5 Standard Method for Inductively-Coupled Argon Plasma Analysis of Industrial Furnace Feedstreams for Trace Elements (Rev. December 2000)

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- S-6 Standard Method for Cold Vapor Mercury Analyses of Industrial Furnace Feedstreams (MHS-10) (Rev. December 2000)
- S-7 ASTM D5839: Standard Test Method for Trace Element Analysis of Hazardous Waste Fuel by Energy-Dispersive X-ray Fluorescence Spectrometry (Rev. December 2000)
- S-8 Standard Method for Cold Vapor Mercury Analyses of Industrial Furnace Feedstreams (VARIAN AA20) (Rev. December 2000)
- S-9 Standard Method for Cold Vapor Mercury Analyses of Industrial Furnace Feedstreams (Leeman Hydra AA) (Rev. December 2000)
- S-10 Standard Method for Cold Vapor Mercury Analyses of Industrial Furnace Feedstreams (Leeman PS200II) (Rev. December 2001)
- S-11 Standard Procedure for the Microwave-Assisted Preparation of Liquid and Solid Waste for Trace Element Analysis (CEM MARS model) (Rev. November 2006)

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- PC-1 Standard Method for Determining the pH of Solid or Liquid Waste (Rev. December 2000)
- PC-2 Standard Method for the Determination of Ignitability of Fuel Quality Waste (Rev. December 2000)
- PC-3 Standard Procedure for Compatibility Testing of Solid or Liquid Waste (Rev. December 2000)
- PC-4 Standard Method for Determining Viscosity of Liquid Waste (Rev. December 2000)
- PC-5 ASTM D5530: Standard Test Method for Total Moisture of Hazardous Waste Fuel by Karl Fischer Titrimetry (Rev. December 2000)
- PC-6 Standard Method for Determining Heat Value and Ash Content of Liquid and Solid Wastes (Rev. December 2000)
- PC-7 Standard Method for the Screening of Cyanide in Fuel Quality Waste (Rev. December 2000)
- PC-8 ASTM D5928: Standard Test Method for the Screening of Waste of

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Radioactivity (Rev. December 2000)

- PC-9 Standard Test Method for the Determination of Insoluble Solids in Organic Liquid Hazardous Waste (Rev. May 2012)
- PC-10 Standard Method for Determining the Density of Liquid Waste (Rev. December 2000)
- PC-11 Standard Method for the Determination of Total Chloride in Feedstreams Materials by Silver Nitrate Titration (Rev. December 2000)
- PC-12 Standard Method for Spectrophotometric Sulfate and Nitrate Determination of Solid and Liquid Waste (Rev. December 2000)
- PC-13 Standard Procedure for the Determination of Separated Water in Liquid Waste (Rev. December 2000)
- PC-14 Standard Method for the Determination of Total Chloride in Feedstreams Materials by Mercuric Nitrate Titration (Rev. December 2000)
- PC-15 Standard Procedure for Total Organic Carbon Analysis of Aqueous Wastes (Rev. December 2000)
- PC-16 Standard Procedure for the Analysis of Total Chloride by Automated Potentiometric Titration (Rev. December 2000)
- PC-17 Standard Method for Spectrophotometric Lead Determination of Solid and Liquid Waste (Rev. November 2009)
- PC -18 Standard Method for Fluoride Determination by Ion-Selective Electrode (Rev. November 2009)
- PC-19 Standard Method for Sodium Determination by Ion-Selective Electrode (Rev. November 2009)
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SECTION IV: MISCELLANEOUS PROCEDURES

- M-1 Standard Procedure for the Analysis of Vapor Monitor Badges by Gas Chromatography (Rev. April 2001)
- M-2 Standard Procedure for the Determination of Method Detection Limits (Rev. April 2001)
- M-3 Standard Procedure for Field Sampling Bulk Trucks and Railcars (Rev. August 2002)
- M-4 Standard Procedure for Field Sampling of Drums and Systanks (Rev. August 2002)
- M-5 Standard Method for the Toxicity Characteristic Leachate Procedure on Cement Kiln Dust (Rev. April 2001)

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Method GC-1

Standard Method for Determining the Organic Composition of Solvent-Based Waste

1.0 SCOPE

- 1.1 This method describes the determination of the organic composition of solvent-based waste materials by gas chromatographic (GC) analyses with a flame ionization detector (FID). It is applicable only to solvent-based, non-aqueous waste.
- 1.2 This method is applicable to liquid and solid waste materials.
- 1.3 Analyses by capillary GC columns are covered in this method.
- 1.4 This method gives instruction for qualitative and quantitative analysis.
- 1.5 *This method does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to its use. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF METHOD

- 2.1 Qualitative: A portion of the waste sample is mixed with carbon disulfide (or other suitable solvent) in a 2 ml vial. If needed, the sample mixture is passed through a column of sodium sulfate for solids/water removal and injected manually or by autosampler into the GC for analysis.
- 2.2 Quantitative: A weighed portion of the waste sample and carbon disulfide (or other suitable solvent) are mixed in a test tube. If needed, the sample mixture is passed through a column of sodium sulfate for solids/water removal and injected manually or by autosampler into the GC for analysis.

3.0 SIGNIFICANCE AND USE

- 3.1 The determination of the organic composition of waste-derived fuel materials is fundamental to our internal Health and Safety Program. Accurate identification of organics is vital to the proper function of our Compound Health Effects Evaluation Model which provides guidance on compound acceptance criteria and required personnel protection to chemical exposures. This method also provides information used in regulatory reporting requirements (e.g., SARA 313, NESHAP).

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Method GC-1

For liquids, this may include graduated glass pipets or a metered positive displacement pipet. For solids, the user may need to choose a standard sampling device and experimentally determine the approximate amount of sample that constitutes the amount specified in the PROCEDURE section.

5.0 REAGENTS AND MATERIALS

- 5.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 5.2 Carbon disulfide, CS_2 . The user may be required to use "low benzene" (< 1 ppm) when quantifying low levels of benzene.
- 5.3 Anhydrous sodium sulfate, Na_2SO_4 , granular.

6.0 INTERFERENCES AND LIMITATIONS

- 6.1 This procedure is limited to the determination of volatile and semivolatile organic compounds. Because this is a general procedure for complex organic matrices, polar and nonpolar compounds will be detected. Generally, the more polar compounds (e.g., oxygen and nitrogen-bearing) will have a lower response than nonpolar compounds.
- 6.2 If a solvent other than CS_2 is used, there is a strong possibility that compounds eluting in the area of the chosen solvent will not be visible because of coelution. It may be necessary to prepare/analyze a separate sample in a solvent with a significantly different retention time.
- 6.3 If the sample does not readily dissolve in the carrier solvent, the sample mixture can be prepared in a test tube and placed in an ultrasonic bath for approximately 5 minutes to aid the dissolution.
- 6.4 Coelution of compounds can occur. The user should be mindful of peak shape irregularities, shoulders, etc. The application of Method GC-4 can be useful in clarifying possible coelutions.

7.0 SAMPLE

- 7.1 Liquids - Because stratification and settling is possible, the laboratory sample must be thoroughly mixed by shaking prior to withdrawing a portion for analysis. Strongly multiphasic samples may require core sampling or each layer may need to be sampled and analyzed separately.
- 7.2 Because solid samples can be heterogenous, the laboratory sample must be thoroughly mixed by stirring or shaking prior to withdrawing a portion for analysis. In some cases, a core sample may be necessary.

8.0 QUALITY CONTROL

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Method GC-1

used if dictated by the sample by the characteristics of the sample. The user must be mindful that dilutions of the sample preparation directly affect the detection limits of this method.

9.2.2 If needed to remove solids/water, pass the sample preparation through a pipet or pipet tip charged with approximately 0.5 - 0.8 g Na_2SO_4 into a new vial or test tube. Centrifuging may aid in separating suspended solids. If a sample preparation does not pass freely through the Na_2SO_4 , apply gentle pressure to the pipet with a rubber bulb or other suitable device. If needed, return the sample preparation to the original or known mass.

9.2.3 The sample is ready for analysis.

10.0 CALCULATION OR INTERPRETATION OF RESULTS

10.1 The determination of the organic composition of a sample is generally accomplished by using some or all of the following techniques:

10.1.1 Matching of GC peak retention time and shape with known chemical standard chromatograms or Chemical Group Mix chromatograms.

10.1.2 Utilizing the Retention Time Index as a guide for listing known compound possibilities.

10.1.3 Utilizing relative retention times and patterns of known GC peaks.

10.1.4 Referencing previous generator analytical data (if available).

10.1.5 Contacting other facilities receiving the same or similar material for additional information.

10.1.6 Comparing the unknowns peak shape versus that of known compounds eluting at the same general time, or that of general classes of chemical compounds (e.g., alcohols, esters, aliphatics, etc.).

10.1.7 Obtaining information from the generator or broker on waste constituents, type or source.

10.1.8 Utilizing Method GC-4 to remove most oxygen-bearing, nitrogen-bearing and double-bonded aromatics/aliphatics from the sample preparation.

10.1.9 Using a confirmation column (e.g., Carbowax 20M, DB-5, SPB-5, etc.) to provide alternate separation results.

10.1.10 The sample may be sent for mass spectral analysis.

10.2 When quantifying a peak against an external standard, it is important that the standard and the peak to be quantified are within the scale of the chromatogram. For this quantification procedure, the standard and peak to be quantified should be

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Method GC-1

Fredonia	0.30	-	-	125
Alpena	0.23	0.01	2.6	95.8
Xenia	0.19	-	-	79.2

¹ Alaskan Crude Oil with a certified benzene concentration of 0.24 % (wt.).

The average lab recovery was 88.2 %.

- 11.3 Detection limits (DL) were determined for the classes of chemicals routinely determined by this method. Except for single compound listing, a minimum of 3 representative compounds were tested for each class. The standard 10X dilution has been applied. The DL for benzene is presented separately. All DLs are in percent.

<u>Compound Class</u>	<u>Detection Limit</u>	<u>Compound Class</u>	<u>Detection Limit</u>	
alkanes	0.11	glycol ethers	0.38	alkenes
aromatics	0.07	aromatic nitrogens	0.16	
ethers	0.18	aliphatic acids	0.50	
aliphatic ketones	0.15	aromatic acids	0.16	
aromatic ketones	0.17	nitriles	1.05 ¹	
aliphatic alcohols	0.27	aliphatic chlorides	0.18	
aromatic alcohols	0.21	aromatic chlorides	0.12	
aliphatic esters	0.13	phenolics	0.13	
aromatic esters	0.13	siloxanes	0.17	
terpenoids	0.13	benzene	0.015	
glycols	0.53			

¹ This detection limit is artificially high because of the high DL of acetonitrile (2.84 %). If acetonitrile is excluded, the DL for the class of nitriles is 0.15 %.

12.0 REFERENCES

- 12.1 U.S. EPA, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd Ed., Vol. 1B) Method 8000.
- 12.2 ASTM D3271, Standard Practice for Direct Injection of Solvent-Reducible Paints into a Gas Chromatograph for Solvent Analysis.
- 12.3 ASTM D5830, Standard Test Method for Solvent Analysis in Hazardous Waste Using Gas Chromatography.

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Method GC-2

Standard Method for the Determination of PCBs in Solvent-Based Waste

1.0 SCOPE

- 1.1 This method describes the determination of PCBs in solvent-based waste by gas chromatographic (GC) analyses with an electron-capture detector (ECD). It is applicable only to solvent-based, non-aqueous waste.
- 1.2 This method is applicable to liquid and solid waste materials.
- 1.3 Analyses by packed and capillary GC columns are covered in this method.
- 1.4 This method gives instruction for qualitative and quantitative analysis.
- 1.5 This method is applicable to other non-oxygenated (H_2SO_4 stable) halogenated compounds.
- 1.6 *This method does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to its use. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF METHOD

- 2.1 Qualitative: A measured portion of the waste sample is mixed with hexane in a 2 ml vial or test tube. The sample mixture is digested with sulfuric acid as described in Method GC-4 and injected manually or by autosampler into the GC for analysis.
- 2.2 Quantitative: A weighed portion of the waste sample and hexane are mixed in a test tube. The sample mixture is digested with sulfuric acid as described in Method GC-4 and injected manually or by autosampler into the GC for analysis.

3.0 SIGNIFICANCE AND USE

- 3.1 PCBs and other select halogenated compounds are restricted or prohibited from being accepted at our facilities. This procedure is used to analyze incoming and blended FQW for PCBs to determine acceptability.

4.0 APPARATUS

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Method GC-2

a) J&W Scientific: 30 m x 0.53 mm fused silica with 1.5 um DB-5 film thickness.

b) Supelco: 60 m x 0.75 mm glass with 1 um SPB-5 film thickness.

4.3 Analytical Balance - capable of weighing to at least 0.0001g.

4.4 Pipet/transfer devices: liquids - Repipetors, glass pipets, positive displacement pipetors; solids - spatula, scooptula or similar device. It is strongly recommended that the device used incorporate some gauge of measure for dispensing solvent and addition of sample. For liquids this may include graduated glass pipets or a metered positive displacement pipet. For solids, the user may need to choose a standard device and experimentally determine the approximate amount of sample that constitutes the amount specified in the PROCEDURE section.

5.0 REAGENTS AND MATERIALS

5.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.

5.2 n-hexanes, C₆H₁₄.

6.0 INTERFERENCES AND LIMITATIONS

6.1 The user may substitute Method GC-6 for Method GC-5 for sample cleanup. The user should be mindful of the limitations of each method. These limitations are described within each method.

6.2 Interferences caused by mercaptans can be reduced or removed by utilizing Method GC-6.

7.0 SAMPLE

7.1 Liquids - Because stratification and settling is possible, the laboratory sample must be thoroughly mixed by shaking prior to withdrawing a portion for analysis. Strongly multiphasic samples may require core sampling or each layer may need to be sampled and analyzed separately.

7.2 Because solid samples can be heterogenous, the laboratory sample must be thoroughly mixed by stirring or shaking prior to withdrawing a portion for analysis. In some cases, a core sample may be necessary.

8.0 QUALITY CONTROL

8.1 The quality control requirements for this method are as follows:

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Method GC-2

3 point calibration for the Aroclor of interest	$r \geq 0.99$	Only for Aroclor quantification
Sample Duplicate	$RPD = \pm 50\%$	1 per batch of 20 or less samples
Matrix Spike	$Accuracy = \pm 50\%$	1 per batch of 20 or less samples

8.2 Quality Control Assessment.

Quality Control Measure	Examples of Corrective Action
3 point calibration for the Aroclor of interest	Repeat if the r value is not ≥ 0.99
Reagent Blank	Check instrument operating conditions and re-run blank if the baseline is not acceptable.
TCMX surrogate	If $> \pm 3s$ investigate for possible causes. Reanalyze the sample. If the reanalysis fails, analyze a CCV sample. If the effect is believed to be negligible, the data can be accepted based on the acceptable CCV recovery.
Quality Control Measure	Examples of Corrective Action
Matrix Spike	If the MS recovery percentage fails, the reason for the MS recovery failure should be assessed and noted.
Laboratory Control Sample	Run if the MS percentage fails, use to assess reasons for MS failure. If LCS fails, rerun all samples in the batch including MS and Sample Duplicate.

- 8.3 Instrument and related maintenance items are listed in the Maintenance & Optimization Log-Gas Chromatograph. Additional related items (i.e., Balance(s)-Check lower and upper ranges or mid-range) are found in a separate M&O Log.

9.0 **PROCEDURE**

9.1 Qualitative Preparation

- 9.1.1 Prepare the **liquid** sample by pipeting approximately 0.975 ml C_6H_{14} and approximately 0.025 ml sample into a 2 ml GC vial or test tube. For **solid** samples, pipet approximately 0.975 ml C_6H_{14} into 2 ml vial or test tube and add approximately 0.025 g of the sample. Mix the sample preparation by withdrawing and expelling the contents or by sealing the vial and shaking for about 1 minute. *In many cases, for liquids and solids the use of test tubes and larger solvent/sample amounts is desirable.* When using test tubes, mixing is generally accomplished by use of a vortex mixer. When using larger volumes, the solvent/ sample

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Method GC-2

window which will increase the size and detail of the chromatographic peaks. These data handling functions are explained in the manufacturer's operating manual.

10.1.3 Appendix 1, PCB Analysis Protocol (see attached) should be followed in the analysis for PCBs. This flowchart is applicable only to bulk materials. Containerized material may follow a different sampling/ resampling scheme.

10.2 When quantifying a sample Aroclor against an external standard Aroclor, it is important that the standard and the sample peaks to be quantified are within the scale of the chromatogram. For this quantification procedure, the standard and sample peaks to be quantified should be approximately the same size. Specific requirements for quantifying Aroclors is given on the attached flowchart. The general formula is as follows:

$$\text{PCB Concentration} = \frac{(\text{Sample Peak Area or Height})(\text{Std. Concentration})}{\text{Std. Peak Area or Height}} (\text{dilution factor})$$

$$\text{Note: Dilution Factor} = \frac{\text{Sample (g)} + \text{Solvent (g)}}{\text{Sample (g)}}$$

10.2.1 When a higher level of accuracy is required, the user should use one of the following alternate methods of quantification:

- 1) Regression curve - using 1 blank + 3 standards in the scale/linear range of the instrument.
- 2) Standards bracketing - using 2 standards at concentrations surrounding the unknown concentration.

11.0 PRECISION AND ACCURACY

11.1 Qualitative

11.1.1 Precision - No statement is made about the precision of this section of the method since it is qualitative and does not produce a numerical result.

11.1.2 Accuracy - No statement is made about the precision of this section of the method since it is qualitative and does not produce a numerical result.

11.2 Quantitative

11.2.1 Precision - The precision of this method has not been completely evaluated.

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Method GC-2

- 12.1 U.S. EPA, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd Ed., Vol. 1B) Method 8000.
- 12.2 U.S. EPA, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd Ed., Vol. 1B) Method 8082.
- 12.3 ASTM D4059, Standard Method for Analysis of Polychlorinated Biphenyls in Mineral Insulating Oils by Gas Chromatography.

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Method GC-2

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Method GC-3

**Standard Method for the Determination of Organochlorine
Pesticides in Organic-Based Liquid and Solid Waste****1.0 SCOPE**

- 1.1 This method describes the determination of organochlorine pesticides in organic-based liquid and solid waste by gas chromatography (GC) analyses. It is not applicable to aqueous waste.
- 1.2 This method includes direction for non-quantitative and quantitative analyses.
- 1.3 This method includes direction for capillary GC columns.
- 1.4 This method is applicable to the following compounds:
- | | |
|-----------|--------------------|
| Aldrin | Endrin |
| Lindane | Heptachlor |
| Chlordane | Heptachlor epoxide |
| DDD | Methoxychlor |
| DDT | Toxaphene |
- 1.5 This method is applicable to other chlorinated compounds not listed in 1.4.
- 1.6 *This method may involve hazardous material, operations and equipment. This method does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 A portion of the waste sample is mixed with hexane in a 2 ml vial or test tube. The sample preparation is cleaned-up using Method GC-5. Fractions 1 and 2 are then combined or analyzed separately by injecting manually or by autosampler into the gas chromatograph.

3.0 SIGNIFICANCE AND USE

- 3.1 Organochlorine pesticides are restricted or prohibited from being accepted at our facilities. This procedure is utilized to analyze incoming and blended waste for organochlorine pesticides, and other select chlorinated compounds.

4.0 APPARATUS

- 4.1 Hewlett-Packard 5890 Gas Chromatograph equipped with an autosampler, data handling system and one or more electron-capture detectors (ECD), or equivalent system. The recommended GC settings are as follows:

Oven Temperature Profile¹

Capillary Column:

7.0 SAMPLE

- 7.1 Because layering is possible in liquid samples, the laboratory sample should be thoroughly mixed by shaking prior to withdrawing a portion for analysis. For solid samples, the laboratory sample should be thoroughly mixed by stirring or shaking prior to withdrawing a portion for analysis. In some cases (liquids and solids), it may be necessary to take a core sample or each layer may need to be sampled and analyzed separately.

8.0 QUALITY CONTROL

- 8.1 The quality control requirements that are listed in the Maintenance and Optimization Log-Gas Chromatograph are as follows:

	<u>Frequency</u>
Run ECD Reagent Blank	Daily
Record ECD Signal	Daily

- 8.2 The quality control requirements are:

	<u>Limit</u>
Record #1 ECD Signal	-
Record #2 ECD Signal (if so equipped)	-
Analytical Blank	<DL
Reference Sample Recovery-Fractions 1 and 2	70% - 130%
Run Pesticide Standards	-
Correlation Coefficient (r) - ECD #1	\$0.990
Correlation Coefficient (r) - ECD #2	\$0.990

- 8.3 Continual assessment of the GC system by use of a surrogate as described in Method GC-7.
- 8.4 Instrument and related maintenance items are listed in the Maintenance and Optimization Log-Gas Chromatograph.

9.0 PROCEDURE

9.1 Qualitative Preparation

- 9.1.1 Prepare the *liquid* sample by pipeting approximately 0.025 ml of the sample and 0.975 ml n-hexanes into a 2 ml vial. For solid samples, pipet approximately 0.975 ml n-hexanes into a 2 ml vial and add approximately 0.025 g sample. Mix the samples by withdrawing and expelling the contents or by sealing the vial and shaking for about 1 minute. *In many cases for liquids and solids, the use of test tubes and larger reagent/sample amounts is desirable.* When using test tubes, mixing is generally accomplished by use of a vortex mixer. When using larger volumes, the reagent/sample ratio should normally be 40:1. Different ratios can be used if dictated by the physical properties of the sample. The user must be mindful that dilutions of the sample preparation directly affect the detection limits of this method.

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Method GC-3

DDT	100	0
Endrin	4	96
Heptachlor	100	0
Heptachlor Epoxide	100	0
Methoxychlor	-	100
Toxaphene	96	-

10.4 The use of a confirmation column is instrumental in proving or disproving the presence of pesticide(s). The confirmation column must be one of the following:

- J & W Scientific: 60 m x 0.53 mm fused silica with 1.5 um DB-608 film thickness, or equivalent.
- Supelco: 60 m x 0.75 mm glass with 1 um SPB-35 film thickness, or equivalent.

If a pesticide is suspected of being present in a sample following analysis on the primary GC column (4.2), it should be reanalyzed using the confirmation column (10.4). If a suspect peak is adequately matched on both columns, the peak should be presumed to be the suspected pesticide (see 10.5 below).

Following analyses on both columns, if the peak is matched on only 1 column, it should be presumed that the suspected pesticide is not present.

10.5 Method GC-4 can also be used to distinguish between oxygen-bearing and non-oxygen-bearing pesticides. Aldrin, Chlordane, Lindane, DDD, DDT, Heptachlor, and Toxaphene are not digestible by GC-4; whereas Endrin, Heptachlor epoxide, and Methoxychlor fully digest.

10.6 If the presence of a pesticide is presumed, the user should follow the attached Pesticide Analysis Protocol.

10.7 When quantifying a sample Aroclor against an external standard Aroclor, it is important that the standard and the sample peaks to be quantified are within the scale of the chromatogram. For this quantification procedure, the standard and sample peaks to be quantified should be approximately the same size. Specific requirements for quantifying Aroclors is given on the attached flowchart.

$$\text{Concentration} = \frac{(\text{Sample Peak Area/Height})(\text{Standard Concentration})}{\text{Standard Peak Area or Height}} \left(\text{dilution factor} \right)$$

$$\text{Note: Dilution Factor} = \frac{\text{Sample (g)} + \text{Solvent (g)}}{\text{Sample (g)}}$$

10.8 When a higher level of accuracy is required, the user should use one of the following alternate methods of quantification:

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Method GC-3

- 13.1 U.S. EPA, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd Ed., Vol. 1B) Method 8000.
- 13.2 U.S. EPA Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd Ed., Vol. 1B) Method 8081.

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Method GC-3

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Method GC-4

Standard Procedure for Acid Digesting Sample Preparations for GC Analysis

1.0 SCOPE

- 1.1 This procedure describes the acid digestion of waste sample preparations using sulfuric acid for the subsequent analysis by GC/FID or ECD.
- 1.2 Because this procedure is designed to digest, or remove polar compounds from a sample matrix, it **cannot** be used when the waste sample is prepared in polar solvents, such as ketones, alcohols, or esters.
- 1.3 *This procedure may involve hazardous materials, operations, and equipment. This procedure does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 The sample is prepared by Method GC-1 or GC-2. An equal volume of concentrated sulfuric acid is added to the sample preparation. The vial or test tube is agitated, centrifuged and the top layer removed to a new vial and the trace acid is removed (ECD only). The digested preparation is then injected manually, or by autosampler into the gas chromatograph for analysis.

3.0 SIGNIFICANCE AND USE

- 3.1 The sulfuric acid digestion used on sample preparations for GC/FID analysis is useful for distinguishing between non-digestible compounds and digestible compounds (see Section 9.0 for complete description). It is an important tool for accurately identifying organic compounds.
- 3.2 The sulfuric acid digestion used on sample preparations for GC/ECD analysis is useful for reducing the level of interference commonly seen in the analysis of WDF for PCBs and other select non-digestible chlorinated compounds.

4.0 REAGENTS AND MATERIALS

- 4.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 4.2 Sulfuric acid, 70%, H_2SO_4 .
- 4.3 Sodium carbonate, Na_2CO_3 .
- 4.4 Sodium bicarbonate, NaHCO_3 .
- 4.5 Anhydrous sodium sulfate, Na_2SO_4 , granular.

5.0 INTERFERENCES AND LIMITATIONS

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Method GC-4

8.1.7 Seal the vial with a cap. The digested solution is now ready for analysis.

8.2 GC/ECD.

8.2.1 The sample is prepared using Method GC-2 or GC-3.

8.2.2 Add approximately 1 ml concentrated sulfuric acid to the vial containing the sample preparation. For quantitative procedures, larger volumes of sample preparation/sulfuric acid in test tubes may be preferable. The ratio of sample preparation to acid should be approximately 1:1.

8.2.3 Seal the vial with a cap, and agitate by shaking for about 1 minute. If using a test tube instead of a vial, the test tube can either be manually agitated by stirring or mixed on the vortex mixer. Do not shake a capped test tube.

8.2.4 To separate the phases, centrifuge the vial for about 1 minute.

8.2.5 After centrifuging, remove the vial cap and transfer the top phase (clear layer) to a new vial (or test tube.).

8.2.6 The residual acid must be removed or neutralized from this top phase. This is accomplished by performing one of the following:

REMOVAL: To the top phase add a minimum of approximately 10% water of the volume of the top phase (i.e., approximately 0.1 ml water per 1.0 ml top phase.). This vial should be shaken, or in the case of test tubes, they should be shaken or mixed on the vortex mixer for approximately 1 minute. This mixture is then centrifuged to separate the phases. The top layer is removed and passed through a column of anhydrous sodium sulfate into a new vial. Seal the vial with a vial cap. The digested solution is now ready for analysis.

NEUTRALIZATION: To the top phase add approximately 10% (sodium carbonate or sodium bicarbonate) of the volume of the top phase (i.e., approximately 0.1 ml Na_2CO_3 or NaHCO_3 per 1.0 ml top phase). This vial (or test tube) should be mixed by shaking or on the vortex mixer for approximately 2 minutes. Centrifuge the mixture to separate the phases. Seal the vial with a vial cap. The digested solution is now ready for analysis.

8.2.7 If quantitatively preparing, the hexane top layer from Step 8.2.6 should be brought back to a known mass.

9.0 CALCULATION OR INTERPRETATION

9.1 GC/FID.

9.1.1 Most of the polar and double-bonded aromatic/aliphatic compounds will have been digested by the sulfuric acid. The chromatogram obtained following GC analysis should display primarily aliphatics, aromatics and chlorinated hydrocarbons. In some samples, the sulfuric acid

Method GC-4

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Method GC-5

Standard Procedure for Florisil Column Clean-Up of Sample Preparations for GC/ECD Analysis

1.0 SCOPE

- 1.1 This procedure describes the Florisil column clean-up of waste sample preparations for the subsequent determination of PCBs and chlorinated pesticides by GC/ECD.
- 1.2 The condition of the Florisil media is critical. The media (bulk and pre-made pipets) used in this procedure needs to be stored in a drying oven at a temperature of 130° F. Prepared daily use pipets may be stored temporarily in a dessicator.
- 1.3 *This procedure does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 The sample is prepared by Method GC-2 or GC-3. The final sample preparation is allowed to pass through a pipet or pipet tip charged with Florisil and a layer of anhydrous sodium sulfate and into a test tube. This fraction is covered and set aside. Using the same Florisil charged pipet, a 97:3 mixture of hexane and methyl isobutyl ketone is allowed to pass through the column and collect in a separate test tube (fraction 2). The fractions are then analyzed individually or combined and analyzed by GC/ECD.

3.0 SIGNIFICANCE AND USE

- 3.1 The Florisil column clean up used on sample preparations for GC/ECD analysis is useful for reducing the level of interference commonly seen in the analysis of WDF for PCBs, chlorinated pesticides, and other select chlorinated compounds.

4.0 REAGENTS AND MATERIALS

- 4.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 4.2 n-hexane, C₆H₁₄.
- 4.3 n-hexane/methyl isobutyl ketone (MIBK), 97:3 solution.

Note: Methyl ethyl ketone (MEK) is an acceptable substitute for MIBK.

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Method GC-5

approximately 1 mm of anhydrous sodium sulfate is placed on top of the Florisil charge.

Note: Pre-made Florisil filters are commercially available. The filters used must not contain >0.35 g charge of Florisil, unless an analyte recovery study is conducted to demonstrate acceptable performance.

- 8.2 Prepare the sample by Methods GC-2 or GC-3.
- 8.3 The charged pipet is pre-wet with hexane, and the eluted hexane is discarded.
- 8.4 The settled pipet is placed over a collecting test tube and 2.5 ml of the waste sample solution from 8.2 is applied to the Florisil/sodium sulfate column.
- 8.5 The sample is allowed to filter slowly through the column and collect in the test tube. Gentle pressure from a pipetor or pipet bulb can be applied to the filter to expel any remaining sample mixture. This effluent is fraction 1 and should be covered and set aside.
- 8.6 Using the same pipet, apply 2.5 ml of a 97:3 hexane/methyl isobutyl ketone solution to the filter and allow to pass through and collect in a new test tube. Gentle pressure from a pipetor or pipet bulb can be applied to the filter to expel any remaining sample mixture. This is fraction 2.
- 8.7 Fractions 1 and 2 can be combined or analyzed separately. The combined fractions or individual fractions are placed in a vial(s). If this is a part of a quantitative procedure, the fraction(s) should be returned to a known mass. If the user combines fractions 1 and 2 and the final preparation must be approximately 5% sample concentration, the starting sample concentration should be 10%.
- 8.8 Seal the vial with a cap. The sample is now ready for analysis.

9.0 CALCULATION OR INTERPRETATION

- 9.1 Many oxygen-bearing interferences can be removed by this procedure. The user needs to be mindful of the potential problems associated with using Florisil as a clean-up medium. These items are detailed in Section 4.0, INTERFERENCES AND LIMITATIONS.

10.0 REPORTING

- 10.1 The chromatogram(s) of samples having been cleaned-up by this procedure should be labeled as such. If fractions 1 and 2 are analyzed separately, each chromatogram must be labeled as their respective fraction.

11.0 PRECISION AND ACCURACY

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Method GC-6

Standard Procedure for Sulfur Clean-Up of Sample Preparations for GC/ECD Analyses

1.0 SCOPE

- 1.1 This procedure describes the steps necessary to perform a sulfur cleanup of sample preparations with elemental copper for the subsequent determination of PCBs by GC/ECD.
- 1.2 *This procedure may involve hazardous materials, operations, or equipment. This procedure does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 The sample is prepared by Method GC-2 or GC-3. To this sample preparation is added a specified amount of elemental copper powder. This preparation is agitated for 1 minute and the solvent layer is removed. The preparation is now ready for analysis.

3.0 SIGNIFICANCE AND USE

- 3.1 The sulfur clean-up procedure is effective in reducing the level of interference from sulfhydryl (-SH) compounds in GC/ECD analysis. This type of interference is common in petroleum, petroleum residues, and some petroleum distillation products.

4.0 REAGENTS AND MATERIALS

- 4.1 Purity of Reagents - Reagent grade chemical shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 4.2 Purity of Water - Unless otherwise indicated, references to water shall be understood to mean meeting the numerical requirements of Type II water as defined by ASTM D 1193.
- 4.3 Nitric acid solution, HNO_3 .
- 4.4 Acetone, $(\text{CH}_3)_2\text{CO}$.
- 4.5 Vortex mixer.

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Method GC-6

7.3 Mix for 1 minute on a vortex mixer.

7.4 Remove the supernatant to a clean vial. The separation of the solvent and copper is necessary to prevent possible degradation of certain sample components. The preparation is ready for analysis.

8.0 **REPORTING**

8.1 The chromatogram of the copper cleaned sample preparation should be labeled as such.

9.0 **PRECISION AND BIAS**

9.1 Precision - No statement is made about the precision since this procedure does produce a specific test result.

9.2 Bias - No statement is made about bias since this procedure does not produce a specific test result.

10.0 **REFERENCES**

10.1 U.S. Environmental Protection Agency, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd Ed., Vol. 1B). Method 3660.

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Method GC-7

**Standard Procedure for the Use of a Surrogate
In the Gas Chromatographic Analysis of Waste****1.0 SCOPE**

- 1.1 This procedure describes the preparation and use of a surrogate in gas chromatographic analysis of solid or liquid wastes.
- 1.2 This procedure is applicable to Method GC-1, GC-2 and GC-3. The sample preparation solvent containing the surrogate is required for each of the above referenced methods.
- 1.3 *This procedure may involve hazardous materials, operations, and equipment. This procedure does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 The surrogate compound is added to the solvent prior to use in preparing samples. This solvent is used in preparing samples for analyses. This sample preparation is subsequently injected into the GC according to the procedures listed in 1.2. The shape, retention time, and peak area or height of the surrogate is evaluated to assess the quality of the injection and the condition of the GC.

3.0 SIGNIFICANCE AND USE

- 3.1 The use of a surrogate in GC analyses allows the user an ongoing means of assessing the condition of the instrument system (columns, gas flows, injectors, detectors, syringes, etc.) and analytical conditions such as the quality of injection.

4.0 APPARATUS

- 4.1 Syringe - 200 to 250 ul capacity. Each should be dedicated to the a given surrogate/solvent mixture (e.g. the syringe used for the FID solvent should be used exclusively for that purpose)
- 4.2 Graduated cylinder or volumetric flask - 500 ml capacity.

Method GC-7

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8.1 GC/FID.

- 8.1.1 Obtain an unused 500 ml bottle of CS₂ and using the 200 - 250 ul syringe, add 200 ul of the surrogate compound. If using CS₂ in larger than 500 ml containers, measure 500 ml CS₂ using a 500 ml graduated cylinder or volumetric flask, transfer to a clean 500 ml bottle, and add the surrogate compound, as noted above.

NOTE: The amount of the surrogate added to 500 ml CS₂ may be modified depending on the specific surrogate chosen. Surrogate amounts should ideally be close to the suggested amounts, but must be unchanging. It is also acceptable to prepare using larger quantities of solvent.

- 8.1.2 Recap the 500 ml bottle and invert several times to mix. Do not shake.

- 8.1.3 The surrogate spiked CS₂ solution is ready for use in preparing samples. Do not use spiked CS₂ in GC syringe flush vials. Unspiked solvent should be used for flushing.

8.2 GC/ECD.

NOTE: The procedure described in this section assumes the use of the 200 mg/ml TMX solution. Neat TMX must be prepared gravimetrically.

- 8.2.1 Obtain an unused 500 ml bottle of hexane and using the 1000 ul syringe, add 2 ml of the surrogate compound, or if using the neat surrogate compound, add 20 ul using the 20 - 50 ul syringe. If using hexane in larger than 500 ml containers, measure 500 ml hexane using a 500 ml graduated cylinder or volumetric flask, transfer to a clean 500 ml bottle, and add the surrogate compound, as noted above.

NOTE: The amount of the surrogate added to 500 ml hexane may be modified depending on the specific surrogate chosen. surrogate amounts should ideally be close to the suggested amounts, but must be unchanging. It is also acceptable to prepare using larger quantities of solvent.

- 8.2.2 Recap the 500 ml bottle and invert several times to mix. Do not shake.

- 8.2.3 The surrogate spiked hexane solution is ready for use in preparing samples. Do not use spiked hexane in GC syringe flush vials. Unspiked solvent should be used for flushing.

9.0 CALCULATION AND INTERPRETATION

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Method IC-1

Standard Method for the Determination of Inorganic Anions by Ion Chromatography

1.0 SCOPE

- 1.1 This method describes the determination of the anions fluoride, chloride, bromide, phosphate and sulfate using an ion chromatograph (IC) with a conductivity detector. It is applicable to washing obtained from oxygen bomb combusted samples and aqueous extractions of non-combustible samples.
- 1.2 *This method does not purport to address all of the safety considerations associated with its' use. It is the responsibility of the user of the standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to it's use. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 The sample is prepared by Method PC-6 or the preparative steps in Method PC-12. The IC is configured and allowed to equilibrate and is calibrated. This method includes instruction for quantitative and semi-quantitative analysis. A portion of the bomb washings are then injected into the eluent stream of the IC. The anion concentration is then calculated manually from the chromatogram or by use of an integrator or PC.

3.0 SIGNIFICANCE AND USE

- 3.1 The Boiler and Industrial Furnace Regulations require that cement kilns utilizing FQW adhere to specific guidelines in assessing potential emissions. Also, most sites have maximum total chlorine limits specified in their operating permits for incoming fuel. Cement plants have maximum chlorine limits because it's effect on kiln operating conditions.

4.0 APPARATUS

- 4.1 Ion Chromatograph, Alltech Universal System or Dionex DX-100. The unit should be equipped with electronic or chemical suppression, pre-column, column heater and temperature-controlled detector cell housing.
- 4.2 Strip chart recorder with attenuation/scale settings, integrator or PC.

5.0 REAGENTS AND MATERIALS

- 5.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 5.2 Purity of Water - Unless otherwise indicated, references to water shall be understood to mean deionized water produced by ion exchange, carbon adsorption or other suitable process.
- 5.3 Glass pipets, 1/5/10 ml capacities.
- 5.4 Volumetric Flasks, 10/25/50/100 ml capacities.
- 5.5 Syringes, minimum capacity of 2 ml with a male pressure fitting.
- 5.6 Analytical Balance, capable of weighing to the nearest 0.0001 g.
- 5.7 Eluant - Follow the instrument/column manufacturer's instructions for eluant preparation and storage.
- 5.8 Stock Standard Solutions - 100 mg/L stock solutions should be prepared as described below. These solutions have a maximum shelf life of 1 month.
 - 5.8.1 Fluoride: Weigh 0.2210 g NaF directly into a 100 ml volumetric flask. Add approximately 50 ml water to the flask, cap and shake until dissolved. Bring to volume with water.
 - 5.8.2 Chloride: Weigh 0.1649 g NaCl directly into a 100 ml volumetric flask. Add approximately 50 ml water to the flask, cap and shake until dissolved. Bring to volume with water.
 - 5.8.3 Bromide: Weigh 0.1288 g NaBr directly into a 100 ml volumetric flask. Add approximately 50 ml water to the flask, cap and shake until dissolved. Bring to volume with water.
 - 5.8.4 Sulfate: Weigh 0.1479 g NaSO₄ directly into a 100 ml volumetric flask. Add approximately 50 ml water to the flask, cap and shake until dissolved. Bring to volume with water.
 - 5.8.5 Phosphate: Weigh 0.1433 g KH₂PO₄ directly into a 100 ml volumetric flask. Add approximately 50 ml water to the flask, cap and shake until dissolved. Bring to volume with water.

Note: Prepared mixed anion standards are widely available. These standards mixes are generally considered to be more accurate than those made from working stocks.

5.9 Working Standards - Mixed anion solutions can be made by combining varying portions of the stock standard solutions from section 5.8. These solution have a shelf life of 1 week. The following is an example of a mixed anion standard solutions. This example assumes the use of volumetric flasks.

a) Add the following amounts of stock solutions to a 250 ml flask:

		Final Mixed	
		Amount	Concentration
Anion		(ml)	(mg/L)
Fluoride (F ⁻)		20	20
Chloride (Cl ⁻)	20		20
Bromide (Br ⁻)		20	20
Sulfate (SO ₄ ²⁻)	100		100

b) Bring to volume with water and mix well.

c) Additional standards can be made by serial dilution.

5.10 Calibration for quantitative analysis must use a minimum of 3 standard concentrations for each anion of interest. Semi-quantitative analysis uses a single standard for each anion of interest. The peak produced by the single standard should be close in size to the sample's anion peak, if possible.

6.0 INTERFERENCES

6.1 Large quantities of ions eluting near the ion of interest may cause an interference. Separation can be improved by adjusting parameters such as eluent concentration and flow rate. Sample dilution and/or the use of the method of standard additions can also be used.

6.2 Organic acid concentrations from incomplete combustion or sample contamination may interfere. Two common species, formate and acetate, elute between fluoride and chloride. Combustion aids can be employed if this type of interference is observed.

6.3 Bromide and nitrate can elute very close together and be potentially interfere with each other.

6.4 Large particles (> 0.45 μ m) in the sample can cause interference and damage to the IC system. These particles must be filtered from the sample solution prior to analysis. Centrifugation is not sufficient for this removal.

6.5 If a packed bed suppressor column is used, it will be slowly consumed during analysis and therefore will need to be regenerated or replaced periodically.

- 6.6 Low recoveries may be obtained if care is not taken to reduce volatile loss (primarily chlorinated hydrocarbons) during the sample preparation.
- 6.7 The negative "water dip" may interfere with early eluting ions. The water dip can be removed by adding concentrated eluant to all standards and samples (bomb washings).
- 6.8 The nitrate and sulfate peaks can exhibit peak migration and poor resolution. The analyst should scrutinize these areas to prevent misidentifications.

7.0 SAMPLE

- 7.1 The bomb washings should be mixed by shaking prior to withdrawing a portion for analysis. Filtration of the bomb washings is necessary. See PROCEDURE.

8.0 QUALITY CONTROL

- 8.1 All quality control items and data quality objectives listed in the site WAP and/or permit must be followed. These items may include check standards, reagent blanks, method blanks, spikes & reference materials. Items 8.3 through 8.5 list the QC required for all analyses.
- 8.2 Analyte concentrations beyond the linear range of the calibration must be diluted and re-analyzed. All dilutions should be done with volumetric glassware.
- 8.3 A minimum of 1 Reagent Blank per analyzed batch should be run to assess system contamination.
- 8.4 A blank consisting of laboratory water should be run with each analyzed batch.
- 8.5 A minimum of 1 Check Standard should be run with each analyzed batch. This standard should be the mid-range standard from the calibration.
- 8.6 Maintenance & Optimization items not listed within this method are in the Maintenance & Optimization Log - Ion Chromatograph.

9.0 PROCEDURE

- 9.1 Allow the instrument to equilibrate and achieve a stable baseline according to the manufacturer's instructions.
- 9.2 Calibration
- 9.2.1 Prepare 3 calibration standards containing the analytes of interest. See Section 5.0.

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Method IC-1

- 9.2.2 Run the 3 standards and blank according to manufacturers directions.
- 9.2.3 Manually or electronically prepare the calibration curve for each analyte (sample concentration vs. peak response).
- 9.2.4 The working calibration curve must be verified on each working day or when the eluent strength is changed. If the response for any analyte varies from the expected values by more than 20%, a new calibration curve must be prepared.

9.3 Sample analysis.

- 9.3.1 Analyze the sample(s) according to the manufacturer's directions.

10.0 CALCULATION OR INTERPRETATION

10.1 Quantitative

Note: This section assumes calibration/sample data will be entered into a calculator or spreadsheet. If an alternate quantification method is used (i.e. standards bracketing) it will need to be included here.

- 10.1.1 Prepare the calibration curves for each anion. See Section 9.0.
- 10.1.2 Enter the calibration concentrations and peak heights into a calculator with linear least squares capabilities, or into a spreadsheet.
- 10.1.3 Calculate the following parameters: slope (s), intercept (I) and correlation coefficient (r). The slope and intercept define a relationship between the concentration and instrument response of the form:

$$y_i = s_i x_i + I$$

where:

y_i = predicted instrument response

s_i = response slope

x_i = concentration of standard i

I = intercept

Most constructed or canned spreadsheets automatically calculate these values.

- 10.1.4 Rearrangement of the equation in 10.2 yields the concentration corresponding to an instrumental measurement:

$$x_j = (y_j - I)/s_j$$

where:

x_j = calculated concentration of the sample.

y_j = actual instrument response for the sample.
 s_j = concentration of standard i (calculated in 10.2)
 I = intercept (calculated in 10.2)

Most constructed or canned spreadsheets automatically calculate these values.

10.2 Semi-Quantitative

10.2.1 When quantifying an anion peak against an external standard, it is important that the standard and the anion peak to be measured are within the scale of the chromatogram.

10.2.2 The standard and peak to be measured should be approximately the same size. The formula for calculating an anion concentration is as follows:

$$\text{Anion Concentration} = \frac{(\text{Sample Peak Area/Height})(\text{Std. Concentration}) (\text{dilution factor})}{\text{Std. Peak Area/Height}}$$

11.0 REPORTING

11.1 The calculated amount should be recorded to the nearest 0.1 %. Low level measurements should be recorded at the actual parts per million calculation. All chromatograms and calculations should be kept on file or with appropriate paperwork.

12.0 REFERENCES

12.1 U.S. EPA, Test Methods for Evaluating Solid Waste: Physical and Chemical Methods (SW-846, 3rd Ed., Vol. 1C). Method 9056.

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Method S-1

Standard Method for Screening Solvent-Based Liquid Waste for Trace Elements

1.0 SCOPE

- 1.1 This method describes the preparation and screening procedure of solvent-based liquid waste for trace elements by flame atomic spectroscopy. It is applicable only to liquid, non-aqueous wastes.
- 1.2 This method is designed to provide the user a rapid procedure for determining approximate trace element concentrations.
- 1.3 *This method may involve hazardous materials, operations, and equipment. This method does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 The sample is prepared by dissolution with a solvent mixture, mixed on a vortex mixer and aspirated into the spectrometer for analysis.

3.0 SIGNIFICANCE AND USE

- 3.1 This is a rapid and effective procedure for screening incoming and blended WDF for trace metals. It is used primarily as a rapid, semi-quantitative screening procedure for unacceptably high trace metals concentrations. High concentrations of some metals may be limited by permit and/or may pose blending problems.

4.0 APPARATUS

- 4.1 Perkin-Elmer or Varian atomic absorption spectrophotometer (AAS) with deuterium background correction, or similar system. It is recommended that this unit function as a double-beam AAS. The instrument should be equipped with a printer for permanent data recording and equipped with an external Superlamp power supply. A high solids nebulizer is required for this method. The nebulizer chamber must be equipped with an airflow spoiler. The instrument should be set with the following parameters for each element.

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Method S-1

4.1.1 Element Settings/Conditions

Element	Wavelength	Mode	Flame Type	Flame Stoichiometry
Ag	328.1	Absorption	Air/Acetylene	oxidizing
As*	193.7	Absorption	N ₂ O Acetylene	reducing
Ba	553.6	Absorption	N ₂ O Acetylene	reducing
Ba	553.6	Emission	N ₂ O Acetylene	reducing
Be	234.9	Absorption	N ₂ O Acetylene	reducing
Cd	228.8	Absorption	Air/Acetylene	oxidizing
Cr	357.9	Absorption	Air/Acetylene	reducing
Cr	425.4	Emission	N ₂ O Acetylene	reducing
Fe	248.3	Absorption	Air/Acetylene	oxidizing
Fe	372.0	Emission	N ₂ O Acetylene	reducing
Na	589.0	Absorption	Air/Acetylene	oxidizing
Pb	283.3	Absorption	Air/Acetylene	oxidizing
Sb*	217.6	Absorption	Air/Acetylene	oxidizing
Se*	196.0	Absorption	N ₂ O Acetylene	highly reducing
Ti	364.3	Absorption	N ₂ O Acetylene	reducing
Ti	399.9	Emission	N ₂ O Acetylene	reducing
Tl	276.8	Absorption	Air/Acetylene	oxidizing
V	318.5	Absorption	N ₂ O/Acetylene	reducing
V	437.9	Emission	N ₂ O/Acetylene	reducing
Zn	213.9	Absorption	Air/Acetylene	oxidizing

* The use of a Superlamp is recommended.

4.1.2 General Instrument Settings/Selections

- Time - Each reading should be a minimum of 1 second in length.
- Average (n) - A minimum of 5 readings per determination should be taken.
- Concentration Mode - The concentration (as opposed to the absorbance) should be selected.
- Background Correction - Should be activated for all element determinations in the absorption mode.
- Burner Head - The 10 cm. burner head is generally used for all elements measured when using air/acetylene; elements measured with N₂O/acetylene require the use of the 5 cm. head.
- Slit Width - Refer to specific instrument manual for proper slit setting.
- Gas Flows - Refer to specific instrument manual for recommended flow settings. These should be checked and/or adjusted prior to each analysis.

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- h) Standard Concentrations - Working standards concentrations may be entered to account for the sample dilution factor.

Example: The Pb working standard at a concentration of 15 ppm should be entered as 1500.

5.0 REAGENTS AND MATERIALS

- 5.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 5.2 Acetylene, C_2H_2 ; Atomic Absorption Grade (minimum purity 99.6%) is recommended. Some labs have found Industrial Grade acetylene acceptable.
- 5.3 Nitrous Oxide, N_2O , Industrial or Medical Grade.
- 5.4 Air, Industrial Grade.
- 5.5 Methyl ethyl ketone (MEK)/xylenes mixture - MEK and xylenes are mixed volumetrically 10% and 90%, respectively.
- 5.6 Standards
- 5.6.1 Trace Element Standards - Organometallic Standards, Conostan Specialty Products. Available as individual elements or blends. Stock standards solutions are prepared volumetrically to the desired concentration. The following is the general formula that should be used when making stock solutions:

$$\frac{\text{Desired (Concentration of dilute std.)} \times \text{Desired (Volume of dilute std.)}}{\text{(Concentration of Stock Solution)}} = \text{Organometallic Volume Standard}$$

Example: Organometallic Std. Concentration = 500 ppm
 Desired stock solution concentration = 15 ppm
 Desired volume of stock solution = 100 ml

$$\frac{(15 \text{ ppm}) (100 \text{ ml})}{(500 \text{ ppm})} = 3 \text{ ml}$$

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Note: New standard preparations should be judged on the basis of theoretical concentration-based absorbance values. **Do not compare to a previously prepared standard.**

- 5.6.2 Recommended Standards Concentration - Working standards should be prepared at the following maximum actual concentrations:

<u>Element</u>	<u>Standard 1</u>
Ag	2
As	50
Ba	30
Be	2
Cd	2
Cr	10
Fe	5
Na	1
Ni	5
Pb	15
Sb	30
Se	50
Ti	50
Tl	30
V	50
Zn	1

These standard concentrations represent the maximum metal value for the linear, optimum concentration range. Samples exceeding these maximum values must be diluted as detailed in Section 9.5.

6.0 INSTRUMENT OPTIMIZATION

- 6.1 Items 6.2 - 6.3 should be performed as needed before instrument is placed in use. Items 6.4 - 6.6 should be performed as needed prior to the analysis for each element.
- 6.2 Burner Head Adjustment - Adjustment of the burner head (with flame off) relative to the light path is done to obtain maximum sensitivity. The height is adjusted by first lowering the head until it is well below the light beam; zeroing the read-out; slowly raising the head until it intersects the beam (this is indicated by a positive reading on the read-out); and then slowly lowered until the read-out returns to zero. At this point, the head is just below the light beam. If the burner head has been removed or appears misaligned, it may be necessary to adjust the horizontal positioning. With elements that require a fuel-rich flame, the burner height will need to be optimized by aspirating a standard solution with the flame on, and

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slowly lowering the head until a maximum signal is obtained (Recheck zero after lowering the burner and readjust if necessary).

- 6.3 Nebulizer Adjustment - Adjustment of the nebulizer must be done while running an air/acetylene element (Pb recommended). The setting determined will be suitable for nitrous oxide/acetylene elements. The optimization of the nebulizer setting is generally accomplished by the following sequence:
1. While aspirating the Pb standard, loosen the locking ring and slowly turn the nebulizer knob counter-clockwise until bubbles appear at the capillary tube end.
 2. While monitoring absorbance, slowly turn the nebulizer knob clockwise until the absorbance value is achieved.
 3. It is generally recommended that the aspiration rate should be 6 ml/minute or less. Excessive rates will reduce the efficiency of atomization and can create an overall cooling effect which will increase the tendency for chemical interferences to occur.
- 6.4 Gas Flows - Aspirate a standard solution and adjust flow until maximum absorbance is attained. Be certain to check zero after each flow level change and readjusting as necessary. As flame absorption may change with the fuel/oxidant ratio, the resultant change in zero may give deceptively high or low readings unless corrected. This step may be unnecessary on instruments equipped with automatically set gas flows.
- 6.5 Hollow Cathode Lamps - The lamps must be used at the recommended current setting. The use of single-element lamps (as opposed to multi-element) will increase the life span and increase sensitivity. Lamps must be allowed to warm-up and stabilize for a minimum of 5 minutes prior to use. Optimize the lamp alignment to the flame by adjusting the directional control knobs located at the lamp holder base. Optimal alignment is achieved at maximum absorbance or PMT output. The Energy Level or PMT value should be within normal limits. Generally, Energy Levels should not vary by more than 2 energy units, and PMT values should not vary by more than 10%.
- 6.6 Superlamps - The lamps must be used at the recommended current setting. With the external power supply on, lamps should be allowed to stabilize a minimum of 5-10 minutes. Follow the Superlamp manufacturer's recommended applied current specifications. Optimize the lamp alignment by the procedure noted in Section 6.5. After lamp alignment, optimize the external power supply output by increasing or decreasing the output to the Superlamp. Optimal alignment is achieved at maximum absorbance or PMT output. The Energy Level or PMT value should be within normal limits. Generally, Energy Levels should not vary by more than 2 energy units, and PMT values should not vary by more than 10%.

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7.0 INTERFERENCES AND LIMITATIONS

- 7.1 Because the sample is dissolved into an organic matrix prior to analyses, the main interferences are chemical and matrix.
- 7.2 Barium and titanium are partially ionized in a nitrous oxide/acetylene flame. It is recommended that a potassium or sodium ionization suppressant be used at a concentration of 2000 mg/L. This suppressant may also be added to the MEK/xlenes mixture.
- 7.3 Each element has specific interferences. In addition to chemical and matrix, spectral and ionization interferences can occur. The user should refer to the manufacturer's methods manual for details on interferences for each element.

8.0 SAMPLE

- 8.1 Sample mixture must be thoroughly mixed on a vortex mixer just prior to aspiration.

9.0 QUALITY CONTROL

- 9.1 See 6.0.
- 9.2 Instrument and related maintenance items are listed in the Maintenance and Optimization Log-Atomic Absorption Spectrophotometer.

10.0 PROCEDURE

- 10.1 The sample should be prepared at a 1% concentration following the steps below. These steps describe the preparation of a 10 ml mixture volume.
 - 10.1.1 Dispense 9.9 ml MEK/xlenes mixture into a test tube.
 - 10.1.2 Using a pipet or other suitable device, add 0.1 ml of the sample to the MEK/xlenes mixture. Rinse the pipet in the sample mixture after dispensing the sample.
 - 10.1.3 Set aside and proceed instrument set-up with 10.2.
- 10.2 Set-up instrument parameters, or recall pre-programmed setting for the element of interest, as detailed in Section 4.1.2.
- 10.3 With the exhaust fan on, ignite flame.

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- 10.4 Set the zero point of the calibration curve by aspirating the analytical blank (MEK/xylenes mixture) and depressing the "Autozero" or "Instrument Zero". It may be necessary to read the blank more than once if the reading's value widely fluctuates or is largely positive.
- 10.5 Set up the calibration curve by entering Standard #1. If the sample reading exceeds the value of the entered standard, a dilution of the sample is required.
- 10.6 Aspirate the blank mixture to flush system.
- 10.7 Mix the sample mixture by vortexing or shaking.
- 10.8 Aspirate the sample, allowing time for the sample to reach the burner flame (about 5 seconds), and depress the "Read" key.
- 10.9 Aspirate the blank mixture for about 5 seconds to purge the aspiration tube/chamber of any remaining sample.
- 10.10 Aspirate the standard and depress the Read key. This is to ensure that the calibration has remained valid. If the result of reading the standard is greater than $\pm 10\%$; Steps 10.4 through 10.10 should be repeated.
- 10.11 Aspirate the blank mixture and depress Autozero before proceeding to another sample of the same element.

11.0 REPORTING

- 11.1 Results of the sample and check standard should be printed as hard data and attached to the appropriate data/paperwork. If a printer is not on-line, the sample and check standard results should be recorded in a log book or pad. Values should not be rounded. Results below the estimated limit of detection should be recorded as less than that value.

12.0 PRECISION AND ACCURACY

- 12.1 Precision - No statement is made about the precision at this time. Future results of QA/QC exercises will be presented at a later date.
- 12.2 Accuracy - No statement is made about the accuracy because this is a screening procedure designed to give approximate values for trace elements.

13.0 REFERENCES

- 13.1 USEPA, SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (3rd Ed., Vol. 1A) Method 3040.

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Method S-1

- 13.2 USEPA, SW-846 Test Methods for Evaluating Solid Waste: Physical Chemical Methods (3rd Ed., Vol. 1A). Method 7000 Series.

Method S-2

Standard Procedure for the Microwave-Assisted Preparation of Liquid and Solid Waste in Trace Element Analysis

1.0 SCOPE

- 1.1 This procedure is for the microwave-assisted leaching of trace elements in liquid and solid wastes using nitric and hydrochloric acid. It is not applicable to aqueous wastes.
- 1.2 This procedure is useful for leaching the majority of trace metals from waste samples. It is not intended as a total digestion procedure.
- 1.3 *This procedure may involve hazardous materials, operations, and equipment. This procedure does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 TERMINOLOGY

- 2.1 Batch (as relates to microwave processing) - A group of up to 12 samples of similar matrix that are processed in the same digestion procedure/program.

3.0 SUMMARY OF PRACTICE

- 3.1 A portion of the waste is combined with nitric and hydrochloric acids in a PFA-lined digestion vessel, and heated in a pre-programmed microwave digestion unit. Following the programmed heating cycle, the vessel is vented and brought to a known volume. The sample is ready for analyses.

4.0 SIGNIFICANCE AND USE

- 4.1 Microwave assisted sample preparation is a rapid and effective procedure for leaching the majority of trace metals from industrial furnace feedstreams. It is used primarily for BIF-related analyses, but is also useful for other sample types in which a quantitative result is required.

5.0 APPARATUS

- 5.1 CEM 81D or 2000 Model Microwave Digestion Unit with auxiliary or built-in Pressure Control accessory, exhaust and automatic turntable.
- 5.2 Lined, high-pressure PFA digestion vessels.

6.0 REAGENTS AND MATERIALS

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- 6.1 Purity of Materials - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 6.2 Purity of Water - Unless otherwise indicated, references to water shall be understood to mean meeting the numerical requirements of Type II water as defined by ASTM D 1193.
- 6.3 Hydrochloric acid, 37%, HCl.
- 6.4 Nitric acid, 70%, HNO₃.
- 6.5 Potassium chloride solution (20%) - Dissolve 100 g KCl in 400 ml water. It may be necessary to place the solution on a magnetic stirrer and with the aid of a stir bar, allow the solution to mix until clear.

7.0 SAMPLE

- 7.1 Because stratification or layering of liquid samples is possible, the laboratory sample should be thoroughly mixed by shaking prior to withdrawing a portion for testing. Solid samples should be thoroughly mixed by shaking or stirring depending on the physical characteristics of the sample.

8.0 QUALITY CONTROL

- 8.1 Refer to the Maintenance and Optimization Log for specific requirements.

9.0 PROCEDURE

- 9.1 For waste-derived fuel, coal, coke, raw feed samples:

- 9.1.1 Weigh a 0.5 g portion of the sample directly in a PFA digestion vessel liner to the nearest 0.001 g.

Note: Larger sample sizes of raw feed (only) may be used. The reaction between the sample and acids will be more vigorous than with a smaller sample size (see 9.1.2).

- 9.1.2 Place the liner with sample in the digestion vessel body and with a pipet unit, or equivalent device, slowly add 8 ml HNO₃, 4 ml HCl, and 1 ml KCl solution to the PFA liner. If a chemical reaction is observed, allow the reaction to subside prior to performing Step 9.1.3. If the sample is being analyzed for K, or by ICP, do not add the KCl solution.
 - 9.1.3 Place PFA and polymer pressure controller cap on the vessel body, and hand tighten to achieve a firm fit. Do not overtighten because this can damage the sealing surface and threads.

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- 9.1.4 Be sure the pressure relief/rupture membrane screw-type fitting houses a new rupture membrane, and is tightened to finger-tightness. Do not overtighten because this can potentially deform the rupture membrane.
- 9.1.5 Place the vessel in the microwave turntable. Insert the pressure sensing line from the pressure controller into the pressure controller cap assembly and tighten to finger-tightness. Be sure the pressure sensing line is completely filled with water (from the pressure controller unit to the pressure control vessel) prior to inserting this line.
- Note: It is often effective to monitor the pressure of the vessel with the highest sample mass.
- 9.1.6 Repeat Steps 9.1.1 and 9.1.2 for 3 or 5 additional vessels. Cap these vessels with standard vessel cap assemblies. Be sure each vessel cap assembly is tightened to firmness. Evenly distribute the digestion vessels in the turntable to ensure even heating of all vessels.
- 9.1.7 It is recommended that a blank, duplicate, and a certified reference standard or a matrix spike be processed with each batch of samples. The QC items specified in a facility's WAP must be followed if analyses are done for regulatory purposes.
- 9.1.8 The samples are ready for microwave processing. Process the samples by the following the MDS 81D or MDS 2000 program. These are suggested programs that may need to be modified.

MDS 81DFor the 4 to 6 digestion vessels

<u>Sample Treatment</u>	<u>Time</u>	<u>Power Output</u>	<u>Wattage</u>	<u>Pressure Limit</u>
0.5 g Sample	1. 2 minutes	40%	252	140
8 ml HNO ₃	2. 2 minutes	0%	0	140
4 ml HCl	3. 18 minutes	80%	504	140
1 ml KCl solution	4. 10 minutes	0%	0	140

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For 10 to 12 digestion vessels

0.5 g Sample	1. 5 minutes	70%	439	140
8 ml HNO ₃	2. 2 minutes	0%	0	140
4 ml HCl	3. 22 minutes	90%	564	140
1 ml KCl solution	4. 0 minutes	0%	0	140

MDS 2000For 10 vesselsProgram Variables

Stage	(1)	(2)	(3)	(4)	(5)
Power	68%	42%	0%	0%	0%
Pressure	140	140	000	000	000
Run Time	30:00	30:00	10:00	00:00	00:00
Time at P (TAP)	06:00	10:00	10:00	00:00	00:00
Temperature	OC	OC	OC	OC	OC
Fan Speed	100%	100%	100%	100%	100%
Number of Vessels:	10				
Volume per Vessel:	12 ml				
Sample Weight:	0.5g				
Acid: HNO ₃ , HCl, KCl solution					

Note: The main heating stage (stage 2 in the above example) must be at the required maximum pressure for at least 9.5 minutes.

Generally, when the number of vessels is increased/decreased, the Power is increased/decreased 5%/vessel.

9.1.9 Following the cooling step (0 power) in Stage 1, the vessels should be cool to the touch. Additional cooling time may be necessary if vessels remain hot. Vent the vessels in a laboratory fume hood or the microwave oven cavity by slowly unscrewing the pressure relief/rupture membrane fitting. The pressure control vessel will need to be vented in the microwave in order to remove the pressure sensing line. Remove the vessel cap assemblies.

9.1.9.1 Flush the pressure sensing line with water to remove any trace acid. This is an important step, because damage will occur to the pressure controller if an acidic solution from the pressure sensing line is allowed to migrate to the pressure controller. Following the flushing, be sure to refill the pressure sensing line with water.

9.1.9.2 Quantitatively transfer digested sample solution to a clean 50 ml volumetric flask and bring to volume with water. If any particulate matter is observed, it may be removed by filtration or centrifugation.

9.1.9.3 The sample is now ready for analysis.

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Method S-2

10.0 **PRECISION AND BIAS**

- 10.1 Precision - No statement is made about the precision since this procedure does not produce a specific test result.
- 10.2 Accuracy - No statement is made about the accuracy since this procedure does not produce a specific test result.

11.0 **REFERENCES**

- 11.1 USEPA, SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd Ed., Vol. 1A). Method 3051.

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Method S-4

Standard Method for Cold Vapor Mercury Analyses of Industrial Furnace Feedstreams (Analyte 16)

1.0 SCOPE

- 1.1 This method describes the cold vapor mercury (Hg) analyses of industrial furnace feedstreams using the Analyte 16 Atomic Absorption Spectrophotometer and vapor generation accessory (VGA). It is applicable to liquid and solid feedstreams.
- 1.2 This method is quantitative.
- 1.3 *This method may involve hazardous materials, operations or equipment. This method does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 The sample is prepared by Method S-2. The Analyte 16 spectrophotometer is peaked/optimized, VGA set-up and operating, the blank, standards, digested sample solutions and quality control samples are loaded into the autosampler and the analyses is initiated. Following standardization and acceptance of the standard curve, the analyses of the unknown samples/QC samples is initiated.

3.0 SIGNIFICANCE AND USE

- 3.1 U.S. Environmental Protection Agency regulations (40 CFR 266, Subpart H, "Hazardous Waste Burned in Boilers and Industrial Furnaces", latest revision) require that cement kilns and other industrial furnaces utilizing waste-derived fuel to perform analyses for certain metals on feedstream materials at site-specific frequencies. This method describes the procedure for the analyses of feedstream materials for Hg by cold vapor atomic absorption. This method is not applicable to other elements.

4.0 APPARATUS

- 4.1 Analyte 16 Spectrophotometer with Smith-Hieftje background correction system. This unit is equipped with a 16 lamp carousel, radio frequency-boostered hollow cathode lamp accessory, nitrogen optics purge, random access autosampler. A high quality UPS or line conditioner with spike/surge suppression must be

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installed. Do not overload this protection with peripheral devices. The data handling system consists of a minimum 386 PC, printer and operational software.

- 4.2 Vapor Generation Accessory including peristaltic pump, reaction vessel, vapor cell and reagent bottles.
- 4.3 General Element Settings/Conditions

<u>Element</u>	<u>Wavelength</u>	<u>Mode</u>
Hg	253.6	Absorption

5.0 REAGENTS AND MATERIALS

- 5.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 5.2 Nitrogen, Pre-Purified or Ultra-Pure grade.
- 5.3 Stannous chloride dihydrate solution, $\text{SnCl}_2 \cdot \text{H}_2\text{O}$: Dissolve 125 g SnCl_2 in 100 ml HCl. This should be done on a hot plate/magnetic stirring unit. Heat the SnCl_2 and HCl under gentle heat and stirring until mixture is clear. Bring this solution to a final volume of 500 ml. This solution may degrade if not used within a few days.
- 5.4 Antifoaming Agent, Dow Corning silicone emulsion 10% solution, or equivalent. Added to the VGA water vessel to yield a concentration between 0.05 - 0.1%. [Optional]
- 5.5 Nitric acid, 70%, HNO_3 .
- 5.6 Hydrochloric acid, 37%, HCl.
- 5.7 Wash Vessel (Jug #2): Mixture of water, HCl, HNO_3 , and KCl solution to be representative of standard/sample solutions.
- 5.8 Glass Pipettes, graduated.
- 5.9 Positive displacement pipettors for 1/5/10 ml glass pipettes.
- 5.10 Stock Hg Standard, 10 parts per million (ppm). Other stock concentrations may be used; this standard is available from Inorganic Ventures, Inc. This standard is

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serial diluted to make the calibration standards. General instructions are given in 5.11.

- 5.11 General instructions for preparing Hg standards mix from 10 ppm stock standard are as follows:

Stock Hg Standard

- 1) Using a 100 ml volumetric flask, combine 50 - 75 ml water, 5 ml HCl, and mix by swirling or with magnetic stirrer. Pipette 10 ml from the 10 ppm Hg stock standard and add to the water/acid mixture. Bring to the final 100 ml volume with water and mix thoroughly. This is the 1 ppm stock Hg standard.
- 2) Two techniques for making calibration standards are described below. Both use the 1 ppm stock Hg standard described above. The concentrations listed below are recommended, but are presented as guidance.

Technique #1

- 1) 5 ppb
Using a dedicated 100 ml volumetric flask, combine 50-75 ml water and 5 ml HCl. Pipette 0.5 ml of the 1 ppm stock Hg standard, bring to 100 ml volume with water and mix thoroughly.
- 2) 10 ppb
Using a dedicated 100 ml volumetric flask, combine 50-75 ml water and 5 ml HCl. Pipette 1.0 ml of the 1 ppm stock Hg standard, bring to 100 ml volume with water and mix thoroughly.
- 3) 20 ppb
Using a dedicated 100 ml volumetric flask, combine 50-75 ml water and 5 ml HCl. Pipette 2.0 ml of the 1 ppm stock Hg standard, bring to 100 ml volume with water and mix thoroughly.

Technique #2

- 1) Using a 500 ml volumetric flask, combine 200-300 ml water and 25 ml HCl. Add 50 ml of the 1 ppm stock Hg standard using a 50 ml volumetric flask and mix thoroughly. This yields a 100 ppb working Hg standard.
- 2) 5 ppb
Using a new 500 ml volumetric flask, combine 200 - 300 ml water and 25 ml HCl. Using a 25 ml volumetric flask, add 25 ml of the 100 ppb Hg standard and mix thoroughly.

- 3) 10 ppb
Using a new 500 ml volumetric flask, combine 200 - 300 ml water and 25 ml HCl. Using a 50 ml volumetric flask, add 50 ml of the 100 ppb Hg standard and mix thoroughly.
- 4) 20 ppb
Using a new 500 ml volumetric flask, combine 200 - 300 ml water and 25 ml HCl. Using a 100 ml volumetric flask, add 100 ml of the 100 ppb Hg standard and mix thoroughly.
- 5.12 Serial dilutions of a 100 ppb working standard is also an acceptable technique if HCl concentrations are kept constant.

Note: Technique #2 is a more accurate method in which to prepare low concentration Hg solutions. Technique #1 is susceptible to greater error because of the small volumes used.

6.0 INSTRUMENT POWER-UP/WAKE-UP

Note: Computer keystrokes are written in boldface.

- 6.1 Turn ON the computer and all other peripheral devices. Note: The Analyte 16 is left ON at all times except during service.
- 6.2 Turn ON nitrogen gas supply. Note: The nitrogen tank supplying the optics purge remains ON at all times.
- 6.3 The data system PC will boot-up with "C:\AA16". Type **F** and **ENTER**. The Master Menu will be displayed on the screen.
- 6.4 Type **W** (Wake-Up). Press **ENTER** key to wake-up unit (HCLs will come on and burner positioner will move horizontally).

7.0 INSTRUMENT OPTIMIZATION

- 7.1 Hollow Cathode Lamp Peaking
- 7.1.1 HCL should be allowed to warm-up for at least 10 min. before proceeding.
- 7.1.2 Depress **ESCAPE** returning to Master Menu.

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- 7.1.3 Depress **L** for Lamp Peaking. This should be done *at a minimum of weekly*.
- 7.1.4 Depress **W** for Wavelength Peaking; type the name of the method; and depress **F1**, to peak the Hg lamps. This should be done *at a minimum of daily* and should be performed *prior to running any analyses*.
- 7.2 Burner Head Adjustment
 - 7.2.1 Depress **ESCAPE** to return to Master Menu.
 - 7.2.2 Type **O** for Other runs; **B** for Burner Adjust; **W** for particular element; type **Hg** and **ENTER**; and **R** for Run.
 - 7.2.3 Place vapor cell and holding bracket on burner head.
 - 7.2.4 If the burner height has been changed (i.e., switching from flame to cold vapor), re-position to the optimal absorbance.
 - 7.2.5 Absorbance readings will be taken about 1 per second and displayed sequentially in columns on the screen. The burner position/head is moved in & out by using the Up & Down computer arrow keys. Movement step sizes range from 0 - 9. A step size of 9 provides a larger step and is used for moving the positioner to the coarse area. A step size of 3 - 4 is provides for smaller step and is used for the fine adjustment of the positioner.
 - 7.2.6 Depress the up & down arrow keys (step size 9) until the desired absorbance is achieved. The instrument briefly stops taking absorption readings at specific intervals in order to take a reference reading. No movement of the positioner should take place during this reference period. When the desired absorbance is achieved, change the step size to 3 or 4.
 - 7.2.7 Depress the up & down arrow keys (step size 3 or 4) to further optimize the absorbance. When the desired absorbance is achieved, depress **I** to set the In Position.
 - 7.2.8 The out position is not routinely set. If resetting is necessary, depress the arrow keys (step size 9) to move the positioner out of the light path until the absorbance is as low as possible. Note: Ideally the lowest absorbance should be 0.0000, but it is most common to achieve a slightly positive or negative absorbance. Depress **O** to set the Out Position.

8.0 INSTRUMENT SET-UP

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- 8.1 Return to the Run Screen.
- 8.2 Type **O** for Other Runs; **A** for Autosampler; and **A** for Autosampler Set-up.
- 8.3 The Autosampler Set-Up screen is displayed and is recommended to be set up as follows:

Auto Calibration	Y
Stop at Curve Fit	Y
Auto Dilution	N
Runs per Sample/Std.	3
Print Data Logging	Y
Auto Log to File	Y
High Speed Delivery Times (sec)	
Wash	20 (<i>minimum</i>)
Sample	20
Delay Times (sec)	
Wash	60
Sample	60
Steady State During Wash	0
Steady State for Samples/Std.	0

- 8.4 Depress **F6** for the Sample Set-Up Screen. If the blank and standards are not already entered, do so at this time.
- 8.5 Enter information for the first sample, and depress **F7** to enter sample dilution information. Repeat this procedure to enter additional samples.
- 8.6 When finished, depress **ESCAPE** and type **Y** to save entered standard/sample information. The Autosampler screen will be displayed.

9.0 AUTOSAMPLER RUN

- 9.1 Place the blank, standards and samples in their appropriate positions in the test tube racks, and depress **R** for Run.

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- 9.2 Enter Log Name. The autosampler will proceed to the wash, and then to the first tube (blank) in the calibration rack.
- 9.3 Following the analysis of the last standard, the system will stop and allow the user to view the calibration curve. The user should select Second Order for the calibration curve fit. The curve should be checked and a hard copy may be printed. If the curve is significantly off, the system should be examined to determine and correct the problem and the calibration must be re-run. When the curve is acceptable, type **ALT F2** to install and the system will proceed with the analyses of the samples.

10.0 ASPIRATION SYSTEM CLEAN-OUT (IF SO EQUIPPED)

- 10.1 After samples are analyzed, type **M** to call up the Wash Method. Highlight "Wash" and **ENTER**; **R** for Run; type *WASH* for the log file name; **R** for replacing existing log file name.
- 10.2 The sipper will aspirate from the wash for 5 minutes.
- 10.3 After the wash out is complete and the instrument will not be used further, depress **ESCAPE** to return to the Master Menu; type **W** for Wake/Sleep and **ENTER**.

11.0 INTERFERENCES AND LIMITATIONS

- 11.1 Particulate material will interfere with the digested sample aspiration and atomization. Digestions must be centrifuged and/or filtered prior to decanting to test tubes.
- 11.2 To minimize or eliminate excessive foaming reactions in the reaction cell, the antifoaming agent should be used.
- 11.3 Element specific interferences may affect some analyses. If excessive interferences significantly affect analytical quality, the method of standard additions should be considered.
- 11.4 The length of time that HCLs are left ON and the operation of the background correction system can shorten lamp life and cause them to give inconsistent output when their condition is deteriorating. HCL condition is generally gauged by monitoring PMT voltages. A minimum of 1 set of spare HCLs for all elements must be on-hand at all times.
- 11.5 The reaction vessel and vapor cell *must* be kept extremely clean. With increased use, the reaction vessel will show a waxy, particulate build-up that will affect

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analytical performance. The vapor cell over time will visibly show signs of contamination; however, it should be cleaned often because surface contamination (e.g., fingerprints, acid residue) is not always noticeable.

- 11.6 Discolored or deformed tubing must be replaced to ensure effective, consistent solution delivery.
- 11.7 To prevent contamination, glassware or plasticware associated with standards/sample preparation, or associated with the Analyte 16 must be kept clean. This is usually accomplished by washing items with a high quality detergent; rinsing with water; rinsing with aqua regia solution; and triple rinsing with water.
- 11.8 Metallic ions which are reduced to the elemental state by stannous chloride can interfere with the cold vapor method. They can amalgamate or form stable compounds with mercury. The absence of non-atomic absorption is typically verified through our routine QC.

12.0 SAMPLE

- 12.1 Particulate material can interfere with the digested sample aspiration and reaction. Digestions must be centrifuged and/or filtered prior to decanting to test tubes.

13.0 QUALITY CONTROL

- 13.1 All quality control items and data quality objectives listed in the site WAP must be followed. The following items may or may not be a part of a site WAP but should be followed to ensure data quality.
- 13.2 The detection limit using the Analyte 16 system was determined in accordance with U.S. EPA SW-846, Update I, July 1992. This limit will vary from system to system and is dependent upon the degree of sample dilution. A 100X dilution has been factored into the limits below. It is presented as a range to account for system-to-system variability.

<u>Element</u>	<u>MDL (ppm)</u>
Hg	0.4 - 1.0

- 13.3 A daily check shall be made of the HCL PMT voltage.
- 13.4 Analyte concentrations beyond the linear range of calibration must be diluted.
- 13.5 A Reagent Analytical Blank per prepared batch can be run to determine contamination.

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- 13.6 A minimum of 1 Method Blank per analytical batch must be run to determine contamination and occurrence of memory effects.
- 13.7 The Rinse Blank, prepared with the same acids used in the sample preparation must be aspirated between each sample and standard. It should be aspirated for a sufficient time to ensure the sample introduction is adequately flushed.
- 13.8 An Initial Calibration Verification (ICV) standard must be analyzed following calibration. The results should agree within 10% of the known value. If not, terminate the analysis, correct the problem and repeat calibration.
- 13.9 Verify the instrument calibration at a frequency of 10% or at the end of each batch using a low or mid-range check standard. The results of the check standard should agree within 20% of the known value. If not, terminate the analysis; correct the problem and reanalyze. Correcting the problem may be as simple as resloping or restandardizing or attending to a hardware problem.

14.0 **REPORTING**

- 14.1 Results should be reported on appropriate paperwork or forms for submitting data to management or cement plant personnel. Hard copies of data must be archived in an appropriate filing system. Hard copy data should contain only data, justified error corrections and when necessary, notes concerning data quality. Do not write unwarranted comments on lab data.

15.0 **REFERENCES**

- 15.1 U.S. EPA, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd Ed., Vol. 1A). Methods 7471.

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Method S-5

S-5 Standard Method for Inductively-Coupled Argon Plasma Analysis of Industrial Furnace Feedstreams for Trace Elements

1.0 SCOPE

- 1.1 This method describes the metals analysis of industrial furnace feedstreams using an inductively-coupled argon plasma spectrometer. It is applicable to solid and liquid feedstreams.
- 1.2 This method is applicable to instruments with radial or axial torch configurations.
- 1.3 This method is quantitative.
- 1.4 Use of this method is restricted to analysts trained in the use of the ICP and are knowledgeable in the correction of chemical, spectral and physical interferences.
- 1.5 This method provides general instruction for trace element analysis using an ICP. Because of instrumental differences, the user is directed to the specific manufacturers operating manual for detailed operating information.
- 1.6 This method describes the procedure for the analyses of feedstream materials for Ag, As, Ba, Be, Cd, Cr, Ni, Pb, Sb, Se and Tl. This method is applicable to other elements.
- 1.7 *This method may involve hazardous materials, operations or equipment. This method does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 The sample is prepared by Method S-2 or S-11. The ICP is set-up and performance verified according to the manufacturer's specifications and programmed with the proper analytical settings (wavelength selection, reporting specifics, flush times, integration times, etc.). The appropriate background correction is determined for each element/sample matrix. The blank, standards, samples and quality control standards are loaded in the autosampler and the analysis is initiated.

3.0 SIGNIFICANCE AND USE

- 3.1 U.S. Environmental Protection Agency regulations HW MACT require that cement kilns and other industrial furnaces utilizing waste-derived fuel to perform analyses for certain metals on feedstream materials at site-specific frequencies.

4.0 APPARATUS

- 4.1 Inductively-Coupled Argon Plasma emission spectrometer equipped with a radio frequency generator (27 Mhz or 40 Mhz) and the following accessories/features:
- 4.1.1 Computer-based data handling system and printer.
 - 4.1.2 Computer-controlled autosampler.
 - 4.1.3 Wavelength range: 160 - 460 nm.

5.0 REAGENTS AND MATERIALS

- 5.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 5.2 Purity of Water - Unless otherwise indicated, references to water shall be understood to mean meeting the numerical requirements of Type II water as defined by ASTM D 1193.
- 5.3 Argon, Ar.
- 5.4 Nitric acid, 70%, HNO_3 .
- 5.5 Hydrochloric acid, 37%, HCl .
- 5.6 Volumetric Flasks.
- 5.7 Glass pipets, graduated.
- 5.8 Positive displacement pipetors.
- 5.9 Stock Element Standards: 1000 ppm of Ag, As, Ba, Be, Cd, Cr, Ni, Pb, Sb, Se and Tl, aqueous solution in dilute HNO_3 or HCl depending on element and source.
- 5.10 Multielement Calibration Standards: Mixed standards should be prepared by combining appropriate volumes of stock solutions in volumetric flasks. The following guidance applies to the preparation of multielement calibration:

- 5.10.1 Volumetric glassware should be used.
- 5.10.2 Increased accuracy and reproducibility can be achieved if multielement standards are prepared from working standards instead of directly from the stock element standards (5.7). Using volumetric glassware, stock element standards can be diluted to lower concentration working standards.
- 5.10.3 Mixed standards should be matrix matched with the appropriate acids/concentrations present in the prepared samples.
- 5.10.4 All elements may not be stable in a single mix. The user may need to have 2 or 3 multielement standard mixes.
- 5.10.5 All mixed standards should be initially scanned to verify the absence of interelement spectral interferences.
- 5.11 Multielement calibration standards can be purchased from various inorganic standard companies. The user should determine potential spectral interferences prior to ordering. Most standard companies will be able to provide guidance in this area.
- 5.12 The suggested high level calibration standard concentration are given below. Concentrations are in ppm.

Ag	5	Cr	10
As	10	Pb	20
Ba	15	Sb	20
Be	2	Tl	5
Cd	2	Ni	5
		Se	5

6.0 INTERFERENCES

- 6.1 Interferences generally fall into the categories of spectral, chemical and physical. In comparison to those observed in flame atomic absorption/emission, interferences in ICP analyses are more numerous and troublesome because of the plasma's higher excitation energies.
- 6.1.1 Spectral: Caused by:
- 1) overlap of a spectral line from another element at the analytical or background wavelength;
 - 2) unresolved overlap of molecular band spectra caused when the sample contains constituents that give rise to molecular species;
 - 3) background contribution from continuum or recombination phenomena;

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4) stray light from the line emission of high concentration elements.

Spectral can be compensated for by computer-correcting raw data after monitoring and measuring the interfering element. Unresolved overlap requires selection of an alternate wavelength. Background contribution and stray light can usually be compensated for by a background correction adjacent to the analyte line. Generally, the higher resolution instruments are better able to resolve spectral interferences.

Table 1 lists recommended wavelengths and potential spectral interferences. This is a general list that is to be considered a guide for potential interferences.

Table 1. Recommended Element Wavelengths and Potential Interferences¹

<u>Analyte</u>	<u>RecommendedAlternate</u>		<u>Potential Interferent²</u>
	<u>Wavelength</u>	<u>Wavelength</u>	
Ag	328.068	338.289	-
Al	308.215 ³	396.152	Mn, V, Pb
As	193.696	189.042	Al, Cr, V
Ba	455.403	493.409	-
Be	313.042	234.861	Tl, V
Cd	226.502 ³	214.438	Fe, Ni
Cr	267.716 ³	205.552	Fe, Mn, V
Cu	324.754	224.700	Fe, Tl, V, Zn
Fe	259.940 ³	238.204	Mn
K	766.491	769.896	
Mn	257.610	259.373	Al, Cr, Fe, Mg
Na	588.995 ³	589.592	Tl
Ni	231.604 ³	221.647	-
Pb	220.353	216.999	Al, Na
Sb	206.833	217.581	Al, Cr, Fe, Tl, V
Se	196.026	203.985	Al, Fe
Tl	190.864	276.787	Al
V	292.402 ³	309.311	Cr, Fe, Tl
Zn	213.856	202.548	Cu, Ni

¹ Taken from USEPA Method 6010A and miscellaneous industry references.

² Interference measured at 100 mg/L.

³ Non-primary wavelength.

Because spectral interferences are very sample specific, the user should refer to the manufacturer's element wavelength guide to ascertain potential primary and secondary line interferences. Table 2 lists typical high concentration elements in feedstream samples. This is intended as a basic reference. It is useful to periodically analyze an interference check sample containing potentially interfering elements (typically at 100 ppm).

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Table 2. Higher Concentration Elements in Feedstreams¹

<u>Feedstream</u>	<u>Element</u>
Raw Feed	Si, Al, Ca, Fe, Mg, K
Coal/Coke	Si, Al, Ca, Fe, Mg, K, Na, As, Cr, Cu, Mn, Ni, Sr, V, Zn, Ba, Ti
Waste-Derived Fuel	Si, Al, Fe, K, Na, Zn, Ti, Ba, Cr, Cu, Pb

¹ This table is not specific as to primary or secondary lines. Some elements such as Fe have thousands of emission lines that can be potential interferents.

6.1.2 Chemical: Causes include molecular compound formation, ionization effects and solute vaporization effects. Normally, these effects are minimal with this technique. If observed, they can be minimized by careful selection of operating conditions (incident power, observation position, etc.), by buffering of the sample, by matrix matching and by standard additions.

6.1.3 Physical: Associated with the sample nebulization and transport processes. Changes in viscosity and surface tension can cause significant inaccuracies, especially in samples containing high dissolved solids or high acid concentrations. Samples with high dissolved solids can cause a salt build-up on the nebulizer tip affecting the aerosol flow. Changing or cleaning the nebulizer can be used as a control measure. It has also been reported that better control of the argon gas flow improves overall instrument performance.

7.0 SAMPLE

7.1 The suspended solids in the digested sample must be removed by filtration or centrifugation prior to analysis. Depending on the element concentration and calibration, the sample may require dilution to be within the calibration scale.

8.0 QUALITY CONTROL

8.1 All quality control items and data quality objectives listed in the site WAP must be followed. The following items may or may not be a part of a site WAP but should be followed to ensure data quality.

8.2 Analyte concentrations beyond the linear range of calibration must be diluted or analyzed using a less sensitive emission line. Most instruments can be set-up to analyze multiple-element emission lines in a single analysis procedure.

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- 8.3 A Reagent Analytical Blank per prepared batch can be run to determine contamination.
- 8.4 A minimum of 1 Method Blank per analytical batch must be run to determine contamination and occurrence of memory effects.
- 8.5 The Rinse Blank, prepared with the same acids used in the sample preparation must be aspirated between each sample and standard. It should be aspirated for a sufficient time to ensure the sample introduction is adequately flushed.
- 8.6 A 50 mg/L (recommended) concentration of Yttrium should be present in all blanks, standards, spikes and samples as a surrogate. The surrogate addition should be done post-digestion. The surrogate is used relatively to assess the solution delivery system and operating configurations.
- 8.7 When initially setting up the instrument or when a new or unusual sample matrix is encountered, a series of tests should be performed prior to reporting concentration data for analyte elements. The suggested tests given below will ensure the user that neither positive or negative interferences are skewing analytical accuracy.
- 8.7.1 Serial Dilution: If the analyte concentration is sufficiently high, an analysis of a 25% dilution should agree within $\pm 10\%$ of the original determination. If not, a chemical or physical interference effect should be suspected.
- 8.7.2 Post Digestion Spike: An analyte spike added to a portion of a prepared sample or its dilution should be recovered to within $\pm 25\%$ of the known value. If the spike is not recovered within the specified limits, a matrix effect should be suspected.

Note: If spectral overlap is suspected, the use of computerized deconvolution, alternate wavelength or comparison with an alternate method is recommended. It is also appropriate to use matrix spikes, duplicates, reference materials and standards for this purpose.

- 8.8 An Initial Calibration Verification (ICV) standard must be analyzed following calibration. The results should agree within 10% of the known value. If not, terminate the analysis, correct the problem and repeat calibration.
- 8.9 Verify the instrument calibration at a frequency of 10% using a low or mid-range check standard. The results of the check standard should agree within 20% of the known value. If not, terminate the analysis; correct the problem and reanalyze.

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Correcting the problem may be as simple as resloping or restandardizing or attending to a hardware problem (e.g. dirty nebulizer tip, peristaltic pump tubing, etc.).

- 8.10 Prior to any calibration or analysis, the instrument must be allowed to equilibrate.
- 8.11 Instrument and related maintenance and optimization items are listed in the Maintenance & Optimization Log - ICP.

9.0 PROCEDURE

- 9.1 The sample is prepared by SAMM Method S-2 or S-11.
- 9.2 The instrument should be set-up, optimized and operationally verified according to the instructions from the manufacturer.
- 9.3 Profile and calibrate the instrument according to the instrument manufacturers recommended procedures using the analytical standards as specified in section 5.0. The sample introduction system must be flushed with the calibration blank as specified in 8.5.

10.0 REPORTING

- 10.1 All results are to be reported in parts per million (ppm) generally understood to be mg/kg. All quality control data specified in section 8.0 is to be reported with sample data.

11.0 PRECISION AND BIAS

- 11.1 The precision and bias is taken directly from 6010B. The true bias of this test method has not been determined because there are no recognized reference feedstream materials.
- 11.2 Detection limits using the Spectro Modula (axial plasma) were determined in accordance with the current promulgated method found in USEPA SW-846, Vol. 1A, Chapter 1. These limits will vary from system to system and are dependent upon the degree of sample dilution. A 100X dilution has been factored into the limits below. They are presented as ranges to account for system-to-system variability.

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Element	MDL (mg/kg) (Range)	Element	MDL (mg/kg) (Range)	Element	MDL (mg/kg) (Range)
Ag	0.4 - 0.8	Be	0.1 - 0.3	Pb	2.0 - 4.0
As	2.0 - 4.0	Cd	0.1 - 0.4	Sb	2.0 - 4.0
Ba	0.1 - 0.3	Cr	0.8 - 1.5	Tl	0.5 - 1.0

11.3 Method Performance - In an interfacility round robin exercise, a secondary oil-based reference sample was distributed to 2 laboratories. This sample contained a reference value for Ag, Ba, Cd, Cr, Pb and Sb. The table below gives the analytical results and summary statistics.

Element	Reference Value KS	AL	X	—	% Recovery (mean)
Ag	18	15.5	20	17.8	98.9
Ba	1135	1065	1035	1050	92.5
Cd	29	25.9	27	26.5	91.4
Cr	300	381	278	330	110.0
Pb	425	415	385	400	94.1
Sb	80	79.3	95	87	108.8

12.0 REFERENCES

12.1 U.S. EPA, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd Ed., Vol. 1A) Method 6010B.

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Method S-6

Standard Method for Cold Vapor Mercury Analyses of Industrial Furnace Feedstreams (MHS-10)

1.0 SCOPE

- 1.1 This method describes the cold vapor mercury (Hg) analyses of industrial furnace feedstreams using the Perkin-Elmer 5000 atomic absorption spectrophotometer with MHS-10 accessory. It is applicable to liquid and solid feedstreams.
- 1.2 This method is quantitative.
- 1.3 This method is only applicable for Hg.
- 1.4 *This method may involve hazardous materials, operations or equipment. This method does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 The sample is prepared by Method S-2. The PE 5000 is peaked and optimized and the MHS-10 set-up and operating. The blank and three standards are run for standardization. The unknown samples and QC samples are then analyzed.

3.0 SIGNIFICANCE AND USE

- 3.1 U.S. Environmental Protection Agency regulations (40 CFR 266, Subpart H, "Hazardous Waste Burned in Boilers and Industrial Furnaces", latest revision) requires that cement kilns and other industrial furnaces utilizing waste-derived fuel (WDF) to perform analyses for certain metals on feedstream materials at site specific frequencies. This method describes the procedure for the analyses of feedstream materials for Hg by cold vapor atomic absorption.

4.0 APPARATUS

- 4.1 Perkin-Elmer 5000 spectrophotometer with deuterium background correction system. It is recommended that the unit be equipped with an autosampler, a high quality UPS or line conditioner with spike/surge suppression and printer.
 - 4.1.1 General instrument settings/selections.

a) Time - Each reading should be 15 seconds in length.

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- b) Average (n) - A minimum of 3 readings per determination should be taken.
- c) Concentration Mode - This mode (as opposed to absorbance) should be selected.
- d) Slit Width - Refer to specific instrument manual for proper slit setting.
- e) Argon flow - Refer to specific instrument manual for recommended flow settings.
- 4.2 MHS-10 vapor generation accessory including reaction vessel, reagent bottles, inert tubing and vapor cell.
- 4.3 General Element Settings/Conditions:
- | <u>Element</u> | <u>Wavelength</u> | <u>Mode</u> |
|----------------|-------------------|-------------|
| Hg | 253.6 | Absorption |
- 5.0 **REAGENTS AND MATERIALS**
- 5.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 5.2 Purity of Water - Unless otherwise indicated, references to water shall be understood to mean meeting the numerical requirements of Type II water as defined by ASTM D 1193.
- 5.3 Stannous chloride dihydrate solution, $\text{SnCl}_2 \cdot \text{H}_2\text{O}$: Dissolve 125 g SnCl_2 in 100 ml HCl. This should be done on a hot plate/magnetic stirring unit. Heat the mixture under gentle heat until the mixture is clear. Bring this solution to a final volume of 500 ml. This solution may degrade if not used within a few days.
- 5.4 Antifoaming agent, Dow Corning silicone emulsion 10% solution, or equivalent. Added to the MHS-10 water vessel to yield a concentration between 0.05% - 0.1%. [optional]
- 5.5 Nitric acid, 70%, HNO_3 .
- 5.6 Hydrochloric acid, 37%, HCl.

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- 5.7 Wash vessel: Mixture of water, HNO_3 and HCl to be representative of standard/sample solutions.
- 5.8 Glass pipets, graduated.
- 5.9 Positive displacement pipettors for 1/5/10 ml glass pipets.
- 5.10 Stock Hg Standard, 10 parts per million (ppm).
- 5.11 General instructions for making 3 calibration standards (25, 12.5, 6.25 ppb) from the 10 ppm stock are as follows:
- Fill a clean 10 ml volumetric flask to volume with the 10 ppm stock standard. Set aside.
 - Add 5 ml HCl to a clean 100 ml volumetric flask. Add the 10 ml stock standard from step a) and bring to volume with water. Mix very thoroughly. This yields the 1 ppm working standard (shelf life = 30 days). Set aside.
 - Fill a clean 10 ml volumetric flask to volume with the 1 ppm working standard. Set aside.
 - Add 5 ml HCl to a clean 100 ml volumetric flask. Add the 10 ml working standard from step c) and bring to volume with water. Mix very thoroughly. This yields the 100 ppb working standard (shelf life = 7 days).
 - Fill a clean 25 ml volumetric flask to volume with the 100 ppb working standard. Set aside.
 - Add 5 ml HCl to a clean 100 ml volumetric flask. Add the 25 ml working standard from step e) and bring to volume with water. Mix very thoroughly. This yields the 25 ppb calibration standard (shelf life = 1 day).
 - Fill a clean 25 ml volumetric flask to volume with the 25 ppb calibration standard. Set aside.
 - Add 2-3 ml HCl to a clean 50 ml volumetric flask. Add the 25 ml working standard from step g) and bring to volume with water. Mix very thoroughly. This yields the 12.5 ppb calibration standard (shelf life = 1 day).
 - Fill a clean 25 ml volumetric flask to volume with the 12.5 ppb calibration standard. Set aside.

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- j) Add 2-3 ml HCl to a clean 50 ml volumetric flask. Add the 25 ml calibration standard from step g) and bring to volume with water. Mix very thoroughly. This yields the 6.25 ppb calibration standard (shelf life = 1 day).

Volumetric glassware should be used for all stages of the preparation. Pipets are to be avoided. Larger volumes of standards may be prepared but the user must be mindful of the shelf life of each solution.

6.0 INTERFERENCES

- 6.1 To minimize or eliminate excessive foaming in the reaction cell, the antifoaming agent should be used.
- 6.2 Element specific interferences may affect some analyses. If excessive interferences significantly affect analytical quality/results, the method of standard additions should be considered.
- 6.3 The length of time that HCLs are left ON can shorten lamp life and cause them to give inconsistent output when their condition is deteriorating. HCL condition is generally gauged by PMT voltages. A minimum of 1 spare HCL for Hg should be on hand at all times.
- 6.4 The reaction vessel and vapor cell must be kept extremely clean. With increased use, the reaction vessel can develop a waxy, particulate build-up that will affect analytical performance. The vapor cell over time can visibly show signs of contamination. Because these signs are not always noticeable, it should be periodically cleaned whether visible signs are present or not.
- 6.5 Discolored or deformed tubing must be replaced to ensure effective, consistent solution delivery.
- 6.6 To prevent contamination, glassware or plasticware associated with standards/sample preparation must be kept clean. This is usually accomplished by washing items with a high quality detergent; rinsing with water; rinsing with aqua regia and allowed to sit 5-10 minutes; and triple rinsing with water.
- 6.7 Metallic ions which are reduced to the elemental state by stannous chloride can interfere with the cold vapor method. They can amalgamate or form stable compounds with mercury. The absence of non-atomic absorption is typically verified through our routine QC.

7.0 SAMPLE

- 7.1 Particulate material will interfere with the digested sample aspiration/transport and reaction. Digestions may need to be centrifuged or filtered prior to analyses.

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8.0 QUALITY CONTROL

- 8.1 All quality control items and data quality objectives listed in the site WAP must be followed. The following items may or may not be a part of a site WAP but should be followed to ensure data quality.
- 8.2 The detection limit for cold vapor Hg analysis by this technique was determined in accordance with U.S. EPA SW-846, 3rd Ed., Chapter 1. This limit will vary from system to system and is dependent upon the degree of sample dilution. A 100X dilution has been factored into the limits below. It is presented as a range to account for system-to-system variability.

<u>Element</u>	<u>MDL (ppm)</u>
Hg	0.4 - 1.0

- 8.3 Print or otherwise record in an appropriate log the PMT voltage for the Hg HCL.
- 8.4 Analyte concentrations beyond the linear range of calibration must be diluted.
- 8.5 A Reagent Analytical Blank per prepared batch can be run to determine contamination.
- 8.6 A minimum of 1 Method Blank per analytical batch must be run to determine contamination and occurrence of memory effects.
- 8.7 The Rinse Blank, prepared with the same acids used in the sample preparation must be aspirated between each sample and standard. It should be aspirated for a sufficient time to ensure the sample introduction is adequately flushed.
- 8.8 An Initial Calibration Verification (ICV) standard must be analyzed following calibration. The results should agree within 10% of the known value. If not, terminate the analysis, correct the problem and repeat calibration.
- 8.9 Verify the instrument calibration for each element at a frequency of 10% or at the end of each batch using a low or mid-range check standard. The results of the check standard should agree within 10% of the known value. If not, terminate the analysis; correct the problem and reanalyze. Correcting the problem may be as simple as resloping or restandardizing or attending to a hardware problem.

9.0 PROCEDURE

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9.1 Prepare the PE 5000 for analysis. Refer to the instrument operations manual and to Section 4.1.1. The HCL should be allowed to warm up for approximately 10 minutes.

9.2 Prepare the MHS -10 for analysis.

Note: For any reading, the plunger and read button must be pressed simultaneously. Continue to depress the plunger throughout the entire 15 second read time. Do not exceed the 15-second read time or liquid will be forced into the vapor cell tubing resulting in contamination. The AA display will flash and display the reading at the end of the 15 seconds. The plunger should be released at this time.

9.2.1 Place the calibration blank onto the MHS-10 and begin aspiration. Read the blank and then press Autozero.

9.2.2 Read the S1 standard and depress the S1 key to store the reading.

9.2.3 Repeat 9.3.2 for S2 and S3.

Note: It is necessary to wait 1-2 minutes between readings to rezero.

9.2.4 Reread S2. The concentration reading should not vary by more than 10%.

9.2.5 Reread the calibration blank.

9.2.6 Begin analysis of unknown samples and quality control samples.

10.0 REPORTING

10.1 Results should be reported on appropriate paperwork or forms for submitting data to management or cement plant personnel. Hard copies of data must be archived in an appropriate filing system. Hard copy data should contain only data, justified error corrections and when necessary, notes concerning data quality. Do not write unwarranted comments on lab data.

11.0 REFERENCES

11.0 U.S. EPA, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd Ed., Vol. 1A) Method 7471.

ASTM D5839: Standard Test Method for Trace Element Analysis of Fuel Quality Waste by Energy-Dispersive X-Ray Fluorescence Spectrometry¹

1.0 SCOPE

- 1.1 This test method applies to the determination of trace element concentrations by energy-dispersive x-ray fluorescence (EDXRF) spectrometry in typical liquid fuel quality waste (FQW) used by industrial furnaces.
- 1.2 This test method has been used successfully on numerous samples of FQW which are mixtures of solvents, oils, paints, and pigments for the determination of the following elements: Ag, As, Ba, Cd, Cr, Hg, Ni, Pb, Sb, Se, and Tl.
- 1.3 This test method also may be applicable to elements not listed above and to the analysis of trace metals in organic liquids other than those used as FQW.
- 1.4 *This standard does not purport to address all of the safety concerns, if any associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 REFERENCED DOCUMENTS

- 2.1 ASTM Standards: C 982 Standard Guide for Selecting Components for Energy-Dispersive X-Ray Fluorescence (XRF) Systems.²

Other ASTM documents: ASTM Data Series DS 46 X-Ray Emission Wavelengths and KeV Tables for Nondiffractive Analysis.³

3.0 SUMMARY OF TEST METHODS

- 3.1 A weighed portion of the sample is transferred to a porcelain evaporating dish and placed on a hot plate. The sample is heated for 15 to 30 minutes at a temperature not exceeding 105EC to evaporate highly volatile components. The dish is removed from the hot plate and allowed to cool. Graphite powder is blended with the evaporated sample until a homogeneous paste is produced and the sample weight is recorded. The blended sample is inserted in a disposable sample cup and placed in the x-ray spectrometer for analysis.

¹ This test method is under the jurisdiction of ASTM Committee D 34 on Waste Management and is the direct responsibility of Subcommittee D34.02 on Physical and Chemical Characterization.

² Annual Book of Standards, Vol. 12.01.

³ 1970 Manual available from ASTM, Philadelphia, PA (Library of Congress No. 71-121001/ISBN 0-8031-2006-0).

- 3.2 The K spectral x-ray emission lines are used for Ag, As, Ba, Cd, Cr, Ni, Sb, and Se.

- 3.3 The L spectral x-ray emission lines are used for Hg, Pb, and Tl.

4.0 SIGNIFICANCE AND USE

- 4.1 The analysis of trace elements is often a regulatory and process specific requirement for facilities utilizing FQW. With proper instrument standardization, set-up, and quality control, this method provides the user an accurate, rapid, nondestructive method for trace element determinations.

5.0 INTERFERENCES

5.1 Spectral Overlaps

- 5.1.1 Samples containing a mixture of elements often exhibit x-ray emission line overlap. Modern Si (Li) detectors generally provide adequate resolution to minimize the effects of spectrum overlaps on the analytical results of the FQW. In those cases where direct emission line overlap exists, spectral deconvolution methods extract corrected analyte emission line intensities. Table 1 lists the significant line overlaps observed for the elements analyzed in FQW. Follow the EDXRF manufacturers recommendations concerning spectral deconvolution of the emission lines. ASTM Data Series DS46 X-ray Emissions, Wavelengths, and KeV Tables for Non-Diffractive Analysis gives detailed information on potential line overlaps.

Table 1. Common emission line spectral interferences for FQW analysis.

Element	Lines Determined	Spectral Interferences
As	K α , K β	Pb L α , Hg L β , Tl L α L β
Cr	K α , K β	V K β , Mn K α
Hg	L α , L β	As K β , Se K α , Pb L β , Tl L α , Br K α
Ni	K α , K β	Cu K β , Cu K α
Pb	L α , L β	As K α , Se K β Hg L β Tl L α , Tl L β , Br K α , Br K β
Se	K α , K β	Pb L β , Hg L β , Tl L β
Tl	L α , L β	As K α , As K β , Se K β , Pb L α , Br K α , Hg L α , Hg L β

Note 1: Not all possible interferences are listed in Table 1. The FQW samples to be analyzed may have other emission line interferences not mentioned. Consult the manufacturer's recommendations for optimum deconvolution methods.

5.2 Matrix Interferences

- 5.2.1 Large concentration variations of metal and/or matrix components in FQW samples can result in non-linear metal x-ray intensity response at increasing metal concentrations. Untreated matrix interactions may have a deleterious effect on metal determination accuracy. Matrix interactions, if exhibited by the FQW samples, must be accounted for by method calibration.

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6.0 APPARATUS

- 6.1 Energy Dispersive X-Ray Spectrometer capable of measuring the wavelengths listed in Table 1. Refer to C 982 for system specifications.
- 6.2 Hot Plate with temperature control to 105EC.
- 6.3 Analytical Balance - Capable of weighing to 0.001 g.
- 6.4 Porcelain evaporating dishes, 70 to 150 ml capacity.

7.0 REAGENTS AND MATERIALS

- 7.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficient high purity to permit its use without lessening the accuracy of the determination.

- 7.2 Graphite powder, mixing grade, 44 μm , 325 mesh.⁴

- 7.3 Oil-based Ag, As, Ba, Cd, Cr, Hg, Ni, Pb, Sb, and Se standards, 10 to 10,000 mg/kg depending on user's analytical requirements.⁵

If the results of this method are to be used for compliance purposes, standards or a commercial source must be traceable to NIST or other certifying body. Quality control samples for analyses done for compliance purposes may need to be prepared with standards from a different vendor or lot number.

- 7.4 Oil or solvent-based Tl standard, 10 to 1000 mg/kg depending on the user's analytical requirements. If the results of this method are to be used for compliance purposes, standards or a commercial source must be traceable to NIST or other certifying body.⁶

- 7.5 Paraffinic base oil.

⁴ Chemplex Industries, Inc., Tuckahoe, NY, or equivalent has been shown to be satisfactory.

⁵ Conostan Specialty Products, Inc., Ponca City, OK; Spex Industries, Inc., Edison, NJ; or equivalent have been shown to be satisfactory.

- 7.6 Sample cups, vented or unvented.

- 7.7 Thin-film sample support.

Note 2: The user should select a thin-film support that provides for maximum transmittance and is resistant to typical components in FQW. The thin-film supports used in the development of this method were 4.0 μm Prolene (Chemplex Industries, Inc., Tuckahoe, NY) and 2.5 μm Mylar (Spex Industries, Inc., Edison, NJ).

8.0 SAMPLING

- 8.1 Because stratification or layering of liquid samples is possible, the laboratory sample should be thoroughly mixed by shaking prior to withdrawing a portion for testing or a sampling method that assures all portions of the sample are represented should be used.

9.0 PREPARATION OF APPARATUS

- 9.1 Follow the manufacturer's instructions for set-up, conditioning, preparation, and maintenance of the XRF spectrometer.
- 9.2 Reference spectra must be obtained from pure element standards for all analytes and interelement correction metals.
- 9.3 Spectral interferences as listed in 5.1.1 must be addressed per manufacturer's recommendations.

10.0 CALIBRATION AND STANDARDIZATION

- 10.1 The spectrometer must be calibrated to an appropriate reference element at the minimum frequency specified by the manufacturer.
- 10.2 Analytical standards should be gravimetrically prepared by blending the elemental standards and graphite listed in Section 7.0. These preparations can contain single or multiple elements and should be prepared at combinations and ratios to meet the user's individual needs. Note 2: For example, a Pb and Cd standard at 125 mg/kg each could be prepared by gravimetrically combining 2 g oil-based Pb standard (500 mg/kg), 2 g oil-based Cd standard (500 mg/kg) and 4 g graphite and blending to a homogenous mixture. For this example, the Pb concentration is calculated as follows:

$$\text{Pb Standard Concentration (mg/kg)} = 500 \text{ mg/kg} \times \frac{\text{Pb Std. (g)}}{\text{graphite (g)} + \text{Cd Std. (g)} + \text{Pb Std. (g)}} (1)$$

⁶ Alfa Aesar, Johnson Matthey, Inc., Ward Hill, MA, or equivalent has been shown to be satisfactory.

- 10.3 The metals standard/graphite paste is placed in an XRF sample cup, and affixed with a thin-film support. The sample cup is inverted and lightly tapped on a level surface until the blended paste makes full contact (no air spaces) with the thin-film support.

10.3.1 The standard blends in the sample cups are placed into the spectrometer's designated sampler holder. Avoid touching the thin-film, as this can further reduce transmittance. Initiate data acquisition for the desired elements according to the manufacturer's instructions.

- 10.4 Two alternative standards calibration methods may be used.

10.4.1 Test Method A (Empirical Calibration Method) - Organic-based metals standards containing the metals of interest are prepared as described in Section 10.2. The standard metal concentrations must bracket the unknown FQW concentration levels. If the standard concentrations are less than 0.1% by weight, a linear calibration method may be used to plot metal emission intensity response against metal concentration.

10.4.1.1 If metal concentration exceeds 0.1% by weight, then a matrix correction technique is employed. Standard mixtures of varying metal composition must be prepared that bracket the FQW unknown concentrations. Equation (1) is solved for the slope, intercept and all alpha terms:

$$C_i = B_i + K_i I_i (1 + \sum \alpha_{ij} C_j) \quad (2)$$

where:

C_i = concentration of analyte element i ;

B_i = intercept term;

K_i = slope term;

I_i = X-ray intensity of element, i ;

α_{ij} = alpha coefficient describing the matrix interaction of element j on analyte i ;

C_j = concentration of matrix element j .

10.4.2 Test Method B (Fundamental Parameters Method.) - Some instrument vendors provide software capable of estimating matrix interferences with a minimum number of standards. A high and low standard concentration mixture or a mid-range concentration mixture gives the fundamental parameters method an initial emission response determination. Using this information and calculations using the principles of x-ray absorption and emission, a data matrix is created sufficient to solve equations of the form in Equation (1) for all sample matrix interactions.

10.4.2.1 Follow the software manufacturer's fundamental parameters set-up recommendations on the number of standard mixtures and the nature of the matrix balance estimate (usually a stoichiometric combination of carbon, hydrogen, and oxygen) for FQW.

10.4.3 Calibration should be repeated at least every two weeks or whenever quality control results as specified in Section 13.0 are outside data quality objectives as determined by the user.

11.0 PROCEDURE

11.1 The FQW sample is thoroughly mixed, see Section 8.1.

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- 11.1.1 To a clean, dry, and tared evaporating dish, add 10 g of the FQW sample and weigh to the nearest 0.001 g. Record the mass.
- 11.1.2 Place the dish on a hot plate at a temperature such that the sample material does not exceed 105°C. Samples containing significant levels of very volatile components may need to be heated initially at a lower temperature. If spattering of the sample is observed, the sample should be removed from the hot plate and allowed to cool slightly. Adjust the hot plate to a lower temperature and replace evaporating dish and sample on the hot plate and continue heating. The heating of the sample is a concentration step, so the heating time is not a critical factor. Generally, the time required to evaporate the volatile fraction from most FQW is approximately 15 to 30 minutes. Because this is a concentration step, it is considered optional.
- 11.1.3 Remove the dish from the hot plate and allow to cool to the touch.
- 11.1.4 If the evaporated sample appears to contain large or variable sized solid material, it may be necessary to grind the sample in a mortar and pestle or other suitable device.
- 11.1.5 Mix graphite into the evaporated sample with a lab spatula or equivalent device until a homogeneous paste results that has no clumping and when allowed to stand briefly, exhibits no visible liquid phase separation. An approximate amount of 4 to 6 g of graphite is normally sufficient. Weigh the graphite/sample mixture and record.
- 11.1.6 Mount the graphite/sample preparation in an XRF sample cup as described in Section 10.3.
- 11.1.7 The mounted sample preparation is placed into the spectrometer's designated sampler holder. Avoid touching the thin-film, as this can reduce transmittance. Initiate data acquisition for the desired elements according to the manufacturer's instructions.
- 11.1.8 After instrument analysis is completed, process analytical results according to Section 12.0.

12.0 CALCULATION

- 12.1 The analytical results for each element obtained by either empirical calibration or fundamental parameters models in 11.1.8 should be corrected for the sample preparation dilution as follows:

$$\text{Corrected concentration (mg/kg)} = \frac{\text{Analytical Result (mg/kg)} \times \text{Mass of graphite (g) + sample (g)}}{\text{Initial mass of FQW (g)}} \times (3)$$

13.0 QUALITY CONTROL

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- 13.1 Before using this method, it is strongly recommended that the user fully investigate any specific regulatory quality control requirements.
- 13.2 A minimum of one QC check standard, matrix spike/matrix spike duplicate and one analytical blank consisting of graphite powder/analyte-free paraffinic oil blend should be processed at a user-defined frequency.
- 13.3 Quality control sample results must be evaluated with each batch of analyzed samples. These results will verify that user defined data quality objectives have been met.

14.0 PRECISION AND BIAS

- 14.1 Precision - No statement is made about precision at this time. An interlaboratory test study will be conducted in the future.
- 14.2 Bias - No statement is made about bias at this time. An interlaboratory test study will be conducted in the future.
- 14.3 Appendix I contains analytical results following this method (10.4.2) on typical FQW, MS/MSD, check standard, and blank. Lower Limits of Detections are also listed.

15.0 KEYWORDS

- 15.1 Spectrometry, spectroscopy, fuel quality waste, trace elements, XRF, EDXRF.

APPENDIX I **(Non-Mandatory Information)**

Analytical and Quality Control Results and Lower Limits of Detection for FQW

Element

FQW Sample #1	V	Cr	Ti	Ni	Cu	Zn	Se	As	Tl	Pb	Hg	Ag	Cd	Sb	Ba	Sn
Blank (mg/kg)	<13.0	<3.0	<8.0	<6.0	<8.0	<7.0	<3.0	<16.0	<6.0	<4.0	<3.0	<3.0	<2.0	<8.0	<34.0	<4.0
Check Standard Recovery (%)	102.1	106.1	110.0	94.5	102.8	102.8	115.0	124.8	-	104.6	110.0	100.3	105.8	108.0	130.0	104.8
MS/MSD-RPD ¹ (%)	2.1	1.2	8.2	9.9	0.2	1.5	25.1	16.4	-	7.2	1.1	4.6	1.3	18.7	15.1	1.2
MS/MSD-Recovery ² (%)	75.7	103.9	102.7	93.0	100.5	102.3	145.7	91.2	-	97.3	123.4	101.9	86.5	70.1	153.2	80.2

¹ Relative Percent Difference = $100 \times (C_1 - C_2) / ((C_1 + C_2) / 2)$

Where: C₁ = concentration result of the matrix spike.
C₂ = concentration result of the matrix spike duplicate.
1 1 = denotes the absolute value of the difference.

² $\frac{((MS - \text{sample result}) + (MSD - \text{sample result})) / 2}{\text{Matrix Spike (Added)}}$ (100) = % Recovery

Lower Limits of Detection (LLD) ¹			
Element	LLD (mg/kg)	Element	LLD (mg/kg)
V	5.0	Tl	-
Cr	2.0	Pb	4.0
Ti	3.0	Hg	3.0
Ni	10.0	Ag	3.0
Cu	7.0	Cd	3.0
Zn	6.0	Sb	8.0
Se	4.0	Ba	26.0
As	4.0	Sn	3.0

¹ $LLD = \frac{3/Bi}{Pi} \times \frac{1}{T} \times \text{conc.}$

Where: Bi = background intensity (counts/second) under fitted analyte peak.
Pi = fitted peak intensity (counts/second) of analyte peak.
T = counting livetime (seconds).
conc. = concentration of analyte from metallic oil standard.

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Method S-8

Standard Method for Cold Vapor Mercury Analyses of Industrial Furnace Feedstreams (VARIAN AA20)

1.0 SCOPE

- 1.1 This method describes the cold vapor mercury (Hg) analyses of industrial furnace feedstreams using the Varian AA20 atomic absorption spectrophotometer with VGA-76 vapor generation accessory and PCC-56 programmable autosampler.
- 1.2 This method is quantitative.
- 1.3 This method is only applicable to Hg.
- 1.4 This method may involve hazardous materials, operations or equipment. This method does not purport to address all of the safety considerations associated with its use. Refer to Systech SOP for Laboratory Safety. It is the responsibility of the user to use good laboratory safety practices and avoid exposure to Hg.
- 1.5 *This method produces waste that is considered hazardous unless proven otherwise. Refer to SOP for samples and waste management. Use good laboratory techniques to minimize the amount of waste generated and prevent pollution. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 The sample is prepared by Method S-2. The Varian AA20 is peaked and optimized and the VGA-76 set-up and operating. The blank and standards are run for standardization. The unknown samples and QC samples are then analyzed.

3.0 SIGNIFICANCE AND USE

- 3.1 U.S. Environmental Protection Agency regulations (40 CFR 266, Subpart H, "Hazardous Waste Burned in Boilers and Industrial Furnaces", (latest revision) requires that cement kilns and other industrial furnaces utilizing fuel quality waste (FQW) to perform analysis for certain metals on feedstream materials at site specific frequencies. This method describes the procedure for the analyses of these feedstream materials for Hg by cold vapor atomic absorption.

4.0 APPARATUS

- 4.1 Varian AA20 atomic absorption spectrophotometer with VAG-76 vapor generation attachment, printer, and PCC-56 autosampler. It is recommended that

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the unit be equipped with a high quality UPS or line conditioner with spike/surge suppression.

5.0 REAGENTS AND MATERIALS

- 5.1 Purity of Reagents - Reagent grade chemicals shall be used in all test. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 5.2 Purity of water- Unless otherwise indicated, references to polished DI water shall be understood to mean meeting the numerical requirements of Type II water as defined by ASTM D 1193.
- 5.3 Stannous Chloride dihydrate solution: Dissolve 50 g SnCl_2 in 40 ml HCL. It may be helpful to heat the mixture under gentle heat on a hot plate/magnetic stirring unit until the mixture is clear. Bring the solution to a final volume of 200 ml with polished DI water. This solution may degrade if not used in a few days.
- 5.4 Antifoaming agent, Triton X100 solution, or equivalent. Added to the VAG-76 water vessel to yield a concentration between 0.05%-0.1%.
[optional]
- 5.5 Nitric acid, 70%, HNO_3 .
- 5.6 Hydrochloric acid, 37%, HCL.
- 5.7 Wash vessel/Rinse Blank: Mixture of water, HNO_3 and HCL to be representative of standard/sample solutions.
- 5.8 Stock Hg Standard, 10 parts per million (ppm).
- 5.9 General instruction for making 1 ppm stock standard and 3 calibration standards (100, 50, 20 ppb) from the 10 ppm stock are as follows:
 - 1) Using a 100 ml volumetric flask, combine 50-75 ml polished DI water, 5 mL HCL, and mix by swirling or with magnetic stirrer and allow to cool. Using class "A" volumetric pipette place 10 mL of 10 ppm stock standard into water/acid mixture. Bring to final 100 ml volume with polished DI water and mix thoroughly. This is the 1 ppm stock Hg Standard. Shelf life is equal to 1 month.
 - 2) 20 ppb
Using a dedicated 100 ml volumetric flask, combine 50-75 ml of polished DI water and 5 ml HCL, mix by swirling and allow mixture to cool. Pipette 2 ml of the 1 ppm stock Hg standard using a dedicated Class A Volumetric

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pipette. Bring to 100 ml volume with polished DI water and mix thoroughly. Shelf life is equal to 1 week.

3) 50 ppb

Using a dedicated 100 ml volumetric flask, combine 50-75 ml of polished DI water and 5 ml HCL, mix by swirling and allow mixture to cool. Pipette 5 ml of the 1 ppm stock Hg standard using a dedicated Class A Volumetric pipette. Bring to 100 ml volume with polished DI water and mix thoroughly. Shelf life is equal to 1 week.

4) 100 ppb

Using a dedicated 100 ml volumetric flask, combine 50-75 ml of polished DI water and 5 ml HCL, mix by swirling and allow mixture to cool. Pipette 10 ml of the 1 ppm stock Hg standard using a dedicated Class A Volumetric pipette. Bring to 100 ml volume with polished DI water and mix thoroughly. Shelf life is equal to 1 week.

Larger volumes of standards may be prepared but the user must be mindful of the shelf life of each solution. These recommended solution concentrations may be modified if necessary.

6.0 INTERFERENCES

- 6.1 To minimize or eliminate excessive foaming in the reaction cell, the antifoaming agent should be used.
- 6.2 Element specific interferences may affect some analyses. If excessive interferences significantly affect analytical quality/results, the method of standard additions should be considered.
- 6.3 The length of time that hollow cathode lamps (HCLs) are left ON can shorten lamp life and cause them to give inconsistent output when their condition is deteriorating. HCL condition is generally gauged by PMT voltages. A minimum of 1 spare HCL for Hg should be on hand.
- 6.4 The reaction tubing, gas/liquid separator, and vapor cell must be kept extremely clean. With increased use, the reaction vessel can develop a waxy, particulate build-up that will affect analytical performance. The vapor cell over time can visibly show signs of contamination. Because these signs are not always noticeable, it should be periodically cleaned whether visible signs are present or not.
- 6.5 Discolored or deformed tubing must be replaced to ensure effective, consistent solution delivery.

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- 6.6 To prevent contamination, glassware or plasticware associated with standards/sample preparation must be kept clean. This is usually accomplished by washing items with a high quality detergent; rinsing with tap water; rinsing with aqua regia and allowed to sit for 5-10 minutes; and triple rinsing with polished DI water.
- 6.7 Metallic ions which are reduced to the elemental state by stannous chloride can interfere with the cold vapor method. They can amalgamate or form stable compounds with mercury. The absence of non-atomic absorption is typically verified through routine QC.

7.0 SAMPLE

- 7.1 The sample is prepared by Method S-2.
- 7.2 Particulate material will interfere with the digested sample transport/aspiration, and reaction. Digestions may need to be centrifuged or filtered prior to analyses.

8.0 QUALITY CONTROL

- 8.1 All quality control items and data quality objectives listed in the site WAP must be followed. The following items may or may not be part of a site WAP but should be followed to ensure data quality. Refer to Comprehensive Quality Assurance Plan manual for additional quality control information.
- 8.2 The detection limit for cold vapor Hg analysis by this technique was determined in accordance with method M-2. This limit will vary from system to system and is dependent upon sample dilution.

<u>Element</u>	<u>MDL (ppm)</u>	<u>Dilution Factor</u>
Hg	0.04	100X
Hg	0.02	40X

- 8.3 Record in an appropriate log the PMT voltage for the Hg HCL.
- 8.4 Analyte concentrations beyond the linear range of calibration must be diluted.
- 8.5 A Reagent Analytical Blank per prepared batch must be ran to determine contamination.
- 8.6 A minimum of 1 Method blank per analytical batch must be run to determine contamination and occurrence of memory effect.

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- 8.7 The Rinse Blank, prepared with the same acids used in the sample preparation must be aspirated between each sample and standard. It should be aspirated for a sufficient time to ensure the system is adequately flushed.
- 8.8 An Initial Calibration Verification (ICV) standard made from a separate source than the calibration standards must be analyzed following calibration. The results should agree within 10% of the known value. If not, terminate the analysis, correct the problem and repeat calibration.
- 8.9 A Continuing Calibration Verification (CCV) standard at low or mid range of calibration must be ran to verify the instrument calibration at a frequency of every 10 samples or at the end of each batch if the batch is less than 10 samples. The results of the check standard should agree within 15% of the known value.

9.0 PROCEDURE

9.1 Prepare the Varian AA20 for analysis.

9.1.1 General instrument settings:

Physical manual settings

- a) Nitrogen Flow - regulator set at 50 psi.
- b) Slit - 0.5R
- c) Wavelength - 253.7
- d) Adjusting lamp carousel adjustment knobs to optimize HCL lamp alignment and PMT voltage.
- e) Levers at burner head adjust vapor cell to optimize alignment of vapor cell and PMT voltage.

9.1.2 Software settings for Instrument, Hg Instrument Method 30.

These suggested programs may be modified if necessary.

- a) Lamp - 1
- b) Lamp ma - 4
- c) Sample introduction - Auto Normal
- d) Delay time (sec) - 90
- e) Measurement time (sec) - 5.0

f) Replicates - 3

g) Background correction - Off

h) Flame - Air Only

i) Wavelength	Slit width	Conc. for 0.2 ABS	Relative Lamp Intensity
253.7	0.5 nm	70 mg/l	(no entry, leave blank)

j) Sample Changer:

Rinse rate - 1

Rinse time (sec) - 100

Recalibration rate - 0 *note: 0 = null value*

Reslope rate - 0 *note: 0 = null value*

k) Standard 1 -	200	<i>for 20 ppb std.</i>
Standard 2 -	500	<i>for 50 ppb std.</i>
Standard 3 -	1000	<i>for 100 ppb std.</i>
Reslope std no. -	2	

9.2 VARIAN AA20 VGA-76 Hg Cold Vapor Analysis

1. **<Important>** Turn on Nitrogen gas first. This will prevent backflow of
2. Turn on exhaust fan.
3. Put tubes in order on peristaltic pump and tighten. Turn on the pump (red switch on side).

Put Acid blank water in middle of sample tray. Put Nitric acid/water in wash/rinse beaker. Put pump tubing in reagent bottles.

4. Turn on power to AA. Put in floppy disk & lock in.
5. Select index button to go to index screen.
6. Type in 1 for program modes.
Press- New page soft key.
7. Select soft key for Automatic Run. This brings up Sequence selection screen. The last method ran will come up (# 30 is regular Hg method or # 29 for slurry with 5 standards). Press clear sequence button then re-type method number. (otherwise instrument uses the last standard curve ran instead of updating and storing the current one about to be ran)

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8. Select sequence control button, this recalls method off of disk and brings up Sequence Control screen. Type in more samples than planning to run in "Last Sample Column" to facilitate moving sample position in tray for if needed (e.g. for re-running).

Delay min.	First Sample	Last sample
0	1	67

9. Press Report Format key.
Report format:
Date: - Change to current date.
Batch no: - Use current date
Calibration graph: - Press home to change no to yes to print graph.
10. Let instrument warm up for 10 minutes
11. Press optimization button.
Record Photomultiplier volts in M&O log book. (Normally near 340.9)
12. Make written log of samples location in autosampler (printout from AA
13. Hit start button to start run. If optimization screen comes up, Press start
14. Watch for test tube leaning. Monitor that sample probe doesn't miss test tube.
15. At end of run flush Stannous line with DI water.
Loosen pump tubing on peristaltic pump.
Remove floppy disk from drive.
Turn off Hg lamp by turning off instrument power switch. (If instrument
Turn off autosampler.
Turn off nitrogen gas.

10.0 REPORTING

- 10.1 Results should be reported on appropriate paperwork or forms for submitting data to management or cement plant personnel. Hard copies of data must be archived in an appropriate filing system. Hard copy data should contain only data, justified error corrections and when necessary, notes concerning data quality. Do not write unwarranted comments on lab data.

11.0 REFERENCES

- 11.1 U.S EPA, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd Ed., Vol. 1A) Method 7471.

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S-9 Standard Method for Cold Vapor Mercury Analyses of Industrial Furnace Feedstreams (Leeman Hydra AA)

1.0 SCOPE

- 1.1 This method describes the cold vapor mercury (Hg) analyses of industrial furnace feedstreams using the Leeman Hydra AA automated mercury analyzer or equivalent instrument.
- 1.2 This method is quantitative.
- 1.3 This method is only applicable to Hg.
- 1.4 **This method may involve hazardous materials, operations or equipment. This method does not purport to address all of the safety considerations associated with its use. Refer to Sytech SOP for Laboratory Safety. It is the responsibility of the user to use good laboratory safety practices and avoid exposure to Hg.**
- 1.5 This method produces waste that is considered hazardous. Refer to SOP for samples and waste management. Use good laboratory techniques to minimize the amount of waste generated and prevent pollution.

2.0 SUMMARY OF PROCEDURE

- 2.1 The sample is prepared by Method S-2 or S-11. The Leeman Hydra AA is standardized and calibrated using a blank and three standards. The unknown samples and QC samples are then analyzed.

3.0 SIGNIFICANCE AND USE

- 3.1 U.S. Environmental Protection Agency regulations (HW MACT) requires that cement kilns and other industrial furnaces utilizing fuel quality waste (FW) to perform analysis for certain metals on feedstream materials at site specific frequencies. This method describes the procedure for the analyses of these feedstream materials for Hg by cold vapor atomic absorption.

4.0 APPARATUS

- 4.1 Leeman Hydra AA Automated Mercury Analyzer. Other cold vapor instruments or models may be used with this method. The user should follow the manufacturer's instructions for instrument set up and operation.

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5.0 REAGENTS AND MATERIALS

- 5.1 Purity of Reagents - Reagent grade chemicals shall be used in all test. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 5.2 Purity of water - Unless otherwise indicated, references to polished DI water shall be understood to mean meeting the numerical requirements of Type II water as defined by ASTM D 1193.
- 5.3 Stannous Chloride dihydrate solution: Dissolve 50 g SnCl_2 in 40 ml HCL. It may be helpful to heat the mixture under gentle heat on a hot plate/magnetic stirring unit until the mixture is clear. Bring the solution to a final volume of 200 ml with polished DI water. This solution may degrade if not used in a few days.
- 5.4 Nitric acid, 70%, HNO_3 .
- 5.5 Hydrochloric acid, 37%, HCL.
- 5.6 Wash vessel/Rinse Blank: 5% Nitric acid solution.
- 5.7 Stock Hg Standard, 10 parts per million (ppm). (Refrigerated)
- 5.8 General instruction for making 1 ppm working stock standards and calibration standards (0, 10, 20, 50 ppb) from the 10 ppm stock are as follows:
 - 1) Reagent Blank:
Use approximately 10 ml of nitric acid and 4 ml of hydrochloric acid diluted to 50 ml with DI water.
 - 2) 1 PPM Working Stock (2 solutions required)
Using a 100 mL volumetric flask, measure 10 ml of the 10 ppm Stock Hg standard, 5 ml hydrochloric acid and dilute to 100 mL using DI water. This is the 1 ppm working stock Hg standard. Repeat using a 10 ppm Stock Hg standard solution from a different lot number source. Label one **1 ppm Hg Working Stock Standard** and label the other **1 ppm Working ICV Stock**. Shelf life is equal to 1 month refrigerated. Warm the Solutions to 60°F before using.
 - 3) 10 ppb
Using a dedicated 100 mL volumetric flask, measure 1 ml of the 1 ppm working stock standard, 5 ml of hydrochloric acid and dilute to 100 ml with DI water. Shelf life is equal to 1 week.

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- 4) 20 ppb
Using a dedicated 100 mL volumetric flask, measure 2 ml of the 1 ppm working stock standard, 5 ml of hydrochloric acid and dilute to 100 ml with DI water. Shelf life is equal to 1 week
- 5) 50 ppb
Using a dedicated 100 mL volumetric flask, measure 5 ml of the 1 ppm working stock standard, 5 ml of hydrochloric acid and dilute to 100 ml with DI water. Shelf life is equal to 1 week.
- 6) 20 ppb ICV
Using a dedicated 100 mL volumetric flask, measure 2 ml of the 1 ppm working ICV Stock solution, 5 ml of hydrochloric acid and diluted to 100 ml with DI water. Shelf life is equal to 1 week.

Larger volumes of standards may be prepared but the user must be mindful of the shelf life of each solution. These recommended solution concentrations may be modified if necessary, and the above directions are only given as a guide.

6.0 INTERFERENCES

- 6.1 Element specific interference may affect some analyses. If excessive interferences significantly affect analytical quality/results, the method of standard additions should be considered.
- 6.2 The length of time that the UV source has been on can affect intensities. It is recommended that the lamp not be used until it has been on for at least 30 minutes.
- 6.3 Discolored or deformed tubing must be replaced to ensure effective, consistent solution delivery.
- 6.4 To prevent contamination, glassware or plasticware associated with standards/sample preparation must be kept clean. This is usually accomplished by washing items with a high quality detergent and rinsing with tap water.
- 6.5 Metallic ions which are reduced to the elemental state by stannous chloride can interfere with the cold vapor method. They can amalgamate or form stable compounds with mercury. The absence of non-atomic absorption is typically verified through routine QC.

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7.0 SAMPLE

- 7.1 The sample is prepared by Method S-2.
- 7.2 Particulate material will interfere with the digested sample transport/aspiration, and reaction. Digestions may need to be centrifuged or filtered prior to analyses.

8.0 QUALITY CONTROL

- 8.1 All quality control items and data quality objectives listed in the site WAP must be followed. The following items may or may not be part of a site WAP but should be followed to ensure data quality. Refer to Comprehensive Quality Assurance Plan manual for additional quality control information.
- 8.2 The detection limit for cold vapor Hg analysis by this technique was determined in accordance with method M-2. This limit will vary from system to system and is dependent upon sample dilution.

<u>Element</u>	<u>MDL (ppm)</u>	<u>Dilution Factor</u>
Hg	0.05	100X
Hg	0.018	40X

- 8.3 Analyte concentrations beyond the linear range of calibration must be diluted.
- 8.4 A Reagent Analytical Blank per prepared batch must be run to determine contamination.
- 8.5 A minimum of 1 Method blank per analytical batch must be run to determine contamination and occurrence of memory effect.
- 8.6 The Rinse Blank (bulk acid solution) must be aspirated between each sample and standard. It should be aspirated for a sufficient time to ensure the system is adequately flushed.
- 8.7 An Initial Calibration Verification (ICV) standard made from a separate source than the calibration standards must be analyzed following calibration. The results should agree within 10% of the known value. If not, terminate the analysis, correct the problem and repeat calibration.
- 8.8 A Continuing Calibration Verification (CCV) standard at low or mid range of calibration must be run to verify the instrument calibration at a frequency of every 10 samples or at the end of each batch if the batch is

less than 10 samples. The results of the check standard should agree within 15% of the known value.

9.0 PROCEDURE

9.1 Prepare the Leeman Hydra AA for analysis.

9.1.1 General instrument settings: Physical manual settings

- a) Nitrogen supply cylinder flow - regulator set at 80 psi.
- b) Gas exhaust tube vented to outside source.

9.1.2 Software settings for Leeman Hydra AA Instrument. These suggested program parameters may be modified if necessary. Software settings are entered in the WinHg folder "Protocol" for inputting the gas flow, pump rate, uptake time, etc.

- a) Gas Flow: 1.00 LPM
- b) Pump Rate: 5 mL/Min
- c) Number of Integrations: 1
- d) Pump time: 60 sec
Uptake time: 30 sec
- e) Measurement time (sec): 20

9.2 Operation

Instrument operation functions are entered in the WinHg "Control" folder to turn on the Nitrogen gas, lamp and peristaltic pump.

- 9.2.1. Turn on Nitrogen supply gas and Lamp if not already on. Nitrogen bottle regulator is normally set at 80 psi. The lamp should be allowed to stabilize for 30 minutes after being turned on.
- 9.2.2. Inspect peristaltic tubing for wear and flattening. Adjust tubing tension or replace tubing as needed. If the instrument has not been used for more than 1 day or new tubing is installed allow the tubing to condition for 10 minutes.

- 9.2.3. Inspect drying tube for moisture or build-up. Replace or recondition as needed.
- 9.2.4. Fill wash/rinse beaker with bulk acid solution. Put pump tubing in reagent bottles. Turn on exhaust fan
- 9.2.5. Choose the Protocol tab and select the method to be used (e.g Mact). Then the Dataset tab to select the dataset to store the data in. The sample ID, weights, volume and autosampler position are entered within " Rack Editor"and this file is entered into the "Sample" folder (e.g.. fuel or slurry). Print the Rack Editor sample list.

9.3 Calibration

- 9.3.1 Standards and calibration samples are entered into "Database" in the "Line Info" folder for autosampler rack position and standard identification.
- 9.3.2 For calibration choose standards by selecting S1, S2, S3, S4 and Rep 1, Rep 2, Rep 3 then Select "Std Auto" to run standards. After standards have ran select in "DB" database Cal curve tab, then select linear curve fit. Make sure curve fit is set to linear. Click on "Accept" to continue if the calibration is acceptable (correlation coefficient (ρ) > 0.995). If the calibration is not acceptable determine the cause and rerun. Print calibration curve.

9.4 Sample Analysis

- 9.4.1 After calibration is complete samples are analyzed within WinHg Runner utilizing the "Sample" folder. Select rack name and enter start, end cup position then click " Run Auto".
- 9.4.2 After analysis is complete, flush the lines with the acid rinse, recommended for at least 5 minutes.
- 9.4.3 Go to the "Control" page and put instrument in standby mode.

10. REPORTING

- 10.1 Results should be reported on appropriate paperwork or forms for submitting data to management or cement plant personnel. Hard copies of data including, rack editor sample list, calibration and curve regression

data must be archived in an appropriate filing system. Hard copy data should contain only data, justified error corrections and when necessary, notes concerning data quality. Do not write unwarranted comments on lab data.

11. REFERENCES

- 11.1 U.S EPA, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd Ed., Vol. 1A) Method 7471.

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Method S-10

**Standard Method for Cold Vapor Mercury Analyses of
Industrial Furnace Feedstreams (Leeman PS200II)**

1.0 SCOPE

- 1.1 This method describes the cold vapor mercury (Hg) analyses of industrial furnace feedstreams using the Leeman PS200II automated mercury analyzer.
- 1.2 This method is quantitative.
- 1.3 This method is only applicable to Hg.
- 1.4 This method may involve hazardous materials, operations or equipment. This method does not purport to address all of the safety considerations associated with its use. Refer to Systech SOP for Laboratory Safety. It is the responsibility of the user to use good laboratory safety practices and to avoid exposure to Hg.
- 1.5 This method produces waste that is considered hazardous unless proven otherwise. Refer to SOP for samples and waste management. Use good laboratory techniques to minimize the amount of waste generated and to prevent pollution.

2.0 SUMMARY OF PROCEDURE

- 2.1 The sample is prepared by Method S-2. The Leeman PS200II is standardized and calibrated using a blank and three standards. The unknown samples and QC samples are then analyzed.

3.0 SIGNIFICANCE AND USE

- 3.1 U.S. Environmental Protection Agency regulations (40 CFR 266, Subpart H, "Hazardous Waste Burned in Boilers and Industrial Furnaces", (latest revision)) requires that cement kilns and other industrial furnaces utilizing fuel quality waste (FQW) perform analyses for certain metals on feedstream materials at site specific frequencies. This method describes the procedure for the analyses of these feedstream materials for Hg by cold vapor atomic absorption.

4.0 APPARATUS

- 4.1 Leeman PS200II Automated Mercury Analyzer. It is recommended that the unit be equipped with a high quality UPS or line conditioner with spike/surge suppression.

5.0 REAGENTS AND MATERIALS

- 5.1 Purity of Reagents- Reagent grade chemicals shall be used. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 5.2 Purity of water- Unless otherwise indicated, references to DI water shall be understood to mean meeting the numerical requirements of Type II water as defined by ASTM D 1193.
- 5.3 Stannous Chloride dihydrate solution: Dissolve 250 g SnCl_2 in 200 ml HCL. It may be helpful to heat the mixture under gentle heat on a hot plate/magnetic-stirring unit until the mixture is clear. Bring the solution to a final volume of 1000ml with DI water. This solution may degrade if not used in a few days.
- 5.4 Nitric acid, 70%, HNO_3 .
- 5.5 Hydrochloric acid, 37%, HCL.
- 5.6 Bulk acid solution (see section 5.8.1)
- 5.7 Wash vessel/Rinse Blank (10% HCL): 100 ml HCL diluted to 1000 ml in a volumetric flask.
- 5.8 Stock Hg Standard, 100 parts per million (ppm). (Refrigerated)
- 5.9 General instruction for making the 1 ppm working standard and calibration standards (50, 20, 10, 0 ppb) are as follows:
 - 1) Blank or 0 ppb (Bulk acid solution):

This is a bulk solution for diluting all samples and standards:
Using a 1L Volumetric Flask, combine 500 ml DI water, 100 ml HCL and 160 mL of HNO_3 . Mix by swirling, then fill to the 1L mark with DI water.
 - 2) 1 PPM Working Standard:

Using a 100 mL volumetric flask, measure 1.00 ml of the 100 ppm stock solution and dilute to 100 mL using the bulk acid solution. This is the 1 ppm Working Standard. Repeat using a 100 ppm Hg solution from a different source. Label one **1 ppm Working Standard**, and the other the **1 ppm ASC Working Standard**. Shelf life is equal to 1 month refrigerated. Warm the solution to 60°F before using.
 - 3) 5 ppb

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Using a dedicated 100 mL volumetric flask, measure 0.500 ml of the **1ppm Working Standard**. Dilute with the bulk acid solution to 100mL. Shelf life is equal to 1 week

4) 10 ppb

Using a dedicated 100 ml volumetric flask, measure 1.00 ml of the **1ppm Working Standard**. Dilute with the bulk acid solution to 100mL. Shelf life is equal to 1 week.

5) 20 ppb

Using a dedicated 100 mL volumetric flask, measure 2.00 ml of the **1ppm Working Standard**. Dilute with the bulk acid solution to 100mL. Shelf life is equal to 1 week.

6) 10 ppb ICV/CCV

Using a dedicated 100 ml volumetric flask, measure 1 ml of the **1 ppm ASC Working Standard**. Dilute with the bulk acid solution to 100mL. Shelf life is equal to 1 week.

Larger volumes of standards may be prepared, but the user must be mindful of the shelf life of each solution. These recommended solution concentrations may be modified if necessary, and the above directions are only given as a guide.

6.0 INTERFERENCES

- 6.1 Element specific interference may affect some analyses. If excessive interferences significantly affect analytical quality/results, the method of standard additions should be considered.
- 6.2 The length of time that the UV source has been on can affect intensities. It is recommended that the lamp not be used until it has been on for at least 30 minutes.
- 6.3 Discolored or deformed tubing must be replaced to ensure effective, consistent solution delivery.
- 6.4 To prevent contamination, glassware or plasticware associated with standard/sample preparation must be kept clean. This is usually accomplished by washing items with a high quality detergent; rinsing with tap water; rinsing with aqua regia, and allowing them to sit for 5-10 minutes; and then triple rinsing with DI water.
- 6.5 Metallic ions that are reduced to the elemental state by stannous chloride can interfere with the cold vapor method. They can amalgamate or form stable

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compounds with mercury. The absence of non-atomic absorption is typically verified through routine QC.

7.0 SAMPLE

- 7.1 The sample is prepared by Method S-2.
- 7.2 Particulate material will interfere with the digested sample transport/aspiration, and reaction. Digestions may need to be centrifuged or filtered prior to analyses.

8.0 QUALITY CONTROL

- 8.1 All quality control items and data quality objectives listed in the site WAP must be followed. The following items may or may not be part of a site WAP but should be followed to ensure data quality. Refer to Comprehensive Quality Assurance Plan manual for addition quality control information.
- 8.2 The detection limit for cold vapor Hg analysis by this technique was determined in accordance with method M-2. This limit will vary from system to system and is dependant upon sample dilution.

<u>Element</u>	<u>MDL (ppm)</u>	<u>Dilution Factor</u>
Hg	0.001	100X
Hg	0.0004	40X

- 8.3 Record in an appropriate log the Lamp Intensity found on the Control page under Setting in the PS 200II software.
- 8.4 Analyte concentrations beyond the linear range of calibration must be diluted.
- 8.5 A Reagent Analytical Blank per prepared batch must be run to determine contamination.
- 8.6 A minimum of 1 Method blank per analytical batch must be run to determine if contamination and/or occurrence of memory effect are present.
- 8.7 The Rinse Blank must be aspirated between each sample and standard. It should be aspirated for a sufficient time to ensure the system is adequately flushed.
- 8.8 An Initial Calibration Verification (ICV) standard made from a separate source than the calibration standards must be analyzed following calibration. The results should agree within 10% of the known value. If not, terminate the analysis, correct the problem and repeat calibration.
- 8.9 A Continuing Calibration Verification (CCV) standard at low or mid range of calibration must be run to verify the instrument calibration at a frequency of every

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10 samples or at the end of each batch if the batch is less than 10 samples. The results of the check standard should agree within 15% of the known value.

9.0 PROCEDURE

9.1 Prepare the Leeman PS200II for analysis.

9.1.1 General instrument settings:

Physical manual settings

- a) Nitrogen Flow - regulator set at 80 psi.
- b) Gas exhaust tube vented to outside source.

9.1.2 Software settings for Instrument.

These suggested programs may be modified if necessary.

- a) Gas Flow: 0.70 LPM {Database, Protocol}
- b) Pump Rate: 7 ml/min {Database, Protocol}
- c) Number of Replicates: 1 {Database, Protocol}
- d) Uptake time: 7 Sec {Database, Protocol}
- e) Integration time (sec): 10 {Database, Protocol}
- f) Sample Changer:
 - Rack - BIF
 - From cup - 1
 - To cup - last sample
 - Rinse time (sec) - 45
- g) Standard 1 - 0 ppb std.
Standard 2 - 5 ppb std.
Standard 3 - 10 ppb std.
Standard 4 - 20 ppb std.
- h.) Protocol: HGPPB2

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9.2 LEEMAN PS 200II Automated Mercury Analyzer - Operation

- 9.2.1 Turn on Nitrogen gas at bottle. Regulator is normally set at 80 psi.
- 9.2.2 Software should be running, if not reboot computer. Load WinHg software.
- 9.2.3 Go to the Control page and turn on lamp. Wait 25 minutes for the lamp to warm up and stabilize if lamp has not been on.
- 9.2.4 Check Dataset name and change if necessary. Name should be the current month followed by the year. (Ex: The Dataset name for an analysis done on 10/24/01 would be named october01)
- 9.2.5 Inspect peristaltic tubing for wear and flattening. Adjust tension on tubing or replace tubing as needed.
- 9.2.6 Inspect drying tube for moisture or build-up. Replace or recondition as needed.
- 9.2.7 Fill wash/rinse reservoir with bulk acid. Put pump tubing in reagent bottles. Turn on exhaust fan.
- 9.2.8 Turn on gas and pump to condition pump tubing. Wait 10 minutes if new tubing is used.
- 9.2.9 Go to the Standard page and select standards (S1 - S4), repetitions (Rep1), and check standards (C1, C2).
- 9.2.10 Transfer the standards and samples to the autosampler vials and place in the autosampler rack.
- 9.2.11 Click on "Std Auto" to calibrate.
- 9.2.12 The "CalCurve" screen will appear when all the calibration standards have been run. Make sure curve fit is set to Quad for quadriatic. Click on "Accept" to continue if the calibration is acceptable (correlation coefficient (ρ) > 0.995). If the calibration is not acceptable determine the cause and rerun. Print calibration curve.
- 9.2.13 Go to the Sample page and select "Concentrations" as the Analysis Type then open rack editor. Enter sample ID, weight, and volume in the appropriate spaces. Enter the End Cup position and print rack editor.

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9.2.14 Click on "Start a New Batch" to save the data from the analysis.
(Ex: Batch ran on 2/27/01 would be named as 22701)

9.2.15 Click on "Run Auto" to start sample run.

9.2.16 Flush the lines with the acid rinse for at least 5 minutes after the run is complete.

9.2.17 Go to the "Control" page and turn off lamp, gas, and pump. Release tension on pump windings.

10. REPORTING

10.1 Results should be reported on appropriate paperwork or forms for submitting data to management or cement plant personnel. Hard copies of data must be archived in an appropriate filing system. Hard copy data should contain only data, justified error corrections and when necessary, notes concerning data quality. Do not write unwarranted comments on lab data.

11. REFERENCES

11.1 U.S EPA, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd Ed., Vol. 1A) Method 7471.

S-11 Standard Procedure for the Microwave-Assisted Preparation of Liquid and Solid Waste in Trace Element Analysis (CEM MARS model)

1.0 SCOPE

- 1.1 This procedure is for the microwave-assisted leaching of trace elements in liquid and solid wastes using nitric and hydrochloric acid. It is not applicable to aqueous wastes.
- 1.2 This procedure is useful for leaching the majority of trace metals from waste samples. It is not intended as a total digestion procedure.
- 1.3 ***This procedure may involve hazardous materials, operations, and equipment. This procedure does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Sytech Health and Safety Guideline: Laboratory Safety for additional information.***

2.0 TERMINOLOGY

- 2.1 Batch (as relates to microwave processing) - A group of up to 12 samples of similar matrix that are processed in the same digestion procedure/program.

3.0 SUMMARY OF PRACTICE

- 3.1 A portion of the waste is combined with nitric and hydrochloric acids in a PFA-lined digestion vessel, and heated in a pre-programmed microwave digestion unit. Following the programmed heating cycle, the vessel is vented and brought to a known volume. The sample is ready for analyses.

4.0 SIGNIFICANCE AND USE

- 4.1 Microwave assisted sample preparation is a rapid and effective procedure for leaching the majority of trace metals from industrial furnace feedstreams. It is used primarily for MACT-related analyses, but is also useful for other sample types in which a quantitative result is required.

5.0 APPARATUS

- 5.1 CEM MARS Model Microwave Digestion Unit with temperature and pressure control, exhaust and automatic turntable.

- 5.2 CEM OMNI High-pressure PFA digestion vessels.

Method S-11

6.0 REAGENTS AND MATERIALS

- 6.1 Purity of Materials - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 6.2 Purity of Water - Unless otherwise indicated, references to water shall be understood to mean meeting the numerical requirements of Type II water as defined by ASTM D 1193.
- 6.3 Hydrochloric acid, 37%, HCl.
- 6.4 Nitric acid, 70%, HNO₃.

7.0 SAMPLE

- 7.1 Because stratification or layering of liquid samples is possible, the laboratory sample should be thoroughly mixed by shaking prior to withdrawing a portion for testing. Solid samples should be thoroughly mixed by shaking or stirring depending on the physical characteristics of the sample.

8.0 QUALITY CONTROL

- 8.1 Refer to the Maintenance and Optimization Log for specific requirements.

9.0 PROCEDURE

- 9.1 For waste-derived fuel, coal, coke, raw feed samples:

- 9.1.1 Weigh approximately 0.5 g portion of the sample directly in a PFA digestion vessel to the nearest 0.001 g.

Note: Larger sample sizes of raw feed (only) may be used. The reaction between the sample and acids will be more vigorous than with a smaller sample size (see 9.1.2).

- 9.1.2 With a pipette dispenser unit, or equivalent device, slowly add approximately 10 ml HNO₃ and 4 ml HCl to the PFA vessel with the sample. If a chemical reaction is observed, allow the reaction

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to subside prior to performing Step 9.1.3. With slurry samples it may be advantageous to add HCl first and allow the reaction to subside prior to adding HNO₃. A minimum volume of 14 mls of acid per OMNI vessel is recommended by the manufacturer. Typically for fuel and slurry samples 10 mls of nitric and 4ml of hydrochloric should be used. Other ratios of these acids may be used as necessary.

- 9.1.3 Place pressure controller cap on the vessel body, and tighten to 60 inch pounds with torque wrench to achieve a firm fit. Do not over tighten because this can damage the sealing surface and threads.
- 9.1.4 Insert the pressure sensing line into the pressure controller cap assembly and tighten to finger-tightness. Insert the temperature monitoring probe into the thermowell in the pressure controller cap and place the vessel in the microwave turntable. Attach the temperature monitoring probe and the pressure sensing line to the microwave connections. Use caution not to twist the pressure sensing line connector onto the microwave connector as this could damage the connectors.
- 9.1.6 Repeat Steps 9.1.1 and 9.1.2 for additional vessels. Cap these vessels with standard vessel cap assemblies. Be sure each vessel cap assembly is tightened to firmness using the torque wrench. Evenly distribute the digestion vessels in the turntable to ensure even heating of all vessels.
- 9.1.7 It is recommended that a blank and a certified reference standard or a matrix spike/matrix spike duplicate be processed with each batch of samples. The QC items specified in a facility's WAP must be followed if analyses are done for regulatory purposes.
- 9.1.8 The samples are ready for microwave processing. Fuel quality waste and slurry samples are normally processed following the User program "MACT". This program may be modified if needed..

MARS**MACT Program Variables**

Stage	(1)	(2)	(3)	(4)	(5)
Power Max 1200W	100%	0%	0%	0%	0%
Pressure	max 700	0	000	000	000
Ramp	20:00	0:00	0:00	00:00	00:00
Time at T. (TAT)	10:00	0:00	0:00	00:00	00:00
Temperature	190C	0C	0C	0C	0C

9.1.9 Vent the vessels in a laboratory fume hood. The pressure sensing line and temperature control line will need to be disconnected from the microwave in order to remove the pressure control vessel for venting. Remove the vessel cap assemblies.

9.1.9.1 Quantitatively transfer the digested sample solution to a clean 50 ml volumetric flask and bring to volume with water. If any particulate matter is observed, it may be removed by filtration or centrifugation.

9.1.9.2 The sample is now ready for analysis.

10.0 PRECISION AND BIAS

10.1 Precision - No statement is made about the precision since this procedure does not produce a specific test result.

10.2 Accuracy - No statement is made about the accuracy since this procedure does not produce a specific test result.

11.0 REFERENCES

11.1 USEPA, SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd Ed., Vol. 1A). Method 3051.

Standard Method for Determining the pH of Solid or Liquid Waste

1.0 SCOPE

- 1.1 This method describes two methods for making pH measurements: 1) indicating pH paper, and 2) electrometric (meter). It is applicable only for non-aqueous waste samples.
- 1.2 *This method may involve hazardous materials, operations, or equipment. This method does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 Equal volumes of water and the waste sample are thoroughly mixed together. This mixture is centrifuged to separate the phases. Paper Method: The water phase is then applied to pH paper to determine the approximate extracted pH. Meter: The water layer is removed to a new test tube. The pH meter is calibrated. The electrode is placed in the water layer extract of the sample, and the pH of the sample is read.

3.0 SIGNIFICANCE AND USE

- 3.1 The pH of incoming and blended FQW is monitored because of permit limits, worker health and safety, fuel compatibility, and to prevent premature storage tank wear.

4.0 REAGENTS AND MATERIALS

- 4.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 4.2 pH paper strips, universal range (0-14), or narrow range pH paper.
- 4.3 pH Buffer Solutions - 4.0, 7.0, 10.0: Must be manufacturer certified against NIST Standard Buffers. Expiration dates on buffer solutions must be observed.
- 4.4 Purity of Water - Unless otherwise indicated, references to water shall be understood to mean meeting the numerical requirements of Type II water as defined by ASTM D 1193.

5.0 APPARATUS

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5.1 pH Meter, Ion Exchange Type: Orion 501, 611, SA720, or equivalent unit. The meter should ideally have the following capabilities:

- a) Two point calibration.
- b) Automatic temperature compensation.

6.0 INTERFERENCES AND LIMITATIONS

Paper

6.1 This procedure is designed to calorimetrically determine the approximate pH of non-aqueous liquid or solid wastes. For a more accurate measurement, sample pH should be determined using a meter.

6.2 Extracted water layers that exhibit a high degree of coloration may affect the color change on the pH paper. If this occurs, a meter is to be used.

Meter

6.3 While not in use, the electrode must be kept immersed in water or buffer solution. If allowed to dry-out, its function may be impaired.

6.4 The electrode must not be directly inserted into non-aqueous waste samples for direct pH measurement. This will damage the electrode.

6.5 For proper operation, the electrode must be filled with electrode solution to the manufacturer specified level.

6.6 Sample temperature can significantly affect readings at pH 11.5 or greater. See Section 9.8.

7.0 SAMPLE

7.1 Because stratification or layering of liquid samples is possible, the laboratory sample should be thoroughly mixed by shaking prior to withdrawing a portion for testing. Solid samples should be thoroughly mixed by shaking or stirring depending on the physical characteristics of the sample.

8.0 QUALITY CONTROL

8.1 Refer to the Maintenance & Optimization Log for specific requirements.

8.2 Meter - Following the pH measurement of the sample, one buffer solution near the sample reading is measured to verify the pH meter/electrode. This buffer reading is to be recorded on the calorimeter ticket or other suitable paperwork.

9.0 PROCEDURE

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Method PC-1

- 9.1 Transfer 5 ml of water and 5 ml waste sample to a centrifuge or test tube. Thoroughly mix the contents of the tube by capping and shaking, vigorously stirring with a glass rod/pipet, or by using the vortex mixer.
- 9.2 To separate the phases, centrifuge the sample/water mixture for approximately 1 minute.

Paper

- 9.3 Remove the water layer by pipet, and apply a sufficient amount to fully wet the indicating portion of the pH strip in order to thoroughly wet it.
- 9.4 The color change observed on the indicating portion of the pH strip should be compared to the pH color change reference provided by the pH strip manufacturer. This comparison should be made while the indicating portion of the pH strip is still wet.

Meter

- 9.5 Remove the water layer by pipet to a new test tube.
- 9.6 Calibrate the pH meter according to the manufacturer's instructions. The user should calibrate the meter using two pH buffers, if possible. For meters allowing only 1 calibration point, the pH buffer closest to the expected sample pH should be used.
- 9.7 After rinsing the electrode with deionized water, fully immerse it in the test tube containing the aqueous sample extract. After pH display stabilized (generally about 30 - 60 seconds), record sample pH.
- 9.8 If the reading indicates pH 11.5 or greater, the sample should be remeasured beginning with 9.5 using the meter's temperature compensation probe.

10.0 REPORTING

- 10.1 Paper - The pH number corresponding to the color change of the pH strip should be recorded to the nearest whole number. The information should be recorded on qualification sheets, truck GC's, or other appropriate paperwork.
- 10.2 Meter - The pH reading from the meter display should be recorded to the nearest tenth unit. This information can be recorded on qualification sheets, truck GC's, or other appropriate paperwork.

11.0 PRECISION AND BIAS**Meter****C0168**

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Method PC-1

- 11.1 The precision estimates are based on an interlaboratory study in which operators at seven different laboratories analyzed three standard materials and two liquid waste fuel samples with pH's ranging from about 2.00 to 9.00. The study was conducted in accordance with ASTM E 691.
- 11.2 Repeatability (Within Laboratory) - The coefficient of variation of results obtained by the same analyst has been estimated at 1.3% relative at 96 degrees of freedom. Two values should be considered suspect (95% confidence level) if they differ by more than 3.67%.
- 11.3 Reproducibility (Between Laboratories) - The coefficient of variation of results obtained by analysts in different laboratories has been estimated to be 3.36% relative at 24 degrees of freedom. Two values should be considered suspect (95% confidence level) if they differ by more than 9.41%.
- 11.4 Bias - No justifiable statement can be made on the bias of the procedure in this test method because no acceptable reference material is currently available. However, measured values for a series of three standard materials were as follows:

<u>Standard Value</u>	<u>Interlaboratory Mean</u>	<u>Measurement Accuracy %</u>
2.00	2.13	106.5
7.40	7.44	100.5
9.00	8.95	99.4

REFERENCES

- 12.1 USEPA, SW-846, Test Methods for Evaluating Solid Waste: Physical/ Chemical Methods (SW-846, 3rd Ed., Vol. 1C) Method 9045.
- 12.2 ASTM D 4980: Standard Test Methods for Screening of pH in Waste.

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Method PC-1

Standard Procedure for the Determination of Ignitability of Fuel Quality Waste

1.0 SCOPE

- 1.1 This procedure describes the determination of ignitability of solid or liquid wastes. It is applicable to inorganic and organic-based materials.
- 1.2 This procedure is used to determine whether a material will or will not flash at a specified temperature. For regulatory purposes, materials are typically tested to assess whether or not their flash point is less than or equal to, or greater than the regulatory definition of ignitable of 140EF (60EC).
- 1.3 *This procedure may involve hazardous materials, operations, or equipment. This procedure does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 A 2 ml portion of liquid samples or approximately 2 g of solid samples are into the sample cup. The sample is brought to the specified temperature and allowed to stabilize. A test flame is applied to the sample in the cup. The sample is observed and noted if it flashed or did not flash.

3.0 SIGNIFICANCE AND USE

- 3.1 A waste material with a flash point of less than 140EF is designated as ignitable by regulatory definition. Ignitability is a property used in classifying waste. This procedure allows the user to rapidly determine if a material is or is not ignitable.

4.0 APPARATUS

- 4.1 Setaflash Flash Point Tester: Manufactured by Stanhope-Seta Ltd. (Surrey, England), distributed by Erdco Engineering (Addison, Illinois), or equivalent. See photograph in Annex I.
- 4.2 Thermometer, bulb-type with a minimum range of 32 to 200EF (0 to 93.3EC).
- 4.3 Syringe, glass, or plastic with a minimum 2 ml capacity, or equivalent.

5.0 REAGENTS AND MATERIALS

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Method PC-2

- 5.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.

5.2 Flash Point Reference Standards

Note 1: A number of flash point reference materials are commercially available. The user should choose an appropriate standard(s) for their specified temperature setting. The standard must be traceable to NIST or equivalent.

5.2.1 p-xylene, $C_6H_4(CH_3)_2$, flashpoint 81EF (27.2EC).

5.2.2 Kerosene, flash point 136EF (57.8EC), available from Alpha Resources, Inc., 3090 Johnson Road, Stevensville, Michigan, 49127-0199, 800-833-3083, Catalogue #AR-3027.

5.2.3 JP-8 Jet Fuel, flash point 124.4EF (51.3EC), available from Alpha Resources, Inc., 3090 Johnson Road, Stevensville, Michigan, 49127-0199, 800-833-3083, Catalogue #AR-3027.

6.0 **SAMPLE**

- 6.1 Because stratification is possible, the liquid laboratory samples should be thoroughly mixed by shaking prior to withdrawing a portion for testing. Solid samples should be thoroughly mixed by shaking or stirring depending on the physical characteristics of the material.

7.0 **QUALITY CONTROL**

- 7.1 Prior to initial use or after removal of the thermometer, insert thermometer into its pocket with a good heat transfer lubricant paste (Dow Corning Silicone #340, or equivalent. Generally supplied with instrument).
- 7.2 The instrument should be thoroughly cleaned after each use.
- 7.3 An appropriate reference standard must be tested with each batch of samples, or at a 10% frequency, whichever is smaller. The reference standard should exhibit a flash point within 2% of its certified temperature. Results should be recorded with the sample results or in an appropriate log.

8.0 **PROCEDURE**

- 8.1 Refer to manufacturer's instructions for instrument operating procedures.

- 8.2 If the instrument is not in standby mode, turn instrument ON.
- 8.3 Close and lock the specimen cup cover. Set target temperature to 140EF and wait until the temperature reaches 140EF.
- 8.4 *Liquid samples:* Charge the syringe with 2 ml sample and transfer into the sample cup through the fill orifice. Remove the syringe. If dealing with a very viscous liquid, the sample can be discharged directly into the sample cup. If the sample cannot be drawn into the syringe, follow the instructions for solid material in 8.5.
- 8.5 Solid Samples: Place approximately 2 g into the sample cup with a lab spatula or equivalent device.
- 8.6 For liquids, set the 1-minute time clock. For solids, set the 2-minute time clock. The time clock setting allow the sample material to stabilize.
- 8.7 Open the gas control valve and light the pilot and test flames. Using the gas pinch valve, adjust the test flame size to about 4 mm.
- 8.8 After the stabilization delay (1 minute for liquids; 2 minutes for solids), the user should look directly at the flame cup door in which the flame is applied and apply the test flame by slowly opening the slide thoroughly and closing completely over a period of 2 to 3 seconds. Watch for the flash, which is typically indicated by a blue flame that appears and propagates itself over the surface of the sample.

Note 1: The user must wear goggles or a full-face shield when performing 8.8.

Note 2: It has been noticed that on occasion, a material with a flash point significantly below the instrument temperature setting can exhibit a yellowish-orange conical flame that appears to burn at the surface of the sample.

9.0 REPORTING

- 9.1 The flash/no flash results should be recorded as less than the tested temperature, or if the sample flashed at the tested temperature. The information should be recorded on qualification sheets, analytical report, or other appropriate paperwork.

10.0 PRECISION AND ACCURACY

- 10.1 Precision - Because an internal interlaboratory study has not been performed, no statement on precision is made at this time. See Section 10.3.
- 10.2 Accuracy - Because an internal interlaboratory study has not been performed, no statement on accuracy is made at this time. See Section 10.3.

- 10.3 Reference method ASTM D 3278 provides the following performance data:

Standard Deviation

<u>Material</u>	<u>Within- Laboratory</u>	<u>Between- Laboratory</u>
Solvents (low viscosity at 100EF.	0.98EF	1.55EF
Resins and Paints (high viscosity at 100EF.	1.89	2.41

11.0 **REFERENCES**

- 11.1 ASTM D 3278: Standard Test Methods for Flash Point of Liquids by Setaflash Closed Tester.

OHIO EPA - DMWM

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Method PC-2

Standard Procedure for Compatibility Testing of Solid or Liquid Waste

1.0 SCOPE

- 1.1 This procedure describes the compatibility testing for the co-mingling of waste materials. It is applicable to solid or liquid wastes.
- 1.2 This procedure is applicable to all qualification samples, and samples from received shipments of bulk and containerized wastes.
- 1.3 *This procedure may involve hazardous materials, operations, and equipment. This procedure does not purport to address all of the safety considerations associated with its use. However, the user should be mindful of the following:*
 - a) Always work under the fume hood and wear the required personal protective equipment. Gloves and safety glasses are required. Goggles or face shield must be used if the hood sash cannot be positioned to protect the user throughout the entire testing period.
 - b) Always point the test tube away from you during handling.
 - c) Always add materials into the test tube slowly at first, and continue adding only if no violent reactions occur.
 - d) Terminate all testing if a violent reaction occurs.

In addition to the above safety measures, it is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.

2.0 TERMINOLOGY

- 2.1 Incompatible - A material may be considered incompatible if during this test it exhibits any of the following reactions:
 1. heat generation
 2. gas evolution (visible bubbles or vapors)
 3. polymerization
 4. gelling
 5. pH limits are exceeded
 6. precipitation or sedimentation of resins or polymers
 7. any other adverse reaction on mixing with waste fuel or pure water.

3.0 SUMMARY OF PROCEDURE

- 3.1 Samples are first tested for pH and the presence of oxidizers. Five (5) ml portions of the waste sample and the waste fuel into which the material will be blended are combined and the mixture is observed for incompatibility.

4.0 SIGNIFICANCE AND USE

- 4.1 Incoming waste materials and stored fuel must be deemed compatible prior to blending. The blending of incompatible materials is a personnel health and safety risk, along with creating the potential for chemical reactions in storage tanks and transfer lines that could result in a rapid increase in temperature, gas generation, gellification, or solidification.

5.0 REAGENTS AND MATERIALS

- 5.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 5.2 Digital thermometer equipped with a programmable alarm and stainless steel probe; OR Thermometer - Glass rod, digital, or dial type. Fahrenheit or centigrade graduated reading.
- 5.3 Potassium iodide (KI) starch paper strips (EM Quant7 Peroxide Test, Cat. No. 1011-1).
- 5.4 H_2O_2 , 3% solution.

6.0 INTERFERENCES AND LIMITATIONS

- 6.1 This procedure was designed to detect potential incompatibilities of co-mingled waste materials. While many incompatible materials can be detected with this procedure, the user should be aware that some wastes may not exhibit incompatibility with this procedure.

7.0 SAMPLE

- 7.1 Because stratification, or layering of liquid samples is possible, the laboratory sample should be thoroughly mixed by shaking prior to withdrawing a portion for testing. Solid samples should be thoroughly mixed by shaking or stirring depending on the physical characteristics of the sample.

8.0 QUALITY CONTROL

- 8.1 All thermometers should be checked at least annually against on NIST traceable thermometer.

9.0 PROCEDURE

The Compatibility Test Procedure is a 4-part test procedure. Part 1 consists of gathering information from the material samplers; Part 2 consists of testing the pH of the waste sample; Part 3 screens for oxidizers; and Part 4 consists of the actual compatibility screening with stored waste fuel.

Part 1:

- 9.1 The laboratory personnel should confer with the material samplers on the nature of the shipment materials. The Chemist(s) may need to examine the material in its shipping container(s).

Part 2:

- 9.2 The waste sample should be screened for pH by using Methods PC-1.

Part 3:

- 9.3 Remove an aliquot of the water extract layer used in the pH extraction and apply to the oxidizer test strip.
- 9.4 If a blue color is evident on the test strip (light blue to dark blue), the test is considered POSITIVE. If a very dark blue to brown or a brown-green color is evident, the oxidizer concentration exceeds the color scale. If this occurs, the water layer from step 2 is to be diluted until a blue color is evident.

Part 4:

- 9.5 Place portions of the material to be tested and the waste into which the material will be blended or other representative material into 20 x 150 mm test tubes (or equivalent). If the material to be tested is a solid or a sludge, use approximately 5 cm³ of material.
- 9.6 Samples of wastes should be tested at the "as received" temperature. It should be judged by the same criteria as unheated materials.
- 9.7 Note the temperature of received material.

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- 9.8 Carefully mix the contents of the tube and monitor temperature for 1 minute. If using an alarm thermometer, program the temperature-rise alarm to sound with a rise of $\leq 5^{\circ}\text{F}$. In some cases, it may be useful to extend the observation period.
- 9.9 Record any incompatible reactions. In some cases, it may be useful to evaluate potential incompatibilities using the NOAA Reactivity software.

10.0 CALCULATION AND INTERPRETATION

- 10.1 If a reaction occurs, the candidate material may be is considered incompatible with the stored waste.

11.0 REPORTING

- 11.1 The results of the procedure should be on the qualification sheet, truck GC's, or other appropriate paperwork. If no incompatibility reactions are observed, then the entry should be "compatible" or "OK". If reactions are observed, they should be briefly described.

12.0 PRECISION AND ACCURACY

- 12.1 Precision - No statement about the precision since this procedure does not produce a specific test result.
- 12.2 Accuracy - No statement is made about the accuracy since this procedure does not produce a specific test result.

13.0 REFERENCES

- 13.1 ASTM D5058: Standard Test Methods for Compatibility of Screening Analysis of Waste.
- 13.2 ASTM D4981: Standard Test Method for Screening of Oxidizers in Waste.

C0179

Standard Method for Determining Viscosity of Liquid Waste

1.0 SCOPE

- 1.1 This method describes the rotational viscometry determination of liquid waste samples. It is applicable only for liquid waste samples.
- 1.2 *This method may involve hazardous materials, operations, or equipment. This method does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 After selecting the appropriate spindle and viscometer speed setting, the spindle is lowered into a representative liquid waste sample to the proper level. The viscometer is turned on and the rotating spindle is allowed to stabilize. After stabilization, the reading on the viscometer is read and recorded. This reading is then multiplied by the proper spindle factor for a final viscosity value.

3.0 SIGNIFICANCE AND USE

- 3.1 A number of sites have a maximum viscosity specification for blended or tendered fuel. This specification is either a permit requirement or a cement plant specific requirement. Viscosity measurements can be useful in assessing pumpability and other fuel handling characteristics.

4.0 APPARATUS

- 4.1 Brookfield Viscometer, LV or DV Series.

5.0 INTERFERENCES AND LIMITATIONS

- 5.1 Some waste samples that have a high viscosity may give a false viscosity reading. This can occur on thick semi-liquid samples that show a high cohesive tendency. In these cases, the rotating viscometer spindle can create a "hole" or "hollowed-out" area in the material. This can yield a systematically low viscosity reading.
- 5.2 Some samples with a high suspended solids content can yield fluctuating viscosity readings as solid material settles out. In these cases, the viscometer reading after stabilization may need to be made quicker than normal.

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- 5.3 Because the viscosity of a waste sample is dependent on temperature, all samples are tested on an "as-received" basis. It may be necessary to record the temperature at which viscosity measurements are taken.

6.0 SAMPLE

- 6.1 Because stratification, or layering is possible, the laboratory sample should be thoroughly mixed by shaking prior to lowering the viscometer spindle into the sample.

7.0 QUALITY CONTROL

- 7.1 A 50,100 or 500 cps viscosity standard shall be analyzed monthly to check performance of the viscometer. If the viscosity measurement of the standard is >10% from the certified value and no operator error can be determined, the viscometer may require manufacturer's service. The user should also investigate the quality of the standard and the temperature at which the standard was analyzed.

8.0 PROCEDURE

- 8.1 Select the appropriate viscometer spindle based on the expected viscosity.
- 8.2 If using an electronic viscometer, it must be set to zero.
- 8.3 The viscometer and spindle is lowered into the sample to the indentation marker on the spindle.
- 8.4 The viscometer is powered-up and allowed to stabilize. Stabilization for electronic viscometers will vary with the individual sample, but is generally 5 - 15 seconds, or the point at which the digital display shows non-rapid change. Stabilization for non-electronic units will also vary with the individual sample, but is generally after 3 - 6 revolutions.
- 8.5 The viscosity reading is now taken. For electronic units, the reading is obtained directly from the digital display. For non-electronic units, the spindle and needle are stopped by depressing the "stop" buttons. The reading is taken from the needle-indicator stop point.
- 8.6 The readings from electronic or non-electronic units are then multiplied by the appropriate spindle factor. The spindle factor for the individual spindles is found in the printed reference material furnished by Brookfield. Final viscosity numbers are calculated by the following formula:

C0181

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Reading from Viscometer X Brookfield Spindle Factor = Final Sample Viscosity

9.0 REPORTING

- 9.1 The final viscosity reading should be recorded to the nearest whole number. The reporting units are Centipoise (cps). Any value measured at greater than 10,000 cps, should be recorded as greater >10,000 cps. This information can be recorded on qualification sheets, truck GC's, or other appropriate paperwork.

10.0 PRECISION AND BIAS

- 10.1 The precision estimates are based on an interlaboratory study in which operators at seven different laboratories analyzed three standard materials with viscosities ranging from about 44 centipoise (cps) to 476 cps. The study was conducted in accordance with ASTM E 691.
- 10.2 Repeatability (Within Laboratory) - The coefficient of variation of results obtained by the same analyst has been estimated at 9.64% relative at 48 degrees of freedom. Two values should be considered suspect (95% confidence level) if they differ by more than 27.00%.
- 10.3 Reproducibility (Between Laboratories) - The coefficient of variation of results obtained by analysts in different laboratories has been estimated to be 12.43% relative at 12 degrees of freedom. Two values should be considered suspect (95% confidence level) if they differ by more than 34.79%.
- 10.4 Bias - No justifiable statement can be made on the bias of the procedure in this test method because no acceptable reference material is currently available. However, measured values for a series of three standard materials were as follows:

<u>Standard Value</u>	<u>Interlaboratory Mean (cps)</u>	<u>Measurement Accuracy %</u>
44.8	47.8	106.7
98.8	103.4	104.7
476.0	496.8	104.4

11.0 REFERENCES

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- 11.1 ASTM D 2196-86: Standard Test Method for Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield) Viscometer.
- 11.2 ASTM E 691: Standard Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method.

ASTM D5530: Standard Test Method for Total Moisture of Hazardous Waste Fuel by Karl Fischer Titrimetry¹

1.0 SCOPE

- 1.1 This test method describes the determination by Karl Fischer titrimetry of total moisture in solid or liquid hazardous waste fuels utilized by industrial furnaces.
- 1.2 This method has been used successfully on numerous samples of hazardous waste fuel composed of solvents, spent oils, paints and pigments. The expected range of applicability for this method is between 1.0 to 100%; however, this evaluation was limited to samples containing approximately 5 to 50% water.
- 1.3 *This standard does not purport to address the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to its use. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 REFERENCED DOCUMENTS

2.1 ASTM Standards

D 1193 - Specifications for Reagent Water²

D 4017 - Standard Test Method for Water in Paints and Paint Materials by Karl Fischer Method³

E 691 - Standard Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method⁴

3.0 SUMMARY OF TEST METHOD

- 3.1 An amount of solvent (see Section 7.3) sufficient to fully immerse the electrode in the titration flask (see Note 1) is titrated to dryness as explained in Section 9.1, and the Karl Fischer Reagent Factor is determined by titration of measured amounts of water. A weighed portion of the sample is dissolved in Karl Fischer solvent and titrated with reagent to dryness. If solid material interferes (see 5.3) with the electrode or

¹ This practice is under the jurisdiction of ASTM Committee D-34 on Waste Management and is the direct responsibility of Subcommittee D34.02 on Physical and Chemical Characterization.

² Annual Book of ASTM Standards, Vol. 11.01.

³ Annual Book of ASTM Standards, Vol. 6.01.

⁴ Annual Book of ASTM Standards, Vols. 6.03, 8.03, and 14.02.

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does not sufficiently dissolve, an extraction using KF solvent is performed prior to introduction into the titration flask. The total moisture in the sample is then determined. The final total moisture percent is an average of two trials for each sample.

- 3.2 The contents of the titration flask may be retained and used for additional analyses. The contents of the titration flask will need to be emptied and replaced with new solvent when the capacity of the flask is nearly exhausted or when solid material affects the sensing by the electrode.

4.0 SIGNIFICANCE AND USE

- 4.1 The determination of total moisture is important in assessing the quality of fuels. Water content will directly affect heating value of fuels and can contribute to instability in operation of an industrial furnace. Additionally, high water contents can present material handling and storage problems during winter months or in cold environments.

5.0 INTERFERENCES

- 5.1 A small number of oxidants such as ferric and chromate salts can oxidize iodide and may produce artificially low results.
- 5.2 Certain reductants oxidized by iodine such as mercaptans, thioacetate, thiosulfate, stannous chloride, sulfides, hydroquinone, and phenylenediamines can consume iodine and may cause artificially high results. Basic materials such as hydroxides, oxides, and inorganic carbonates may cause artificially high results by water-forming reactions.
- 5.3 Some types of solid material found in waste-derived fuel may interfere with the electrode by blocking its contact with the solvent. Depending on the nature of the solid material, artificially high or low results can occur.

6.0 APPARATUS

- 6.1 Karl Fischer potentiometric titration unit - automated or semi-automated equipped with a magnetic vessel stirrer. The user must follow manufacturer's instructions for installation and use.

Note 1: The Karl Fischer unit used in developing this method was equipped with a twin platinum electrode, 25 - 80 ml capacity titration flask, magnetic stirrer, electronic piston burette, adjustable delay interval, LED display, visual and audible end-point notification.

- 6.2 Syringe - 100 ul capacity, with needle.
- 6.3 Syringe - 1 to 5 ml capacity, without needle.
- 6.4 Analytical balance - Minimum capacity of 160 g and capable of weighing to 0.0001 g.

7.0 REAGENTS AND MATERIALS

- 7.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available. Other grades may be used, providing that it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.⁵
- 7.2 Purity of Water - Unless otherwise indicated, references to water shall be understood to mean meeting the numerical requirements for Type II water as given in ASTM D 1193.
- 7.3 Karl Fischer Solvent - The solvent system must be a non-methanol formulation for the analysis of aldehydes and ketones, and for general usage. The use of a strictly general-purpose solvent is not acceptable because of the potential of obtaining artificially high results from water-forming reactions by chemicals with active carbonyl groups.
- 7.4 Karl Fischer Reagent - The reagent should have a standard titer value of 5 mg H₂O/ml reagent and be listed as being compatible with the solvent system.

8.0 SAMPLE

- 8.1 Because stratification or layering of liquid samples is possible, the laboratory sample should be thoroughly mixed by shaking prior to withdrawing a portion for testing. Strongly multi-phasic samples should have each layer analyzed separately, and the total moisture percent of the sample calculated as a weighted average. Solid samples should be thoroughly mixed by shaking or stirring, depending on the physical characteristics of the sample.

⁵ Reagent Chemicals, 8th edition, American Chemical Society Specifications, "Am. Chemical Soc., Washington, D.C.

9.0 QUALITY CONTROL

9.1 Determination of Karl Fischer Reagent Factor (F):

- 9.1.1 Determine the mg H₂O/ml reagent (F) for each new procurement of KF titrant and at a minimum of weekly on a solvent retained for further titrations (see Section 3.0).
- 9.1.2 Add a sufficient quantity of solvent to cover the electrode tip, set the delay interval to 30 s, and engage the magnetic stirrer.
- 9.1.3 Bring the KF solvent to dryness by titrating with reagent to the endpoint. The end-point is typically indicated by a visual and/or audible alarm depending on equipment manufacturer.
- 9.1.4 Refill the burette with reagent.
- 9.1.5 Fill the 100 ul syringe with approximately 10 ul of water and weigh to the nearest 0.0001 g.
- 9.1.6 Dispense the syringe contents into the titration vessel and immediately replace the sample port stopper. Reweigh the syringe and record the water mass.
- 9.1.7 Titrate with reagent until the endpoint is reached. Record the titrant volume used.
- 9.1.8 The final value for F should be based on the mean of a minimum of three replicates.
- 9.1.9 Calculation:
 - 9.1.9.1 Calculate F by the following formula:

$$F(\text{mg/ml}) = \text{water weight}(\text{mg})/\text{reagent volume}(\text{ml})$$

- 9.1.9.2 The replicate values for F should have a relative standard deviation of not greater than 5%. If a greater variance is determined, the standardization should be repeated.

10.0 PROCEDURE

- 10.1 Bring the KF solvent to dryness by titrating with reagent to the endpoint. The end-point is typically indicated visually and/or by an audible alarm depending on equipment manufacturer.

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- 10.2 Refill the burette with reagent.
- 10.3 Draw a portion of the sample into the 1 - 5 ml syringe, and clean any residual sample material from the syringe tip. If the sample contains a large amount of solids or its viscosity is such that it cannot be easily drawn into the syringe, it may be necessary to weigh the sample and introduce it using a lab spatula, or suitable device.
- 10.4 Weigh the syringe with sample to the nearest 0.0001 g.
- 10.5 Add the sample to the titration vessel and allow sufficient time for the material to adequately dissolve. The suggested amount of sample based on the amount of expected water content is as follows:

TABLE 1. Specimen Guidelines

Expected water, %	Approximate Specimen Mass, g	Approximate Titrant Volume at 5 mg/ml titre, ml
0.5-1.0	5	5-10
1-3	2-5	10-20
3-10	1-2	10-20
10-30	0.4-1.0	15-25
>70	0.1	20

Note 2: The information above is described in ASTM D 4017, Standard Test Method for Water in Paints and Paint Materials by Karl Fischer Method.³

- 10.6 Reweigh the syringe and record the sample mass added to the vessel to the nearest 0.0001 g.
- 10.7 If solid material is observed interfering with the sensing probe, or it is observed that the sample is not sufficiently dissolved in the KF solvent, extract the sample with solvent as follows:
- 10.7.1 Beginning again with a new sample, gravimetrically combine the sample and solvent at an approximate 1:1 ratio in a large test tube. Record the mass of both sample and solvent.
- 10.7.2 The sample mixture should be capped and shaken or mixed on a vortex-type or orbital mixer for approximately 1 minute.
- 10.7.3 Centrifuge the sample mixture to separate the undissolved/leached solids.

10.7.4 Analyze the supernatant beginning with Section 10.1.

10.7.5 In addition to the extracted sample, a blank solution of virgin KF solvent should be analyzed beginning with Section 10.1. The KF solvent blank (ml of titrant used) is subtracted in 10.9.3.

10.8 Titrate with reagent until the end point is reached. Record the volume.

10.9 The final percentage of water is normally based on a single reading.

10.9.1 Calculation:

10.9.2 For unextracted samples, calculate the percentage water as follows:

- a) $(V)(F) = W$
- b) $(W/S) 100 = \text{Water, weight \%}$

where:

V = reagent volume (ml)
 F = Karl Fischer reagent factor (mg/ml)
 W = mass of water contained in the sample (mg)
 S = sample mass (mg)

10.9.3 For extracted samples, calculate the percentage water as follows:

- a) $(V - \text{solvent blank})(F) = W$
- b) $(W/S) (\text{dilution factor}) (100) = \% \text{ Water}$

where:

V = reagent volume (ml)
 F = Karl Fischer reagent factor (mg/ml)
 W = mass of water contained in the sample (mg)
 S = sample mass (mg)

$$\text{dilution factor} = \frac{\text{KF solvent(mg)} + \text{sample(mg)}}{\text{sample(mg)}}$$

10.9.4 For extracted samples, for the Mettler unit, calculate the percentage water as follows:

$$\% \text{ water} = \frac{\text{Total percent water} - (\text{Diluent percent water} \times \text{Diluent mass})}{\text{sample mass}}$$

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Sample Mass percent

11.0 PRECISION AND BIAS

11.1 The precision estimates are based on an interlaboratory study in which operators in six different laboratories analyzed in duplicate, on separate days, five samples of hazardous waste fuel containing between 13 and 32% water. The results were analyzed statistically in accordance with ASTM E691.

11.1.1 Repeatability (Within Laboratory) - The coefficient of variation of results (each the average of duplicate determinations), obtained by the same analyst on different days has been estimated to be 1.3% relative at 30 degrees of freedom. Therefore, results of two properly conducted tests, by the same operator on the same sample, should not differ by more than 3.6% of their average.

11.1.2 Reproducibility (Between Laboratories) - The coefficient of variation of results (each the average of duplicate determinations), obtained by analysts in different laboratories, has been estimated to be 4.3% relative at 5 degrees of freedom. Therefore, results of properly conducted tests on identical samples of the same material, by two different labs, should not differ from each other by more than 12.4% of their average.

11.2 Bias - The bias of this test method has not been determined because there are no recognized reference standards.

12.0 KEYWORDS

Karl Fischer titrimetry
Total moisture
Percent water
Hazardous waste fuel

Standard Method for Determining Heat Value and Ash Content of Liquid and Solid Wastes

1.0 SCOPE

- 1.1 This method describes the calorimetric gross heat value determination and ash measurement of liquid or solid waste samples.
- 1.2 *This method may involve hazardous materials, operations, and equipment. This method does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 An aliquot of a representative waste sample is weighed in a combustion capsule, and placed in the capsule holding bracket in the oxygen bomb. The fuse wire is placed at the samples surface, and the bomb is sealed and charged with oxygen. The bomb is placed in the water bucket, electrodes are attached, and the calorimeter lid is closed. The calorimeter controller initiates the equilibrium and subsequent determination of the gross heat value. The combustion capsule is dried and the ash is determined gravimetrically.

3.0 SIGNIFICANCE AND USE

- 3.1 Operating permits specify a minimum heat value and/or ash for incoming fuel acceptance. Incoming materials are required to have a minimum heat value to ensure their use in energy recovery. Heat value of the blended fuel is important in assessing the quality of the fuel being supplied to the cement plant. Most cement plants have specifications regarding heat value of the blended fuel.

4.0 APPARATUS

- 4.1 Parr Instrument Company, Model 1261 or 1241 isoparabolic or adiabatic calorimeter equipped with automatic controller. The controller should be pre-programmed with the following information and recommended settings:

Acid 18

Fuse 15

Sulfur .2

DYNAMIC MODE

Additional input information required to running samples are as follows:

Sample ID

Sample Mass

Cal ID

EE Value

- 4.2 Analytical Balance - capable of weighing to at least 0.001 g.

5.0 REAGENTS AND MATERIALS

- 5.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the specifications of the American Chemical Society (ACS), where such specifications are available.
- 5.2 Parr Instrument Company, Nickel Fuse Wire, or equivalent.
- 5.3 Sodium hydroxide solution NaOH, 0.1 N: Dissolve 4.0 g sodium hydroxide in water and bring to a volume of 1 liter.
- 5.4 Sodium hydroxide solution NaOH, 0.01 N (Bombwash): Dilute 0.1 N sodium hydroxide 1:10 with water.
- 5.5 Purity of water - Unless otherwise indicated, references to water shall be understood to mean meeting the numerical requirements of Type II water as defined by ASTM D 1193.
- 5.6 Oxygen, minimum purity of 99.5%.
- 5.7 Parr Instrument Company, Combustion capsules or equivalent.

6.0 INTERFERENCES AND LIMITATIONS**6.1 Heat Value**

- 6.1.1 High levels of nitrogen and sulfur in a waste sample can cause minor heats of formation in the formation of nitric and sulfuric acids.

6.2 Ash

- 6.2.1 Some ash components can be expelled from the capsule upon sample combustion.
- 6.2.2 Burnt pieces of fuse wire left in the capsule may cause artificially high results.

7.0 SAMPLE

- 7.1 Because stratification, or layering is possible, the laboratory sample should be thoroughly mixed by shaking prior to withdrawing a portion for testing. Solid

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samples should be thoroughly mixed by shaking or stirring depending on the physical characteristics of the sample. On strongly multi-phasic or heterogeneous materials, a core of the lab sample may be necessary.

8.0 QUALITY CONTROL

- 8.1 Run benzoic acid standard (pellet form) to check accuracy and calibration weekly. Results should be within 3% of standard heat value. If the heat value is outside these limits, a redetermination of the oxygen bomb's Energy Equivalent Value is necessary.
- 8.2 Instrument and related maintenance items are listed in the Maintenance and Optimization Log for the calorimeter.

9.0 PROCEDURE

9.1 Heat Value.

- 9.1.1 Affix fuse wire to bomb head arm brackets, and wet internal bomb head surface with 0.01 N sodium hydroxide solution.
- 9.1.2 Add 20 milliliters of 0.01 N sodium hydroxide solution to the bomb vessel.
- 9.1.3 On a gravimetric balance, weigh out 0.8 g - 1.2 g of the well mixed sample (or core sample) in a combustion capsule. Transfer the combustion capsule with sample to the oxygen bomb. When dealing with a volatile liquid sample, it may be necessary to cover the sample combustion capsule during transfer to the oxygen bomb to prevent any potential evaporation of the sample.
- 9.1.4 Place sample combustion capsule in capsule holding bracket and place dichrome fuse wire at the samples surface level. Insert complete bomb head unit into the bomb vessel and seal with the holding ring. Be sure that the vent valve protruding from the bomb head is closed tightly.
- 9.1.5 Slowly charge the sealed oxygen bomb with 30 atm. of oxygen. Some calorimeter units are equipped with automated oxygen charging features.
- 9.1.6 Using the tongs provided, lower the sealed and charged bomb into the vessel bucket containing 2 liters of water. Insert the electrodes into the receptacles protruding from the bomb head.
- 9.1.7 Close cover of calorimeter, and initiate calorimeter sequence by depressing the following key sequence on the controller:

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*START	ENTER	ENTER	Method PC-6
CAL I.D. (#)	SAMPLE I.D. (#)	SAMPLE MASS (#)	ENTER

*Key steps followed by (#) require the user to enter specific number codes, identifications, or values.

- 9.1.8 Following the pre-period, firing sequence, and post-period equilibration, the calorimeter report will be automatically printed out at the controller or external printer.

NOTE: For waste samples which have high ash or moisture content, or both, or are ash samples that do not easily burn completely, one of the following procedures are recommended. (1) The mass of the sample may be varied to obtain good ignition. (2) A known amount of benzoic acid may be mixed with the sample as a spiking agent. Correction must be made for the calorific value of benzoic acid when calculating the calorific value of the sample. (3) A known amount of mineral oil, ethylene glycol, or other combustion aid may be mixed with the sample. The amount of combustion aid may be mixed with the sample. The amount of combustion aid will be dependent on the completeness of combustion. Calorific value for the combustion aid must be determined so as to make the necessary correction for the use of the aid as a spiking agent. When using spiking agents or combustion aids, the total amount of combustibles should meet the following guidelines:

1. For high inorganic and/or low water content materials:

Mineral oil is mixed with the sample in a recommended quantity of 0.2 g. The sample is then combusted as normal, and the combustion aids heat value is subtracted from the total heat value of the spiked sample.

2. For high water content materials:

Ethylene glycol is mixed with the sample in a recommended quantity of 0.2 g. The sample is then combusted as normal, and the combustion aids heat value is subtracted from the total heat value of the spiked sample.

Additionally, benzoic acid can be used as a combustion aid if the above guidelines are followed.

9.2 Ash.

- 9.2.1 After slowly venting the oxygen bomb, remove the bomb holding ring, bomb head and remove the combustion capsule.
- 9.2.2 Dry the capsule and ash using a hot plate, oven or other suitable device. The appropriate drying time should be determined by the user. Remove any traces of fuse wire.
- 9.2.3 Weigh the capsule and calculate ash amount as follows:

$$\frac{\text{Capsule} + \text{Ash (g)} - \text{Capsule (g)}}{\text{Capsule (g)}} (100) = \% \text{ Ash}$$

Sample Mass (g)

10.0 REPORTING

10.1 Heat Value - The calorimeter report should be attached to truck, qualification or other appropriate lab data, and filed from record. In addition, calorimeter data may need to be reported on qualification sheets or other appropriate form(s). The heat value, usually expressed as Btu/lb., may be rounded to the nearest 100 Btu/lb.

10.2 Ash - The result should be recorded on the calorimeter ticket or other appropriate paperwork. The percentage ash should be recorded to the nearest 0.1.

11.0 PRECISION AND BIAS

11.1 Heat Value - The precision estimates are based on an interlaboratory study in which operators at seven different laboratories analyzed three samples of flammable or combustible liquids with heat values ranging from about 9000 Btu/lb to 19,800 Btu/lb. The study was conducted in accordance with ASTM E 691.

11.2 Repeatability (Within Laboratory) - The coefficient of variation of results obtained by the same analyst has been estimated at 0.71% relative at 48 degrees of freedom. Two values should be considered suspect (95% confidence level) if they differ by more than 1.99%.

11.3 Reproducibility (Between Laboratories) - The coefficient of variation of results obtained by analysts in different laboratories has been estimated to be 0.86% relative at 12 degrees of freedom. Two values should be considered suspect (95% confidence level) if they differ by more than 2.41%.

11.4 Bias - No justifiable statement can be made on the bias of the procedure in this test method because no acceptable reference material is currently available. However, measured values for a series of three standard materials were as follows:

<u>Reference Value (Btu/lb)</u>	<u>Interlaboratory Mean (Btu/lb)</u>	<u>Measurement Accuracy %</u>
9767	9187	94.1*
18278	18050	98.8
19879	19748	99.3

* This standard material was a primary alcohol, and is susceptible to water absorption.

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- 11.5 In an interfacility round robin exercise, a secondary oil-based reference sample was distributed to 6 laboratories. This sample contained a reference value for ash of 10.24% " 0.5. The table below gives the analytical results and summary statistics.

Lab	n	\bar{X}	s	% Recovery of Ref. Value (mean)
Paulding	4	11.2	2.2	109.6
Fredonia	7	11.7	0.3	113.8
Alpena	4	11.0	1.9	107.4
Demopolis	4	10.6	0.5	103.5
Lebec	3	11.1	0.2	108.1
Xenia	1	12.0	-	117.2

12.0 REFERENCES

- 12.1 ASTM D 240: Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimetry.
- 12.2 ASTM D 5468: Standard Test Method for Gross Calorific and Ash Value of Waste Materials.
- 12.3 ASTM E 691: Standard Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method.

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Method PC-7

Standard Procedure for the Screening of Reactive Cyanide in Fuel-Quality Waste

1.0 SCOPE

- 1.1 This procedure describes the screening procedure for reactive cyanide in solid or liquid wastes.
- 1.2 This procedure is designed to give the user a rapid screening of wastes for the presence of cyanide. It is intended as a preliminary test to complement more sophisticated quantitative techniques.
- 1.3 This procedure consists of two complimentary tests: a) colorimetric for cyanides amenable to chlorination (chloramine-T) and b) cyanides that are reactive with acid to produce HCN.
- 1.4 *This procedure may involve hazardous materials, operations, and equipment. This procedure does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Specific hazard information is given in Section 7.0. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 Method A - A portion of the sample is mixed with a buffer solution and chloramine-T reagent in a test tube. A quantity of pyridine-barbituric acid solution is added to the test tube. A red color indicates the presence of cyanides.
- 2.2 Method B - A portion of the sample is acidified in a beaker to release cyanide as hydrogen cyanide gas. The gas is funneled through a detector tube by a sampling pump. A definitive color change in the detector tube indicates a positive presence of cyanide.

3.0 APPARATUS

- 3.1 Method B
Note: See attached diagram for suggested apparatus set up.
- 3.2 Precision air sampling pump - Sensidyne Model 800.
- 3.3 Hydrogen cyanide detector tubes - Sensidyne-Gastec No. 12L, 0.36 to 120 ppm.
- 3.4 Ring stand with brackets.

- 3.5 Magnetic stirrer.
- 3.6 Stir bar.
- 3.7 Laboratory jack stand - Lab-Line Multi-Jack or equivalent.
- 3.8 Beaker - 250 to 400 ml.
- 3.9 Funnel - Must be sized properly in order for the wide end to completely cover the beaker opening, and the narrow end to allow the insertion of the gas detector tube.

4.0 REAGENTS AND MATERIALS

- 4.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 4.2 Purity of Water - Unless otherwise indicated, references to water shall be understood to mean meeting the numerical requirements of Type II water as defined by ASTM D 1193.
- 4.3 Method A
- 4.4 Chloramine-T (100 g/L) - Dissolve 10 g chloramine-T in 100 ml water. Allow sufficient time for the reagent to dissolve.
- 4.5 Sodium hydroxide solution (0.1 M) - Dissolve 4 g NaOH in water and diluted to 1 L.
- 4.6 Potassium dihydrogen phosphate (0.1 M) - Dissolve 13.6 g PDP (KH_2PO_4) in water and dilute to 1 L.
- 4.7 Phosphate buffer solution - Mix 46 ml 0.1 M NaOH solution and 50 ml 0.1 M PDP solution.
- 4.8 Pyridine-barbituric acid solution - Dissolve 1.5 g barbituric acid with 10 ml water. Add 7.5 ml pyridine. Add 1.5 ml HCl and dilute with water to 25 ml.
- 4.9 Method B
- 4.10 pH 2 buffered solution - Add 500 ml concentrated phosphoric acid and 740 g trisodium phosphate to 4 L water. Mix on a magnetic stirrer under gentle heat until fully dissolved. Adjust the pH to 2 with H_3PO_4 , if necessary.

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- 4.11 Saturated lead acetate solution - Dissolve lead acetate in a quantity of water using a magnetic stirrer until saturation point is reached.
- 4.12 pH paper strips - universal range (0 to 14), or narrow range paper.

5.0 HAZARDS

- 5.1 Method B is designed to release highly toxic hydrogen cyanide vapors by acidification of waste samples or prepared HCN standards. Tests should be performed under a laboratory fume hood. Appropriate safety gear should be worn to protect the user from corrosive materials and potential incompatibilities.

6.0 INTERFERENCES AND LIMITATIONS

- 6.1 Method A
- 6.2 The presence of formaldehyde and high levels of reducing agents interferes with this method.
- 6.3 Thiocyanate (SCN-) reacts with chloramine-T creating a positive interference.
- 6.4 Method B
- 6.5 Sulfur dioxide, hydrogen fluoride, nitric acid, chlorine and sulfuric acid can produce a positive interference.
- 6.6 Hydrogen sulfide can produce a similar stain at concentrations greater than 5 ppm. Saturated lead acetate solution is added to the sample/reagent mixture to reduce the effect of this interferant.
- 6.7 Hydrogen chloride can produce a similar stain at concentrations greater than 5 ppm.
- 6.8 Chloride can decolorize the stain made by HCN at concentrations greater than 5 ppm.

7.0 SAMPLE

- 7.1 Because stratification or layering of liquid samples is possible, the laboratory sample should be mixed by shaking prior to withdrawing a portion for testing. Solid samples should be mixed by shaking or stirring, depending on the physical characteristics of the sample.

8.0 QUALITY CONTROL

- 8.1 An aqueous HCN standard should be analyzed periodically. A method blank should be analyzed when a positive sample result is obtained.

9.0 PROCEDURE

9.1 Method A

- 9.2 Combine 0.9 ml water + 0.1 ml sample in a small test tube or clear centrifuge tube and mix.
- 9.3 Add 0.8 ml phosphate buffer solution and mix. Using pH paper, verify that the pH is 8. If necessary, add additional buffer solution to adjust to 8.
- 9.4 Add 0.8 ml chloramine-T solution and mix.
- 9.5 Add 0.8 ml pyridine-barbituric acid solution and mix.
- 9.6 The presence of cyanides is indicated by a red color change. The color will normally develop within about 30 seconds. For very dark samples, the color change can still be detected but it may be clouded or muted. In some cases, the color change may appear to be dark, orange-red.

9.7 Method B

- 9.8 Place approximately 20 g of the sample to be tested into a beaker with magnetic stir bar. If necessary, solid samples should be crushed into small particles <9.5 mm (3/8-inch mesh screen).
- 9.9 Add 1 to 2 ml of the saturated lead acetate solution to the sample and mix by stirring or with the magnetic stirrer.
- 9.10 Add approximately 50 ml of the pH 2 buffer solution to the beaker. Place the funnel securely on the beaker.
- 9.11 Insert the gas detector tube into the air sampling pump according to the manufacturer's directions.
- 9.12 Using the lab jack, raise the magnetic stirrer, beaker, and funnel to a point at which the gas detector tube enters the narrow end of the funnel and its tip is past the neck of the funnel (generally about 1 to 2 inches).
- 9.13 Engage the magnetic stirrer to provide a brisk but not vigorous mixing.

- 9.14 Activate the air sampling pump by pulling out the handle to draw in 100 cc of atmosphere.
- 9.15 Allow a minimum of 1 minute reaction time before reading results.
- 9.16 A positive cyanide presence is indicated by a color stain in the gas detector tube. The normal color stain is bright pink.

10.0 **REPORTING**

- 10.1 The results of this test should be recorded on incoming shipment paperwork, qualification data forms, or other appropriate paperwork. If the presence of cyanide is observed, the paperwork should be marked positive. If no presence is observed, the paperwork should be marked negative.

11.0 **PRECISION AND ACCURACY**

- 11.1 Precision - No statement is made about the precision of this procedure because it produces only a positive or negative result.
- 11.2 Accuracy - No statement is made about the bias of this procedure because it produces only a positive or negative result.

12.0 **REFERENCES**

- 12.1 ASTM D 5049: Standard Method for the Screening of Cyanides in Waste.

ASTM D5928: Standard Method for the Screening of Waste for Radioactivity¹

1.0 SCOPE

- 1.1 This test method describes the screening for α , β , and γ radiation above background levels in liquid, sludge, or solid waste materials.
- 1.2 This standard is intended to be a screening method for determining the presence or absence of radioactive materials in liquid, sludge, or solid waste materials. It is not intended to replace more sophisticated quantitative analytical techniques, but to provide a method for rapidly screening samples for radioactivity above background levels for facilities prohibited from handling radioactive waste.
- 1.3 *This standard does not purport to address the safety concerns associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to its use. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 REFERENCED DOCUMENTS

- 2.1 ASTM Standards: C859 - Standard Terminology Relating to Nuclear Materials.²

3.0 TERMINOLOGY

- 3.1 For terminology related to radioactive materials, see C859.

4.0 SUMMARY OF METHOD

- 4.1 A sample is held within 6 mm of the detector window of a radiation survey meter and the visible and/or audible reaction of the meter is noted. A "Negative" test result indicates radiation levels are at or below naturally occurring background levels; a "Positive" test result indicates the possible presence of radioactive material(s).

5.0 SIGNIFICANCE AND USE

- 5.1 This method provides a rapid method for screening waste material samples in the field or laboratory for the presence or absence of

¹ This practice is under the jurisdiction of ASTM Committee D-34 on Waste Management and is the direct responsibility of Subcommittee D34.02 on Physical and Chemical Characteristics.

² Annual Book of ASTM Standards, Vol. 12.01.

radioactivity above background levels. It is important for our facilities to be able to verify generator supplied information that radioactive or mixed wastes have not been included in shipments of waste materials.

6.0 INTERFERENCES

- 6.1 Needle deflections and/or audible clicks of the survey meter occur due to naturally occurring omni-directional background radiation. This level of background radiation should be periodically assessed. See the section on CALIBRATION AND STANDARDIZATION.
- 6.2 Possible sources of interference include pacemakers, x-ray generating equipment, radium-based luminescent dials, polonium-based static eliminators, and smoke detectors containing a radioactive isotope sensing mechanism. Such interferences can usually be traced to their source using the portable instrument specified in this method.
- 6.3 A large amount of potassium in the waste sample may produce a positive result due to the natural presence of the radioactive isotope, potassium-40.
- 6.4 The sensitivity of this method to beta and gamma radiation may be dependent on sample volume. A small sample volume with readings near background levels may give a false negative result.
- 6.5 Some radioactive isotopes, such as ^3H and ^{14}C , may not emit radiation of sufficient energy to be detected. If suspected to be present in the waste, another procedure should be used that is appropriate to their determination.
- 6.6 Liquid samples, as well as moisture in solid samples, are good attenuators of radiation and will hinder detection of many radionuclides unless they emit high energy gamma radiation. The possible inability to detect alpha particles and low level beta emissions which may be attenuated, in many cases, should not be a serious shortcoming in this method because these emissions are often accompanied by higher energy gamma emissions.

Moisture-laden Americium 241-bearing waste would be a case where there is a high probability of non-detection due to attenuation.

- 6.7 Survey meter contamination can cause artificially low or high results when reading standard sources or background. If this occurs, the survey meter performance shall be considered unreliable and should be appropriately decontaminated by qualified personnel, or disposed of in accordance with applicable regulations.
- 6.8 The radiation monitor should be operated in accordance with the manufacturer's instructions.

7.0 SAMPLE

- 7.1 Because stratification of liquid samples is possible, the sample should be thoroughly mixed by shaking or stirring prior to testing. Strongly multi-phasic

samples should have each layer tested separately. Solid samples should be thoroughly mixed by a method appropriate to their size and physical characteristics.

8.0 APPARATUS

- 8.1 Radiation survey meter with a halogen-quenched uncompensated Geiger-Mueller tube with thin mica end-window.

Note: The meter used in the development of this method was the Monitor 4, manufactured by SE International, Inc. (Summertown, Tennessee). A number of other survey meters (e.g., Five Level Portable Meter, manufactured by Harshaw-Bicron, Inc., Solon, Ohio; Ludlum Measurements, Inc., Sweetwater, Texas; Eberline Instrument Corporation, Santa Fe, New Mexico) are suitable for this method. Through the end-window, this unit is capable of detecting and indicating alpha radiation (down to 2.5 MeV with a typical detection efficiency of 80% at 3.6 MeV), beta radiation (down to 150 KeV with a typical 75% detection efficiency), gamma radiation and x-rays (down to 10 KeV), with the survey meter set on its lowest energy range of 0.1 mr/hr.

9.0 REAGENTS AND MATERIALS

- 9.1 The check sources used in the development of this method were manufactured by Oxford Instruments, Inc. (Oak Ridge, Tennessee). Other suitable check sources are available from a number of suppliers (e.g., The Source, Inc., Santa Fe, New Mexico; Ludlum Measurements, Inc., Sweetwater, Texas; Eberline Instrument Corporation, Santa Fe, New Mexico). The check sources used in the development of this method are federally exempt and do not require licensing. Sources other than those listed below (i.e., Cesium 137) are appropriate for this method. The sources, levels of activity, and half-lives used in the development of this method are as follows:

<u>Source</u>	<u>Type</u>	<u>Activity</u>	<u>Half-Life ($t^{1/2}$)</u>
Polonium 210	alpha	0.1 μ Ci	138.4 days
Strontium 90	beta	0.1 μ Ci	28.6 years
Cobalt 60	gamma	1.0 μ Ci	5.3 years

- 9.2 Check sources should be replaced at least every 3 half-lives.

10.0 CALIBRATION AND STANDARDIZATION

- 10.1 The battery power source of the survey meter must be checked prior to use. If the battery check indicates that the battery charge is not in the optimal power range, it must be replaced prior to use.

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- 10.2 The survey meter's performance should be checked at least daily using the α , β , and γ check sources. This is done by observing the survey meter response when held within 6 mm of each check standard.
- 10.3 The survey meter should be factory calibrated at least yearly.
- 10.4 The level of background radiation should be assessed periodically. This may be prior to each test, daily, weekly, or monthly depending on user requirements.
 - 10.4.1 Set the survey meter to its X1 or most sensitive setting and enable the audible alarm, if unit is so equipped.
 - 10.4.2 Record the number of audible meter clicks over a period of 60 seconds (counts per minute). Repeat this procedure two more times, and take the average of the three repetitions using the following formula:

$$\text{Average background radiation} = \frac{\text{Measurement \#1} + \text{Measurement \#2} + \text{Measurement \#3}}{3}$$

- 10.5 Unexpectedly high readings for background or standard sources infers that the survey meter is contaminated. See the section on INTERFERENCES.

11.0 PROCEDURE

- 11.1 Perform the necessary steps presented in the section on CALIBRATION AND STANDARDIZATION.
- 11.2 Allow the survey meter to stabilize for 10 to 15 seconds at its X1 or lowest appropriate setting.
- 11.3 Place the end-window of the survey meter within 6 mm of the sample. Depending on the physical characteristics of the sample and sample container, it may be necessary to withdraw a representative portion of the sample to an alternate sample container, watch glass or other appropriate vessel to allow the end-window to be placed within 6 mm of the sample. Do not allow the survey meter to come in direct contact with the sample. This may contaminate the meter and may damage the end-window.
- 11.4 Record the counts per minute for a period of 60 seconds (counts per minute).
- 11.5 If the counts per minute exceed the average background radiation as determined in the section on CALIBRATION AND STANDARDIZATION, then the sample may contain radioactive material.

Note: The user should recognize the potential interferences mentioned in the section on INTERFERENCES.

- 11.6 If radioactivity above background levels is observed, the background levels should be re-determined as described in the section on CALIBRATION AND

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STANDARDIZATION. The sample should then be re-tested beginning with Section 10.2.

- 11.7 If radioactivity is confirmed to be above background levels, sample testing should be discontinued, and the appropriate health and safety professional or site regulatory officer should be contacted for further instructions.
- 11.8 If no radioactivity above background is observed, the test result may be recorded as not detected.

12.0 PRECISION AND BIAS

- 12.1 Precision - No statement is made about the precision because this screening method produces only a positive or negative test result.
- 12.2 Bias - No statement is made about the bias because this screening method produces only a positive or negative test result.
- 12.3 Method Performance - In an interfacility round robin exercise, two isotope spiked FQW samples were distributed to 6 laboratories (blind format). These samples contained activities of 0.1 μCi α and 10 μCi β , respectively. A sample with a γ spike was not evaluated because of the long half-life. The criteria used in this evaluation for deeming a sample + was 3X background. The table below gives the analytical results and summary statistics.

β Spike

Ambient Background Counts/
Sample Counts/Result
(+ or -)

Laboratory	n	
Paulding	5	13/410/Positive
Alpena	3	12/315/Positive
Fredonia	4	12/242/Positive
Demopolis	4	11/392/Positive

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Lebec	3	27/536/Positive
Xenia	2	10/165/Positive

 α Spike

Laboratory	n	Ambient Background Counts/Sample Counts/Result (+ or -)
Paulding	5	13/12/Negative
Alpena	3	15/7/Negative
Fredonia	4	15/9/Negative
Demopolis	4	10/8/Negative
Lebec	3	20/14/Negative
Xenia	2	11/15/Negative

The negative results for the α spike are expected with this method because α particles are almost completely attenuated by water or other liquid. This is not considered a serious shortcoming of this method because γ and high-energy β radiation are usually present with α radiation.

13.0 KEYWORDS

Radioactivity
Screening method
Waste materials

Standard Test Method for the Determination of Insoluble Solids in Fuel Quality Waste

1.0 SCOPE

- 1.1 This method describes the determination of the approximate amount of insoluble, suspended solid material in organic liquid hazardous waste (FQW).
- 1.2 This standard is intended to be used in approximating the amount of insoluble, suspended solids in determining the material handling characteristics and fuel quality of FQW. It is not intended to replace more sophisticated procedures for the determination of total solids.
- 1.3 *This standard does not purport to address the safety concerns associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to its use. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF METHOD

- 2.1 A 10 ml aliquot of FQW sample is decanted into a 15 ml graduated centrifuge tube, a user selected blend of clean solvents is added and agitated to mix the solid and liquid phases and centrifuged for 3 minutes. The separated liquid phase is decanted into an appropriate waste vessel. The amount of remaining solid material is read. Calculate the percent solids.

3.0 SIGNIFICANCE AND USE

- 3.1 Facilities utilizing bulk liquid hazardous waste fuels are concerned about material handling characteristics and the overall quality of the fuel. A high percentage of insoluble, suspended solid material can create pumping, filtering, or grinding difficulties in the off-loading of bulk shipments of FQW and can contribute to excessive wear on processing equipment. High solids can also decrease the quality and consistency of commingled fuel by decreasing the effectiveness of agitation in storage tanks.

4.0 APPARATUS

- 4.1 Centrifuge - Capable of spinning two or more centrifuge tubes at a speed controlled to give a relative centrifugal force of between 1200 to 1400. The speed to achieve this is generally between 3100 to 3600 rpm. The rotation speed necessary to achieve the relative centrifugal force can be determined from one of the following equations:

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$$1) \text{ rpm} = 1335 \text{ rcf/d}$$

$$2) \text{ rpm} = 265 \text{ rcf/d}$$

where:

rpm = rotation speed, in revolutions per minute.

rcf = relative centrifugal force.

d = diameter of swing, in mm (Eq. 1) or in. (Eq. 2), measured between the tips of opposite tubes when the tubes are in rotating position.

Note 1: The equations above are described in ASTM D 96, Standard Test Methods for Water and Sediment in Crude Oil by Centrifuge Method (Field Procedures)².

- 4.2 Centrifuge Tubes - Centrifuge tubes shall be cone shaped, made of glass or a solvent resistant plastic or polymer, have a minimum capacity of 15 ml when filled to volume, and graduated with minimum subdivisions of 0.5 ml.

5.0 REAGENTS AND MATERIALS

- 5.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available. Other grades may be used, providing that it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.
- 5.2 Clean Solvent Blend - The user should formulate the clean solvent blend based on the "average" normal chemical composition of the commingled FQW. The chemical composition of FQW is usually determined by gas chromatographic analysis. The clean solvent blend will vary in complexity depending on the specifications of the user.

Note 2: The clean solvent blend may be as simple as a single component (e.g., toluene) or a complex mixture of aliphatic and aromatic hydrocarbons, alcohols, esters, ketones, ethers, terpenoids, and halogenated compounds. The user should formulate the clean solvent blend based on compositional knowledge of the FQW that the sample material is to be commingled with. If the commingled FQW contains water, it may be appropriate to include in the clean solvent blend.

6.0 SAMPLE

- 6.1 Because settling of insoluble solid material in liquid samples is probable, the

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laboratory sample should be thoroughly mixed by shaking prior to withdrawing a portion for testing.

7.0 QUALITY CONTROL

- 7.1 All quality control items and data quality objectives listed in the site WAP must be followed. Refer to the Comprehensive Quality Assurance Plan for additional quality control information.

8.0 PROCEDURE

- 8.1 Fill a centrifuge tube to the 10 ml graduation mark with the FQW sample.

Note 3: It will be necessary to use an additional tube with an equal amount of water or other suitable liquid to balance the centrifuge.

- 8.2 Place the tubes from 8.1 in the trunnion cups or centrifuge tube slots on opposite sides of the centrifuge. Close the centrifuge lid and engage safety lock, if so equipped.
- 8.3 Set the centrifuge speed (rpm) to provide a minimum relative centrifugal force between 1200 to 1400 (see 4.1).
- 8.4 Engage centrifuge and allow to spin for 3 minutes.
- 8.5 Remove the tube containing the mix and decant the liquid phase to an appropriate waste vessel.
- 8.6 Add 5 ml Clean Solvent Blend to the remaining solid phase. Shake or agitate to mix solvent with the solid phase.
- 8.7 Centrifuge sample as before for an additional 3 minutes.
- 8.8 Decant solvent and dissolved material to an appropriate waste vessel.
- 8.9 Visually estimate the remaining solid phase to the nearest milliliter.

9.0 CALCULATION

- 9.1 The estimated amount of solid material is calculated as follows:

$$(A/10 \text{ ml}) 100 = \text{Insoluble solids, percent}$$

where: A = volume of solids from centrifuge tube.

10.0 PRECISION AND BIAS

- 10.1 Precision - The precision of this method is being determined.
- 10.2 Bias - The bias of this method has not been determined because there are no recognized reference materials.
- 10.3 Method Performance - Three samples were prepared and distributed to 6 laboratories. The sample descriptions are given below.

Sample	Solid Material/g Added	Liquid/Final Volume
1	Ca/Na stearate/35	kerosene/200 ml
2	elemental carbon/6	used motor oil/200
3	railcar sludge/22	kerosene/200

Because the mass amount of solid material cannot be directly related to the numerical results of this procedure, all results are assessed relatively. The results and summary statistics are given in the table below.

Sample 1

Laboratory	n	\bar{X}	s	RSD%
Paulding	5	35.5	4.6	12.9
Demopolis	4	37.5	1.9	5.1
Lebec	3	43.0	1.2	2.7
Fredonia	7	25.0	2.9	11.8
Alpena	4	47.5	4.8	10.1
Xenia	2	36.5	2.1	5.8
Overall Mean = 37.5		s = 7.6	RSD = 20.4 %	

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Sample 2

Laboratory	n	\bar{X}	s	RSD%
Paulding	5	1.5	0.6	34.2
Demopolis	4	1.5	0.5	40.0
Lebec	3	10.0	0	0
Fredonia	7	1.5	0.5	37.4
Alpena	4	1.0	0	0
Xenia	2	8.0	5.7	70.7
Overall Mean = 3.9			s = 4.0	RSD = 102.4%

Sample 3

Laboratory	n	\bar{X}	s	RSD%
Paulding	5	19.5	4.7	24.1
Demopolis	4	19.0	2.2	11.4
Lebec	3	25.5	1.5	6.0
Fredonia	7	17.0	3.0	17.7
Alpena	4	16.5	3.3	20.3
Xenia	2	25.5	7.8	30.5
Overall Mean = 20.5			s = 4.0	RSD = 19.7 %

11.0 KEYWORDS

Centrifuge
Hazardous waste
Insoluble solids

Organic liquid hazardous waste
Suspended solids

12.0 REFERENCED DOCUMENTS

2.1 ASTM Standards.

D 96 - Standard Test Methods for Water and Sediment in Crude Oil by
Centrifuge Method (Field Procedure)

D6050 - Standard Test Method for the Determination of Insoluble Solids
in Organic Liquid Hazardous Waste

Standard Procedure for Determining the Density of Liquid Waste

1.0 SCOPE

- 1.1 This procedure describes the gravimetric determination of the density of liquid wastes. This procedure is designed to give an approximate value for density. It is not fully applicable to solid wastes.
- 1.2 *This procedure may involve hazardous materials, operations, or equipment. This procedure does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 A centrifuge tube and beaker are tared on an analytical balance. The liquid waste sample is added to the centrifuge to the 10 ml mark and re-weighed. The mass displayed is volume corrected and reported as g/ml.

3.0 SIGNIFICANCE AND USE

- 3.1 Density is a parameter that can be used to characterize waste materials. The density measurement is commonly used in the conversion of volumes to weights.

4.0 REAGENTS AND MATERIALS

- 4.1 Graduated centrifuge tube, 15 ml minimum capacity, or 10 ml volumetric flask.

5.0 SAMPLE

- 5.1 Because stratification or layering of liquid samples is possible, the laboratory sample should be thoroughly mixed by shaking prior to withdrawing a portion for testing.

6.0 QUALITY CONTROL

- 6.1 Refer to the Maintenance and Optimization Log for specific requirements.

7.0 PROCEDURE

- 7.1 Tare centrifuge tube and beaker (or other suitable holder) on an analytical balance.
- 7.2 Add the liquid waste to the centrifuge tube to the 10 ml mark.
- 7.3 Re-weigh the centrifuge tube with liquid waste and beaker.
- 7.4 The mass displayed on the balance is volume converted and reported in grams/ml by the following:

$$\text{Mass (g)/10 ml} = \text{density (g/ml)}$$

Example: Mass displayed: 9.700 g

$$9.700 \text{ g/10 ml} = 0.97 \text{ g/ml}$$

8.0 PRECISION AND BIAS

- 8.1 Precision - No statement is made about the precision because this procedure is used to obtain approximate values.
- 8.2 Accuracy - No statement is made about the accuracy because this procedure is used to obtain approximate values.

PC-11 Standard Method for the Determination of Total Chloride in Feedstream Materials by Silver Nitrate Titration

1.0 SCOPE

- 1.1 This method describes the total chloride determination of cement kiln feedstream materials by titration with silver nitrate.
- 1.2 This method is applicable to combustible and noncombustible materials.
- 1.3 *This method may involve hazardous materials, operations, or equipment. This method does not purport to address the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 TERMINOLOGY

- 2.1 Batch (as related to MACT chloride) - Feedstream samples are prepared one at a time. This is considered a "continuous run" analysis. For chloride analysis, a batch is conservatively defined as 10 samples. This number is independent of matrix, but dependant on preparation method. Samples that are bombed (combustible) and samples that are extracted (non-combustible) are considered separately. Each lab must determine if this definition is allowable in their WAP.
- 2.2 Method Blank (Method Blank) - An analyte-free matrix to which all reagents are added in the same volumes as used in sample preparation are taken through the analytical process. For combustible samples, chlorine-free oil should be used; and for non-combustibles, a water blank is sufficient.
- 2.3 QC Standard (or Sample) - A primary or secondary third party provided reference material containing the analyte of interest. For combustibles, a chlorine in paraffin oil can be used; and for non-combustibles, an aqueous chlorine can be used.
- 2.4 SRM - Standard Reference Material are only available from the National Institute of Standards and Technology (NIST). Other secondary reference materials are available from a number of suppliers (e.g., Alpha Resources, Brammer Standards, etc.).

3.0 SUMMARY OF PROCEDURE

- 3.1 This procedure is performed in two parts: 1) Combustion or extraction of the sample, and 2) titration of combustion bomb washings. The feedstream sample is combusted in an oxygen bomb (or extracted in the case of non-combustibles), and the bomb head and internal surfaces are scrubbed and washed down to a set volume, and titrated with a silver nitrate solution to endpoint. The total chloride is then calculated.

4.0 SIGNIFICANCE AND USE

- 4.1 The Hazardous Waste Combustor Maximum Achievable Control Technology regulations and facility operating permits require that boilers, cement kilns, and other industrial furnaces utilizing FQW adhere to specific guidelines in assessing potential emissions. Cement plants also have maximum chlorine limits because of its effect on kiln operating conditions.

5.0 APPARATUS

- 5.1 Parr Instrument Company, Model 1261 or 1241 isoparabolic or adiabatic calorimeter equipped with automatic controller.
- 5.2 Analytical Pan-Type balance, manual or electronic.
- 5.3 Buret, with a maximum of 0.1 ml graduations (high level) and 0.05 ml graduations (low level).
- 5.4 Magnetic stirrer.
- 5.5 Stir bar.
- 5.6 Rubber policeman, or equivalent.
- 5.7 pH meter, Orion 501, 611, SA720, or equivalent unit.

6.0 REAGENTS AND MATERIALS

- 6.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 6.2 ASTM Type II water, or equivalent.
- 6.3 Sodium hydroxide solution, NaOH, 0.1N: Dissolve 4.0 g sodium hydroxide in water and bring to a volume of 1 liter.
- 6.4 Sodium hydroxide solution, NaOH, 0.01N (Bombwash): Dilute 0.1N sodium hydroxide solution 1:10 in water.
- 6.5 Potassium chromate, K_2CrO_4 , 5% solution.
- 6.6 Hach, Inc., 10 mg/L m-nitrophenol indicator solution, or equivalent.
- 6.7 Hydrogen peroxide, H_2O_2 , 30% solution.
- 6.8 Sulfuric acid, H_2SO_4 , 0.5% solution: Combine 0.1 ml H_2SO_4 , with 19.9 ml water. The user may perform additional dilutions, if needed.
- 6.9 Silver nitrate solution, $AgNO_3$, 0.014N.

- 6.9.1 Sodium carbonate, Na_2CO_3 , 2.5%: Dissolve 2.5 g Na_2CO_3 in water to a final volume of 500 ml.
- 6.9.2 Parr Instrument Company, nickel fuse wire, or equivalent.
- 6.9.3 Parr Instrument Company, combustion capsules, or equivalent.
- 6.9.4 Oxygen, minimum purity 99.5%.
- 6.9.5 Orion 100 ppm chloride standard, or equivalent.
- 6.9.6 Alpha Resources, Inc., 2% chloride in oil standard, or equivalent.
- 6.9.7 Yellow tinted safety glasses or goggles (optional).
- 6.9.8 Alpha Resources, Inc., chloride-free Base Paraffin Oil.
- 6.9.9 Benzoic acid, $\text{C}_6\text{H}_5\text{COOH}$, granular or powder.

7.0 INTERFERENCES AND LIMITATIONS

- 7.1 Although this determination is reported as total chloride, this procedure determines total halogens and is not designed to speciate between the halogens.
- 7.2 Orthophosphate and polyphosphates can interfere if present at concentrations greater than 250 and 25 mg/L, respectively.
- 7.3 Certain hydroxides that precipitate at a pH of approximately 8.3 may cause error by occlusion.
- 7.4 Suspended solids in the bomb washings may interfere in the endpoint determination. Filtering the bomb wash may be required.
- 7.5 If bomb washings (typically from samples containing a high percentage of halogens) exhibit a high degree of coloration, dilution of the bomb washings may be necessary in order to accurately determine the titration endpoint.
- 7.6 Because silver nitrate titrant can be affected by light if left exposed for long periods of time, the buret should be emptied and the titrant discarded at the end of each day.
- 7.7 Because of potential cross-contamination, low and high chloride concentration samples should not be processed alternately (if possible). The oxygen bomb must be thoroughly scrubbed with a laboratory detergent between each run and triple-rinsed with lab grade water.

8.0 SAMPLE

- 8.1 All feedstream sample should be analyzed in the form that they are introduced into the cement kiln.

- 8.2 Because stratification, or layering is possible, the laboratory sample should be thoroughly mixed by shaking prior to withdrawing a portion for testing. Solid samples should be thoroughly mixed by shaking or stirring depending on the physical characteristics of the sample.
- 8.3 The bomb washings should be mixed by shaking prior to withdrawing a portion for titration. Filtration and/or dilution may be necessary.

9.0 QUALITY CONTROL

- 9.1 Refer to the Maintenance and Optimization Log for specific maintenance requirements.
- 9.2 QA/QC Requirements - If analyses are being performed for regulatory purposes, the QC requirements of the WAP are to be followed.

10.0 PROCEDURE

10.1 Combustible Samples

NOTE: For non-combustible materials (i.e. raw feed), refer to 10.11 for sample preparation instructions.

- 10.1.1 The sample should be combusted by performing PC-6.
- 10.1.2 After the temperature reading stabilizes, remove the oxygen bomb using the tongs, and slowly vent.
- 10.1.3 Remove the bomb holding ring, bomb head unit, and combustion capsule.
- 10.1.4 Using a dispensing bottle containing 0.01N sodium hydroxide solution, and a rubber policeman, scrub and rinse the bomb head surface and the bomb's internal surface. The user should thoroughly scrub or rinse all areas of the bomb including the capsule posts. If a scrub brush is used it should be rinsed. The user should also conservatively apply the 0.01N NaOH solution. Excess NaOH can cause titration errors by occlusion.
- 10.1.5 Transfer the bomb washings collected in the oxygen bomb to a 100 ml volumetric flask and bring to volume with water.
- 10.1.6 After the wash from Step 10.1.5 is well mixed by shaking, the following instruction for low or high chlorine levels should be followed:

Low Level (Raw Feed, Coal). Alternatively, Low level Chloride samples may be titrated with Mercuric Nitrate and diphenyl carbazone/bromophenol blue indicator solution in place of Silver Nitrate. Use of this alternative is advantageous due to the easier to distinguish endpoint color change and is further described in SAMM method PC-14.

- 10.1.7 Measure a 25 ml quantity of wash using a 25 ml volumetric flask and transfer to a clean glass beaker. Rinse the volumetric flask with water and transfer to the glass beaker. Bring the total beaker volume to approximately 50 ml.
- 10.1.8 Engage the magnetic stirrer to provide a brisk but not vigorous swirling.
- 10.1.9 If the presence of sulfites is suspected, add 0.25 ml 30% H_2O_2 solution and allow to mix for approximately 1 minute.
- 10.1.9.1 Add 10 drops m-nitrophenol indicator solution.
- 10.1.9.2 With the calibrated pH meter, insert pH probe into swirling mixture and allow pH reading to stabilize. By the addition of 0.1N or 0.01N sodium hydroxide solution, or 0.5% H_2SO_4 solution, adjust to pH 7.8 - 8.0.
- 10.1.9.3 Remove the pH probe and add 0.5 ml K_2CrO_4 indicator solution.
- 10.2 Record the level of silver nitrate solution in the buret. While wearing the yellow-tinted safety glasses, place the buret over the swirling mixture, add the silver nitrate solution drop-wise until the yellow chromate color **first** changes to a persistent pale orange color. After reaching this color, allow the mixture to swirl about 5 seconds to ensure that the endpoint has been reached.
- 10.2.1 Record the level of AgNO_3 solution in the buret.
- 10.2.2 Refer to Section 11.0 CALCULATION AND INTERPRETATION for the total chloride calculation.

High Level (Fuel-quality waste)

- 10.3 After the wash from Step 10.1.5 is well mixed by shaking, measure a 10 ml quantity using a 10 ml volumetric flask or graduated cylinder, and transfer to a clean glass beaker. Rinse the 10 ml vessel with water and add the approximate 10 ml volume to the glass beaker.
- 10.4 Engage the magnetic stirrer to provide a brisk but not vigorous swirling.
- 10.5 To the swirling mixture, add 2 drops of nitrophenol indicator solution.
- 10.6 With a dispensing bottle or pipet, add 0.1 N or 0.01 N sodium hydroxide solution until the swirling mixture exhibits a very pale yellow color. This color is an indication that the pH of the mixture is within the required 7 - 10 pH range needed to perform the titration. Excess concentrated sodium hydroxide should not be added, for it will give the mixture an elevated pH and make the titration endpoint difficult to determine.

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- 10.7 To the pH modified mixture, add a sufficient quantity of 5% potassium chromate solution to give the pH adjusted mixture a bright yellow coloring. The amount used is typically 0.5 - 1.0 ml.
- 10.8 Record the level of the silver nitrate solution in the buret. With the buret over the swirling pH adjusted mixture, add the silver nitrate solution in a drop-by-drop manner until a persistent orange color change is observed. After reaching this color, allow the mixture to swirl about 5 seconds to ensure that the endpoint has been reached. If the color of the mixture returns to a yellow color, add additional silver nitrate solution until the change to the orange endpoint appears stable.
- 10.9 For samples that contain a high percentage of total halogens (chloride), it may be necessary to perform a dilution of the bomb head washings from the 100 ml volumetric flask prior to adding to the clean glass beaker. If high percent halogen samples bomb washings are not diluted prior to titration, the excessive amount of silver nitrate needed to precipitate the chloride will saturate the swirling mixture making the endpoint difficult to determine. It may also be useful to re-bomb the material using a lesser amount of sample.
- 10.10 Record the level of silver nitrate in the buret, and subtract the initial volume to determine the amount of silver nitrate used.

Noncombustible Sample (Raw Feed Materials)

- 10.11 Weigh approximately 1.0 g of sample into a 100 ml volumetric flask.
- 10.12 Bring volumetric flask to volume. Cap and shake the flask for about 1 minute.
- 10.13 Allow the solid material in the flask to settle or centrifuge for about 1 minute. This is the sample extract prepared at approximately the same percentage (1%) as a combusted sample.
- 10.14 Follow the directions beginning with 10.1.7 (Low Level Chloride). Alternatively, Low level Chloride samples may be titrated with Mercuric Nitrate and diphenyl carbazone/bromophenol blue indicator solution in place of Silver Nitrate. Use of this alternative is advantageous due to the easier to distinguish endpoint color change and is further described in SAMM method PC-14.
- 10.15 Refer to Section 11.0 CALCULATION AND INTERPRETATION for the total chloride calculation.

11.0 CALCULATION OR INTERPRETATION

- 11.1 The total chloride is calculated as follows:

$$\text{Total Chloride mg/L} = \frac{(A-B)(N)(35450)(C)}{D \quad S}$$

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Where: A = ml of AgNO_3 used for sample
B = ml of AgNO_3 used for 50 ml water blank
C = Final Bomb Wash or Extract Volume (ml)
D = Actual sample weight (g)
N = Normality of AgNO_3 solution
S = Milliliters of titrated bomb wash or extract

12.0 REPORTING

- 12.1 The calculated amount should be recorded to the nearest mg/L for low level chloride samples (coal, raw feed), and in weight percent to two decimal places for high level chloride samples. The results should be recorded with associated QA/QC results.

13.0 PRECISION AND ACCURACY

- 13.1 The precision estimates are based on an interlaboratory study in which operators at seven different laboratories analyzed three standard materials with halogen (chloride) values ranging from about 2.00% to 6.90%. The study was conducted in accordance with ASTM E 691.
- 13.2 Repeatability (Within Laboratory) - The coefficient of variation of results obtained by the same analyst has been estimated at 4.95% relative at 48 degrees of freedom. Two values should be considered suspect (95% confidence level) if they differ by more than 13.86%.
- 13.3 Reproducibility (Between Laboratories) - The coefficient of variation of results obtained by analysts in different laboratories has been estimated to be 9.90% relative at 12 degrees of freedom. Two values should be considered suspect (95% confidence level) if they differ by more than 27.72%.
- 13.4 Bias - No justifiable statement can be made on the bias of the procedure in this test method because no acceptable reference material is currently available. However, measured values for a series of three standard materials were as follows:

<u>Interlaboratory Standard Value (%)</u>	<u>Mean (%)</u>	<u>Measurement Accuracy %</u>
2.00	2.03	101.5
5.00	4.64	92.8
6.90	6.47	93.8

13.0 REFERENCES

- 13.1 U.S. Environmental Protection Agency, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd Ed., Vol. 1C). Method 9253.

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- 13.2 ASTM E 691: Standard Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method.
- 13.3 U.S. EPA, Test Methods for Evaluating Solid Waste: Physical and Chemical Methods (SW-846, 3rd Ed., Vol. 1C). Method 5050.

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Standard Method for Spectrophotometric Sulfate and Nitrate Determination of Solid and Liquid Waste

1.0 SCOPE

- 1.1 This method describes the determination of sulfate and nitrate levels in solid or liquid wastes by spectrophotometry.
- 1.2 This method is limited to the total recoverable sulfate and nitrate following sample preparation using Method PC-6.
- 1.3 Procedural instructions are given for using older (Hach DR/3) and newer instruments.
- 1.4 *This method may involve hazardous materials, operations, or equipment. This method does not purport to address the safety concerns associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 The sample is prepared by performing Method PC-6. Twenty-five (25) ml of sample bomb washings are transferred to a clean sample cell and reacted with selected reagents. While sample is undergoing reaction, a second aliquot of the sample washings (no reagents added) that serve as the analytical blank are decanted to a clean sample cell, and inserted in the spectrophotometer and a reading taken. The sample cell containing the reacted sample is inserted into the unit and a reading is displayed. This is done for sulfate and nitrate.

3.0 SIGNIFICANCE AND USE

- 3.1 Most facilities performing this analysis are required by operating permits to measure total sulfur and/or nitrate. This method is a spectrophotometric procedure common to the waste water testing industry, and has been adapted for use on samples prepared by Method PC-6.

4.0 APPARATUS

- 4.1 Hach DR/2000 Spectrophotometer, or equivalent.

5.0 REAGENTS AND MATERIALS

- 5.1 Purity of Reagents - Reagent grade chemical shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the

specifications of the American Chemical Society (ACS), where such specifications are available.

- 5.2 Sample cells, 25 ml.
- 5.3 Hach Sulfaver 4 Sulfate Reagent Powder Pillows.
- 5.4 Hach NitraVer 5 Nitrate Reagent Powder Pillows or NitraVer 5 Nitrate AccuVac Ampules.
- 5.5 Purity of Water - Unless otherwise indicated, references to water shall be understood to mean meeting the numerical requirements of Type II water as defined by ASTM D 1193.

6.0 INTERFERENCES AND LIMITATIONS

6.1 Sulfate

- 6.1.1 Silica and calcium may interfere at levels above 500 mg/L and 20,000 mg/L as CaCO_3 , respectively.
- 6.1.2 Chloride and magnesium do not interfere at levels up to at least 40,000 mg/L as Cl and 10,000 mg/L as MgCO_3 , respectively.

6.2 Nitrate

- 6.2.1 Strong oxidizing and reducing substances will interfere.
- 6.2.2 Ferric ion presence will bias results high.
- 6.2.3 Sample washings with high chlorine contents may require the use of standard additions.
- 6.2.4 The user may be required to make a heat value based correction to compensate for total N due to atmospheric contributions from Method PC-6.
- 6.2.5 The presence of nitrite may cause interference in the measurement. If nitrite concentrations are suspected, the following procedure can be used:
 - a) Add a 30 mg/L aqueous bromine solution drop-wise to the unreacted sample aliquot until a yellow color remains.
 - b) Add 1 drop of 30 mg/L aqueous phenol solution to remove the coloration.

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- c) If results are to be converted from N, they should be reported as total nitrate and nitrite.

7.0 SAMPLE

- 7.0 The bomb washings should be mixed by shaking prior to decanting to the sample cell. Filtration or dilution may be needed.

8.0 QUALITY CONTROL

- 8.1 An analytical blank must be analyzed for each sample, or each sample batch.
- 8.2 A QC standard (recommended concentration 50 mg/L-sulfate; 10 mg/L-nitrate) should be analyzed at a user specified frequency.

9.0 PROCEDURE

9.1 Sulfur.

- 9.1.1 The procedure for S determinations using the Sulfaver powder pillows only is presented. Items in boldface represent keystrokes/LED display.

Sulfaver Powder Pillows - Newer Instruments

- 9.1.2 Enter the stored program number (680) for a range of 0 to 70 mg/L. Depress 6 8 0 read/enter, the display will show dial nm to 450.
- 9.1.3 Rotate the wavelength dial until the display shows 450 nm.
- 9.1.4 Depress read/enter; the display will show mg/L SO_4^{2-} .
- 9.1.5 Fill a sample cell with 25 ml of sample bomb washing.
- 9.1.6 Add the contents of 1 Sulfaver 4 powder pillow to the cell and affix stopper. Depress shift timer.
- 9.1.7 Swirl the sample preparation mixer to dissolve. Depress shift timer. This begins the 5-minute reaction period.
- 9.1.8 Fill a second sample cell with 25 ml of sample bomb washing.
- 9.1.9 When the timer beeps, the display will show mg/L SO_4^{2-} . Place the blank (second sample cell) into the cell holder and close the light shield.

- 9.1.10 Depress zero; the display will show wait, then 0.0 mg/L N SO₄²⁻.
- 9.1.11 Remove the stopper from the first sample cell containing the reacted sample, place in the cell holder and close the light shield.
- 9.1.12 Depress read/enter. The display will show wait, then the result in mg/L sulfate will be displayed. This result should be multiplied by the sample dilution factor from Method PC-6.

Sulfaver Powder Pillows - Hach DR/3

- 9.1.13 Turn power on DR/3 meter and insert Sulfate 450nm mg/l card.
- 9.1.14 Adjust wavelength dial to 450 nm.
- 9.1.15 Fill sample cell with 25 ml of sample and dilute with distilled water to 25 ml.
- 9.1.16 Place filled sample cell in DR/3 and close the light shield.
- 9.1.17 Set blank to zero.
- 9.1.18 Remove sample cell and add contents of one Sulfaver 4 pillow to sample cell and affix stopper.
- 9.1.19 Shake the cell vigorously for about one minute. Then allow the cell to react for five minutes.
- 9.1.20 Remove the stopper, place the reacted sample cell into the DR/3 and close the light shield.
- 9.1.21 Read the results in mg/l from the card display and perform calculation in Section 10.0.

NITRATE

9.2 Nitrate.

- 9.2.1 The procedure for N determinations using the Nitraver powder pillows only is presented. Items in **boldface** represent keystrokes/LED display.

Nitraver Powder Pillows - Newer Instruments

- 9.2.2 Enter the stored program number (355) for high range nitrogen. If the Hach DR/2000 contains software Version 2.0 or 2.2, it may be necessary to enter the calibration as an update to the Hach-stored programs. See

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Hach instruction handbook. Depress **3 5 5 read/enter**, the display will show **dial nm to 500**.

- 9.2.3 Rotate the wavelength dial until the display shows **500 nm**.
- 9.2.4 Depress **read/enter**; the display will show **mg/L N NO³⁻ H**.
- 9.2.5 Fill a sample cell with 25 ml of sample bomb washing.
- 9.2.6 Add the contents of 1 Nitraver 5 powder pillow to the cell and affix stopper. Depress **shift timer**.
- 9.2.7 Shake the cell vigorously until the timer beeps (about 1 minute). When the timer beeps, depress **shift timer**. This begins the 5-minute reaction period.
- 9.2.8 Fill a second sample cell with 25 ml of sample bomb washing.
- 9.2.9 When the timer beeps, the display will show **mg/L N NO³⁻ H**. Place the blank (second sample cell) into the cell holder and close the light shield.
- 9.2.10 Depress **zero**; the display will show **wait**, then **0.0 mg/L N NO³⁻ H**.
- 9.2.11 Remove the stopper from the first sample cell containing the reacted sample, place in the cell holder and close the light shield.
- 9.2.12 Depress **read/enter**. The display will show **wait**, then the result in mg/L nitrogen will be displayed. This result should be multiplied by the sample dilution factor from Method PC-6.

Nitraver Powder Pillow - Hach DR/3

- 9.2.13 Turn power on DR/3 meter and insert Nitrogen, Nitrate 500nm mg/l card.
- 9.2.14 Adjust wavelength dial to 500 nm.
- 9.2.15 Fill sample cell with 2.5 ml of sample and dilute with distilled water to 25 ml.
- 9.2.16 Place filled sample cell in DR/3 and close the light shield.
- 9.2.17 Set blank to zero.
- 9.2.18 Remove sample cell and add contents of one Nitraver 5 pillow to sample cell and affix stopper.

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- 9.2.19 Shake the cell vigorously for about one minute. Then allow the cell to react for five minutes.
- 9.2.20 Remove the stopper, place the reacted sample cell into the DR/3 and close the light shield.
- 9.2.21 Read the results in mg/l from the card display and perform calculation in Section 10.0.

10.0 CALCULATION OR INTERPRETATION

10.1 Sulfate.

10.1.1 The SO_4^{2-} results are read directly from the Hach LED display. If any additional dilution was made on the sample bomb washing, then the result from Step 9.12 must be multiplied by the dilution factor.

10.1.2 The results can be expressed as S by multiplying the SO_4^{2-} by 0.333.

10.2 Nitrate.

10.2.1 The N results are read directly from the LED display in Step 9.12. If any additional dilution was made on the sample bomb washing, then the result from Step 9.12 must be multiplied by the dilution factor.

10.2.2 The results can be expressed as NO_3^- by multiplying the N result by 4.4.

11.0 REPORTING

11.1 The calculated result should be recorded to the nearest tenth of a percent. The result should be recorded on the calorimeter report, qualification sheets, or other appropriate paperwork.

12.0 PRECISION AND BIAS

12.1 Precision - No statement is made about the precision at this time.

12.2 Bias - No statement is made about the bias at this time.

12.3 Sulfur - In an interfacility round robin exercise, a secondary oil-based reference sample was distributed to 6 laboratories. This sample contained a sulfur reference value of 3.2 % wt./wt. The table below gives the analytical results and summary statistics.

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Laboratory	n		\bar{X}	s	% Recovery (mean)
Paulding	5	2.59	0.23		80.9
Fredonia	2	1.82	2.14		56.9
Alpena	3	2.04	0.3		63.8
Demopolis	4	2.26	0.25		70.6
Xenia	1	3.3	-		103.1
ASI	1	2.73	-		85.3

13.0 REFERENCES

13.1 USEPA, Method 375.4 (Sulfate).

13.2 Hach DR/2000 Spectrophotometer Handbook, Sulfate (0 to 70 mg/L) method.

13.3 Hach DR/2000 Spectrophotometer Handbook, Nitrate - High Range method.

Standard Procedure for the Determination of Separated Water in Liquid Waste

1.0 SCOPE

- 1.1 This procedure describes the determination of separated water in liquid waste. It is applicable only to liquid waste.
- 1.2 This procedure is not designed to be quantitative. It is a general procedure for estimating the amount of separated water in liquid wastes.
- 1.3 *This procedure may involve hazardous materials, operations, or equipment. This procedure does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 A 10 ml quantity of the waste is decanted to a graduated tube. The amount of separated water is then estimated at percentage levels.

3.0 SIGNIFICANCE AND USE

- 3.1 Some operating permits and cement plants have maximum suspended solids specifications for blended fuel. The amount of separated water can affect material handling characteristics and pumping equipment wear.

4.0 REAGENTS AND MATERIALS

- 4.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 4.2 Graduated tubes, 15 ml minimum capacity.

5.0 INTERFERENCES AND LIMITATIONS

- 5.1 Because the user is making a visual estimation, darkly pigmented wastes can impair relative judgment in some samples.
- 5.2 Some liquid wastes can contain significant amounts of water-soluble solvents that may interfere with the users estimation.

6.0 SAMPLE

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- 6.1 Because stratification or layering of liquid samples is possible, the laboratory sample should be thoroughly mixed by shaking prior to withdrawing a portion for testing.

7.0 QUALITY CONTROL

- 7.1 Refer to the Maintenance and Optimization Log for specific requirements.

8.0 PROCEDURE

- 8.1 Transfer 10 ml of the waste sample to a graduated tube. Be certain that the fuel is at the 10 ml mark on the tube.
- 8.2 By gauging through the tube, estimate the total amount of separated water.

9.0 REPORTING

- 9.1 The amount of separated water should be estimated to the nearest percentage. It should be recorded on qualification sheets, truck/received data sheets, or other appropriate paperwork.

10.0 PRECISION AND ACCURACY

- 10.1 Precision - No statement is made about the precision of this procedure because it is intended to be an estimating tool.
- 10.2 Accuracy - No statement is made about the accuracy of this procedure because it is intended to be an estimating tool.

11.0 REFERENCES

- 11.1 ASTM D4979: Standard Test Method for Physical Description Screening Analysis in Waste.

60232

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Method PC-14

**Standard Procedure For The Determination
Of Total Chloride In Feedstreams Materials
By Mercuric Nitrate Titration**

1.0 SCOPE

- 1.1 This procedure describes the total chloride determination of cement kiln feedstream materials by titration with mercuric nitrate.
- 1.2 This procedure is applicable to combustible and noncombustible materials.
- 1.3 *This procedure may involve hazardous materials, operations, or equipment. This procedure does not purport to address the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 This procedure is performed in two parts: 1) Combustion or extraction of the sample, and 2) titration of bomb washings. The feedstream sample is combusted in an oxygen bomb or extracted, and the bomb head and internal surfaces are scrubbed and washed down to a set volume, and titrated with a mercuric nitrate solution to endpoint. The total chloride is then calculated.

3.0 SIGNIFICANCE AND USE

- 3.1 The Boiler and Industrial Furnace Regulations require that boilers, cement kilns, and other industrial furnaces utilizing FQW adhere to specific guidelines in assessing potential emissions. This procedure describes a mercuric nitrate titration used to measure low levels of total chloride in feedstream materials.

4.0 APPARATUS

- 4.1 Parr Instrument Company, Model 1261 or 1241 isoparabolic or adiabatic calorimeter equipped with automatic controller.
- 4.2 Analytical Pan-Type balance, manual or electronic.
- 4.3 Buret, with a maximum of 0.05 ml graduations.
- 4.4 Magnetic stirrer.
- 4.5 Stir bar.

4.6 Rubber policeman, or equivalent.

5.0 REAGENTS AND MATERIALS

5.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.

5.2 ASTM Type II water, or equivalent.

5.3 Sodium hydroxide solution, NaOH, 1%: Dissolve 1 g sodium hydroxide in water and bring to a volume of 100 ml.

5.4 Sodium hydroxide solution, NaOH, 0.01N (Bombwash): Dilute 0.1N sodium hydroxide solution 1:10 in water.

5.5 Diphenylcarbazone (Aldrich #12,453-2)/Bromophenol Blue Indicator (Aldrich #11,439-1) solution: Dissolve 0.5 g crystalline diphenylcarbazone and 0.05 g bromophenol blue powder in 75 ml ethanol in a 100 ml volumetric flask. Fully dissolve by shaking or magnetic stirring. Bring to volume with ethanol. Store in a brown or amber bottle and discard after 6 months. This solution is available from a number of suppliers.

5.6 Alphazurine indicator solution: Dissolve 0.005 g of alphazurine blue-green dye (Aldrich # 19, 814-5) in 75 ml ethanol and bring to volume in 100 ml volumetric flask. This solution is available from a number of suppliers.

5.7 Ethanol, C₂H₅OH, denatured.

5.8 Hydrogen peroxide, H₂O₂, 30% solution.

5.9 Nitric acid, HNO₃, 3.0% solution: Combine 3.0 ml HNO₃, with 100 ml water.

5.10 Mercuric nitrate, Hg(NO₃)₂ solution, 0.01N (low level).

5.11 Mercuric nitrate, Hg(NO₃)₂ solution, 0.141N (high level).

5.12 Parr Instrument Company, nickel fuse wire, or equivalent.

5.13 Parr Instrument Company, combustion capsules, or equivalent.

5.14 Oxygen, minimum purity 99.5%.

- 5.15 Orion 100 ppm chloride standard, or equivalent.
- 5.16 Alpha Resources, Inc., 2% chloride in oil standard, or equivalent.
- 5.17 Alpha Resources, Inc., chloride-free Base Paraffin Oil.
- 5.18 Benzoic acid, C_6H_5COOH , granular or powder.

6.0 INTERFERENCES AND LIMITATIONS

- 6.1 Although this determination is reported as total chloride, this procedure also titrates bromide and iodide.
- 6.2 Suspended solids in the bomb washings interfere in the endpoint determination. Filtering the bomb wash is required.
- 6.3 If bomb washings (typically from samples containing a high percentage of halogens) exhibit a high degree of coloration, dilution of the bomb washings may be necessary in order to accurately determine the titration endpoint.
- 6.4 Because of potential cross-contamination, low and high chloride concentration samples should not be processed alternately. The oxygen bomb must be thoroughly scrubbed with laboratory detergent between each run and triple-rinsed with lab grade water.
- 6.5 Sulfite interference can be eliminated by oxidizing the titrated solution with 1 ml H_2O_2 solution.

7.0 SAMPLE

- 7.1 All feedstream sample should be analyzed in the form that they are introduced into the cement kiln.
- 7.2 Because stratification, or layering is possible, the laboratory sample should be thoroughly mixed by shaking prior to withdrawing a portion for testing. Solid samples should be thoroughly mixed by shaking or stirring depending on the physical characteristics of the sample.
- 7.3 The bomb washings should be mixed by shaking prior to withdrawing a portion for titration. Filtration and/or dilution may be necessary.

8.0 QUALITY CONTROL

- 8.1 Refer to the Maintenance and Optimization Log for specific maintenance requirements.

- 8.2 The water blank determination must be done on a volume equal to the sample volume being titrated.
- 8.3 QC Requirements - If analyses are being performed for regulatory purposes, the QC requirements of the WAP must be followed.

9.0 PROCEDURE

9.1 Combustible Samples

- 9.1.1 The sample is prepared (combusted) by Method PC-6.
- 9.1.2 After the temperature reading stabilizes, remove the oxygen bomb using the tongs, and slowly vent.
- 9.1.3 Remove the bomb holding ring, bomb head unit, and combustion capsule.
- 9.1.4 Using a dispensing bottle containing 0.01N sodium hydroxide solution, and a rubber policeman, scrub and rinse the bomb head surface and the bomb's internal surface. The user should thoroughly scrub or rinse all areas of the bomb including the capsule posts. If a scrub brush is used it should be rinsed.
- 9.1.5 Transfer the bomb washings collected in the oxygen bomb to a 100 ml volumetric flask and bring to volume with water.
- 9.1.6 After the wash from Step 9.1.5 is well mixed by shaking, the following instruction for low and high chlorine levels should be followed:
- Low Level Chloride (coal) - Measure a 50 ml quantity of wash using a 50 ml volumetric flask and transfer to a clean glass beaker.
- High Level Chloride (FQW) - Measure a 10 ml quantity of wash using a 10 ml volumetric flask and transfer to a clean glass beaker. Add an additional 40 ml of water to the beaker.
- 9.1.7 Engage the magnetic stirrer to provide a brisk but not vigorous swirling.
- 9.1.8 To the swirling mixture, add approximately 15 drops of Indicator Solution.
- 9.1.9 If a yellow or orange color forms on the addition of the indicator solution, add NaOH 1% solution dropwise until the color changes to blue-violet. Add HNO₃ solution dropwise until the color changes to yellow. Add an additional 1 ml quantity of the HNO₃ solution.

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9.1.10 If a blue-violet or reddish color appears, add nitric acid solution until a pale yellow color persists. Add an additional 1 ml quantity of the HNO_3 solution.

9.2 Use the 0.01N $\text{Hg}(\text{NO}_3)_2$ solution for low level titrations. The 0.141N $\text{Hg}(\text{NO}_3)_2$ solution is used for high level samples.

9.3 Record the level of mercuric nitrate solution in the buret. Place the buret over the swirling mixture, add the mercuric nitrate solution drop-wise until the pale yellow changes to a persistent blue-violet color. After reaching this color, allow the mixture to swirl about 5 seconds to ensure that the endpoint has been reached.

9.3.1 Record the level of $\text{Hg}(\text{NO}_3)_2$ solution in the buret.

9.3.2 Refer to Section 10.0 CALCULATION AND INTERPRETATION for the total chloride calculation.

9.4 Noncombustible Sample (Raw Feed Materials)

9.4.1 Weigh approximately 1.0 g of sample into a 100 ml volumetric flask. Up to 2 g of sample can be used.

9.4.2 Bring volumetric flask to volume with water. Cap and shake for about 1 minute.

9.4.3 Allow the solid material in the flask to settle or centrifuge for about 1 minute. Remove remaining solids by using an appropriate filter. This is the sample extract prepared at approximately the same percentage (1%) as a combusted sample preparation.

9.4.4 Follow the directions beginning with 9.1.6 (Low Level Chloride).

9.4.5 Refer to Section 10.0 CALCULATION AND INTERPRETATION for the total chloride calculation.

10.0 CALCULATION OR INTERPRETATION

10.1 The total chloride is calculated as follows:

$$\text{Total Chloride mg/L} = \frac{\frac{(A-B)(N)(35450)(C)}{D}}{S}$$

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Where: A = ml of $\text{Hg}(\text{NO}_3)_2$ used for sample
B = ml of $\text{Hg}(\text{NO}_3)_2$ used for 50 ml water blank
C = Final Bomb Wash Volume (ml)
D = Actual sample weight (g)
N = Normality of $\text{Hg}(\text{NO}_3)_2$ solution
S = Milliliters of titrated bomb washings or extract

11.0 REPORTING

11.1 The calculated amount should be recorded to the nearest mg/kg for low level chloride samples (coal, raw feed), and in weight percent to two decimal places for high level chloride samples. The results should be recorded with associated QA/QC results.

12.0 PRECISION AND ACCURACY

12.1 To be determined at a later date.

13.0 REFERENCES

13.1 U.S. EPA, Test Methods for Evaluating Solid Waste: Physical and Chemical Methods (SW-846, Update I, July 1992), Method 9252.

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Method PC-15

STANDARD PROCEDURE FOR TOTAL ORGANIC CARBON ANALYSIS OF AQUEOUS WASTES

1.0 SCOPE

- 1.1 This method describes the determination of organic carbon in aqueous waste samples. It is not applicable to solid samples.
- 1.2 This method is applicable to wastewaters.
- 1.3 *This procedure may involve the use of hazardous materials, operations or equipment. This method does not address the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices Refer to Sytech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 Following calibration, the sample is sparged to remove inorganic carbon, injected into the analyzer and analysis is initiated.

3.0 SIGNIFICANCE AND USE

- 3.1 TOC is typically measured when evaluating wastewater samples for possible discharge, or prior to uses such as process water for cement kiln feedstreams.

4.0 APPARATUS

- 4.1 Dohrman Model 80 TOC Analyzer-utilizing catalytic combustion and non-dispersive infrared detection.
- 4.2 Test tubes 13/100mm borosilicate glass.
- 4.3 SMI Micropettor or equivalent-with a dispensing volume of 40ul.

5.0 REAGENTS AND MATERIALS

- 5.1 Purity of reagents-reagent grade chemicals shall be used in all procedures. Unless otherwise specified, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 5.2 Prepare the 2,000 parts per million (ppm) calibration standard as follows; weigh out 0.425 grams of reagent grade Potassium Hydrogen Phthalate (KHP),

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$\text{KC}_8\text{H}_5\text{O}_4$, into a clean 100 ml volumetric flask, add approximately 50 ml of deionized water and 2 drops H_3PO_4 and bring up to volume with DI water, shake until dissolved.

5.3 Concentrated Phosphoric Acid-(reagent grade).

5.4 Cobalt Oxide catalyst combustion column tube. Prepare by:

1. Ensure that the combustion tube and associated parts are cool.
2. Remove the combustion tube from the analyzer.
3. Place the combustion tube in an upright position with the dimpled end down.
4. Insert a tuft of glass wool into the open end of the tube and seat the wool gently against the dimple.
5. Carefully pour about three inches of cobalt oxide catalyst into the open end of the tube.
6. Gently tap the tube several times in order to pack the catalyst.
7. Insert a second tuft of glass wool through the open end of the tube to secure the packed catalyst.
8. Reinstall combustion tube.
9. Condition the catalyst by removing the exit line of the combustion tube from its connection at the mist trap. Immerse the free end of the exit line in a beaker containing dilute sodium hydroxide solution. Turn on the carrier gas switch. Verify gas flow through the exit line and turn the furnace power switch to the on position. Allow the catalyst to condition for 1 hour. Turn the furnace power switch off. After furnace is cool, re-install the tubing.

5.5 Granular, copper and tin 20 mesh AR drying column tube. Prepare by:

1. Fit a cored septum into one end of the scrubber tube.
2. Insert a tuft of glass wool into the tube and pack securely against the septa.
3. Place about 2 inches of 20 mesh granular tin into the tube.
4. Place a second tuft of glass wool into the tube and pack securely.
5. Fill the remainder of the tube with 20 mesh copper.
6. Secure the packing with a third tuft of glass wool and seal the end of the tube with a cored septa.

6.0 INTERFERENCES AND LIMITATIONS

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- 6.1 Carbonate and bicarbonate carbon (inorganic carbon) interfere with this determination and should be removed, by sparging the acidified sample prior to analysis.
- 6.2 Chlorine and chlorides may interfere fouling the detector and therefore sample dilution may be necessary.
- 6.3 This method is applicable only to samples which can be injected reproducibly by means of a microliter syringe or pipet. The opening of the syringe/pipet limits the maximum particle size included in the sample.
- 6.4 The removal of carbonate/bicarbonate by acidification and sparging, can result in the loss of volatile organics from the sample.

7.0 SAMPLE

- 7.1 The laboratory sample should be thoroughly homogenized by vigorous shaking prior to withdrawing a portion for analysis.
- 7.2 Sampling and storage of samples in glass bottles is preferred. Other materials such as polyethylene may contribute contaminating organics to the sample.
- 7.3 Due to the possibility of oxidation or bacterial decomposition, the time between sample collection and analysis should be minimized.
- 7.4 When analysis cannot be initiated within 2 hours of sample collection, the sample should be acidified with HNO_3 or H_3PO_4 and stored at 4 degrees C.

8.0 PROCEDURE

- 8.1 Follow the manufacturers instructions for instrument set-up, configuration and power-up.

Important! Turn on oxygen cylinder (normal setting for the oxygen regulator is 25 psi.) and boat gas toggle switch and observe flow through glass bubbler. Allow flow through system **before** turning power on to furnace. Allow sufficient time for temperature and detector stabilization (approx. 30 minutes). Detector and temperature are stable when the green temperature light is on and the detector 'ready' light is on.

Instrument Operating Range:

Volume, microliters	Operating Range, ppm	Standard Conc. Ppm
40	100-4000	2000

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200	0-800	400
1000	0.1-160	10

Set instrument mode switch to TOC, the det/ppm switch to ppm C, the sample volume switch to 40 ul., and Range selector switch set to High

8.2 Calibration

- 8.2.1 Slide empty sample boat into furnace to heat and remove residual contamination from the boat. Withdraw boat to cooling block and let cool. If the boat is hot it will prematurely vaporize the sample during sample introduction.
- 8.2.2 Clean pipette tip with DI water and condition with 2000 ppm standard. Remove the septum from the sample introduction port and carefully inject 40ul of 2,000 ppm standard into a clean, cool sample boat. Replace septa in port and press the 'Start' button on the control panel. Then, advance the sample boat into the furnace.
- 8.2.3 The analysis cycle has now started and the instrument control panel displays the results in parts per million (ppm) and the attached printer automatically prints the result.
- 8.2.4 Withdraw the sample boat from the furnace into the cooling block and allow to cool for a minimum of one minute prior to injecting the next sample.
- 8.2.5 Press the 'Calibration' button for one second and release. Observe that the reading is 2000 +/- 5% if not, repeat calibration procedure starting at 8.2.2. The instrument is now calibrated and ready for sample analysis.

8.3 Sample Analysis

- 8.3.1 Clean pipette tip with DI water between samples to prevent cross contamination.
- 8.3.2 Verify that the instrument is calibrated by analyzing a 2,000ppm standard. The value obtained should be +/- 5%, if not, recalibrate the instrument following steps in section 8.2 above.
- 8.3.3 Homogenize the sample by shaking and perform the sample analysis by transferring 10mls of sample into a test tube. Place the test tube in the sparging station and acidify with two drops H₃PO₄. Insert the sparge gas tube into the test tube containing the sample and turn on the sparge gas. Allow to sparge for 10 minutes, to remove inorganic carbon interferences.

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- 8.3.4 Remove the septum from the sample introduction port and carefully inject 40ul of 2,000 ppm standard into a clean, cool sample boat. Replace septa in port and press the 'Start' button on the control panel. Then, advance the sample boat into the furnace.
- 8.3.5 The analysis cycle has now started and the instrument control panel displays the results in parts per million (ppm) and the attached printer automatically prints the result.
- 8.3.6 Withdraw the sample boat from the furnace into the cooling block and allow to cool for at least one minute prior to injecting the next sample.
- 8.3.7 Perform a minimum of two runs and calculate the mean value.
- 8.4 Instrument shutdown. Turn off power to furnace and allow to cool. Turn off oxygen cylinder regulator. Leave power switch for instrument in on position.

9.0 CALCULATION OF RESULTS

- 9.1 The final results are to be calculated in parts per million (ppm) as follows:

TOC run#1 + TOC run #2 / total # of runs= sample TOC value

10.0 QUALITY CONTROL

- 10.1 Refer to the manufacturers recommendations for specific maintenance requirements.
- 10.2 A Check Standard is to be analyzed with each sample batch. An acceptable standard reading is +/- 5% of the gravimetrically prepared value.
- 10.3 The precision and accuracy of this method has not been fully established.

11.0 REFERENCES

- 11.1 U.S. EPA, Test Methods For Evaluating Solid Waste: Physical and Chemical Methods (SW-846, 3rd Ed., Vol. 1c), Method 9060.

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Method PC-16

PC-16 STANDARD PROCEDURE FOR THE ANALYSIS OF TOTAL CHLORIDE BY AUTOMATED POTENTIOMETRIC TITRATION

1.0 SCOPE

- 1.1 This method describes the determination of total chlorides in fuel quality waste by automated potentiometric titration.
- 1.2 This method is applicable to combustible materials.
- 1.3 This method is quantitative.
- 1.4 *This procedure may involve the use of hazardous materials, operations or equipment. This method does not address the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*
- 1.5 This method produces titrated waste that is considered hazardous unless demonstrated otherwise. Refer to SOP for samples and waste management. Use good laboratory techniques to minimize the amount of waste generated and prevent pollution.

2.0 SUMMARY OF PROCEDURE

- 2.1 This procedure is performed in two parts: 1) Combustion of the sample by method PC-6 and 2) titration of combustion bomb washing. The feedstream sample is combusted in an oxygen bomb. The bomb head and internal surfaces are scrubbed, washed down to a set volume, and titrated with silver nitrate solution in an automated potentiometric titrator.

3.0 SIGNIFICANCE AND USE

- 3.1 The Hazardous Waste Combustor Maximum Achievable Control Technology rules and facility permits require that cement kilns utilizing fuel quality waste adhere to specific guidelines in assessing potential emissions. Cement plants also monitor chlorine because of its effect on kiln operating conditions.

4.0 APPARATUS

- 4.1 Mettler-Toledo DL-21 or DL50Graphix Potentiometric Titrator with DM141-SC silver ring electrode for argentometric titration and the Mettler-Toledo ST20A Autosampler.
- 4.2 Parr Instrument Company, Model 1261 oxygen bomb calorimeter system.
- 4.3 Analytical Balance

- 4.4 Brass bristle brush, or equivalent.
- 4.5 Volumetric flasks: 10 ml and 100 ml volumes.
- 4.6 Plastic 100 ml beakers.

5.0 REAGENTS AND MATERIALS

- 5.1 Purity of Reagents - Reagent grade chemicals shall be used in all procedures. Unless otherwise specified, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 5.2 ASTM Type II water, or equivalent. Unless otherwise indicated references to water shall be understood to mean ASTM type II water or equivalent.
- 5.3 Sodium hydroxide solution, NaOH, approximate 0.01 N (Bombwash).
- 5.4 Sulfuric acid, H₂SO₄, approximate 0.1% solution: Combine 5 ml of H₂SO₄ with 1 gallon of water in reagent jar. Add approximately 0.5 to 1ml of Titron X surfactant.
- 5.5 Silver nitrate solution, AgNO₃, 0.0141 N. Other normalities (e.g. 0.141N, 0.10N) may be used for higher level chlorides.
- 5.6 LabChem, 1000 ppm chloride standard, or equivalent.
- 5.7 Alpha Resources, Inc., 2% chloride in oil standard, or equivalent.
- 5.8 Titron X surfactant, or equivalent,

6.0 INTERFERENCES AND LIMITATIONS

- 6.1 Although this determination is reported as total chlorides, this procedure determines total halogens and does not differentiate between halogen species.
- 6.2 Certain sulfur-bearing compounds can interfere with this method but are not expected on a fully combusted sample.
- 6.3 The silver nitrate titrant used in this procedure is light sensitive and should be stored in a amber glass bottle.

7.0 SAMPLE

- 7.1 All feedstream samples should be analyzed in the form that they are introduced into the kiln.

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- 7.2 The laboratory sample should be thoroughly mixed by vigorous shaking or stirring depending upon the physical characteristics of the sample prior to withdrawing a portion for combustion by method PC-6. For strongly multi-phasic or heterogenous materials, a core sample may be necessary.
- 7.3 The bomb washings should be thoroughly mixed by shaking, prior to withdrawing a portion for analysis.

8.0 QUALITY CONTROL

- 8.1 Refer to the maintenance and optimization log and manufacturers recommendations for specific maintenance requirements.
- 8.2 All quality control items and data quality objectives listed in the Waste Analysis Plan (WAP) must be followed. The following items may or may not be part of a site WAP but should be followed to ensure data quality. Refer to Comprehensive Quality Assurance Plan and SOP for Data validation/verification for additional quality control information.
- 8.3 A minimum of 1 Method blank per analytical batch must be ran to determine contamination. The method blank is prepared by method PC-6 using a benzoic acid pellet as the sample.
- 8.4 An initial check (ICS) standard (Lab Chem, 1000 ppm or equivalent) made by weighing approximately 1 gram of standard and diluting to 10 ml with DI water. The results should agree within 15% of the known value. If not, terminate the analysis, correct the problem and repeat check standard verification.
- 8.5 A continuing check (CCS) standard (Lab Chem, 1000 ppm or equivalent) made by weighing approximately 1 gram of standard and diluting to 10 ml with DI water to verify the instrument calibration at the end of each batch. The results of the check standard should agree within 15% of the known value.
- 8.6 Spike and Spike duplicate. Weigh out approximately equal portions of sample and spike standard (e.g. 0.5 grams FQW sample and 0.5 grams Alpha Resources, 2% chloride in oil standard), in a bomb capsule and prepare by SAMM method PC-6.

9.0 PROCEDURE

- 9.1 Automated titrator instrument settings for Mettler model DL50Graphix with DM141-SC silver ring electrode and 5 ml dispensing buret. These recommended instrument parameters may be modified if necessary.

Sample:

Entry type	weight
Molar Mass M	35.453
Equivalent number z	1
Titration stand	ST20A
Pump	yes

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Solvent Acid Solution
 Volume ml 40.0
 Stir No
 Pump No
 Rinse Yes
 Solvent Acid Solution
 Volume ml 10
 Conditioning No
 Temperature sensor Manual

Stir
 Speed % 35
 Time [s] 30

EQP titration
 Titrant/Sensor
 Titrant AgNO_3
 Concentration [mol/L] 0.0141
 Sensor DM141
 Unit of measure mv
 Predispensing No
 Titrant addition Dynamic
 E (set [mv] 8
 V (min) [mL] 0.02
 V(max) [mL] 0.2
 Measure mode
 Timed increment T [s] 3

Recognition
 Threshold 150.0
 Steepest jump only No
 Range No
 Tendency Positive
 Termination
 at maximum volume [mL] 30.0
 at potential yes
 Potential [mv,pH,..] 160
 At slope No
 After number EQPs yes
 N= 1
 Comb. Termination cond. No

Evaluation
 Procedure Standard
 Potential 1 No
 Potential 2 No
 Stop for reevaluation No

00247

Calculation	
Formula	R=ET1
Constant	
Decimal Places	5
Result unit	V
Result name	Volts
Statistics	No

Calculation	
Formula	R2=EPOT
Constant	
Decimal Places	5
Result unit	V
Result name	Volts
Statistics	No

Calculation	
Formula	$R3=Q \cdot C / m \cdot f$
Constant	C=M
Decimal Places	5
Result unit	%
Result name	C1
Statistics	No

Report	
Output	Printer
Results	No
All results	Yes
Raw results	No
Table of measured values	No
Sample data	Yes
E -V curve	Yes

- 9.2 The sample should be combusted by performing method PC-6.
- 9.3 Remove the oxygen bomb and slowly vent.
- 9.4 Remove the bomb holding ring, carefully remove bomb head unit and combustion capsule. Collect any drops from interior of bomb head in bomb. Prevent calorimeter bucket water that may be present on top of the bomb head unit from dripping into the bomb.
- 9.5 Using a dispensing bottle containing bomb wash or DI water, and a brass bristle brush, thoroughly scrub and rinse the bomb head interior surface and the bomb's internal surface collecting all of the scrub rinse in the bomb.
- 9.6 After scrubbing is complete rinse the brush bristles collecting the rinse in the bomb.

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- 9.7 Transfer the bomb washing collected in the oxygen bomb to a clean 100 ml volumetric flask and bring to volume with water.
- 9.8 Measure a 10 ml aliquot of wash in a clean 10 ml volumetric flask. Dispense the wash aliquot from the flask into a clean 100 ml plastic sample beaker.
- 9.9 Place the beaker containing the wash aliquot into the 'ready' position in the ST20A autosampler.
- 9.10 Using the controllers alphanumeric keypad, enter the sample weight and start the analysis.
- 9.11 The analysis cycle initiates and the autosampler moves the sample cup into position with the probe and stirrer. The instrument adds ~40 ml of 0.1% H_2SO_4 solution so that the argentometric titration of the chloride is carried out in an acidic medium. The automatic titration proceeds with 0.0141 N AgNO_3 . When the equivalence point is detected the instrument control panel displays the results in weight percent chloride and the attached printer automatically prints the results.

10.0 REPORTING

- 10.1 Report results as weight percent chloride.

11.0 PRECISION AND ACCURACY

- 11.1 The precision and accuracy estimates are based on intra-laboratory analysis of standard materials and spiked materials. These performance values are not independent of sample preparation because the lab analyzed separate spiked fuel quality waste (FWQ) materials.

	Spiked FWQ	Chloride Standard
Total no. runs.	63	63

Accuracy:

Average % Recovery	104%	101%
Average Std. Dev.	13	4

	Spiked FWQ	Chloride Standard
Precision:		
Average RPD	9%	
Average Std Dev	8	

FWQ spiked with Alpha Resources, Inc., 2% chloride in oil standard.
Chloride Standard solution LabChem, 1000 ppm chloride in water.

12.0 REFERENCES

- 12.1 EPA SW-846 Method 9253 and Mettler DL25 Titrator Application No. 29 "Titration of Chlorine".

Standard Method for Spectrophotometric Lead Determination of Solid and Liquid Waste

1.0 SCOPE

- 1.1 This method describes the determination of lead levels in solid or liquid wastes by spectrophotometry.
- 1.2 This method is limited to the total recoverable lead following sample preparation using Method PC-6.
- 1.3 Procedural instructions are given for using Hach DR/2400.
- 1.4 ***This method may involve hazardous materials, operations, or equipment. This method does not purport to address the safety concerns associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.***

2.0 SUMMARY OF PROCEDURE

- 2.1 The sample is prepared by performing Method PC-6. One hundred (100) ml of sample bomb washings are transferred to a clean beaker and reacted with selected reagents. The sample is extracted. The sample cell containing the reacted sample is inserted into the unit and a reading is displayed.

3.0 SIGNIFICANCE AND USE

- 3.1 Most facilities performing this analysis are required by operating permits to measure total lead. This method is a spectrophotometric procedure common to the water testing industry, and has been adapted for use on samples prepared by Method PC-6.

4.0 APPARATUS

- 4.1 Hach DR/2000 Spectrophotometer, or equivalent.

5.0 REAGENTS AND MATERIALS

- 5.1 Purity of Reagents - Reagent grade chemical shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to

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the specifications of the American Chemical Society (ACS), where such specifications are available.

- 5.2 Sample cells, 25 ml.
- 5.3 Hach LeadTrack reagent set
- 5.4 Nitric Acid ACS
- 5.5 Purity of Water - Unless otherwise indicated, references to water shall be understood to mean meeting the numerical requirements of Type II water as defined by ASTM D 1193.

6.0 INTERFERENCES AND LIMITATIONS

6.1 Lead

- 6.1.1 Aluminum 0.5 mg/l
- 6.1.2 Ammonium 500 mg/l
- 6.1.3 Barium 6 mg/l
- 6.1.4 Calcium 500 mg/l
- 6.1.5 Chloride 1000 mg/l
- 6.1.6 Copper 2 mg/l
- 6.1.7 Fluoride 10 mg/l
- 6.1.8 Iron 2 mg/l
- 6.1.9 Magnesium 500 mg/l
- 6.1.10 Manganese 0.5 mg/l
- 6.1.11 Nitrate 1000 mg/l
- 6.1.12 Sulfate 1000 mg/l
- 6.1.13 Zinc 1 mg/l

7.0 SAMPLE

- 7.0 The bomb washings should be mixed by shaking prior to decanting to the sample cell. Filtration or dilution may be needed.

8.0 QUALITY CONTROL

- 8.1 An analytical blank must be analyzed for each sample, or each sample batch.
- 8.2 A QC standard (recommended concentration 10 mg/L-lead) should be analyzed at a user specified frequency.

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9.0 PROCEDURE

9.1 Lead

- 9.1.1 The procedure for Pb determinations using the powder pillows only is presented. Items in boldface represent keystrokes/LED display.
- 9.1.2 Enter the stored program number (283) for a range of 5 to 150 ug/L. Depress read/enter, the display will show dial nm to 477.
- 9.1.3 Rotate the wavelength dial until the display shows 477 nm.
- 9.1.4 Depress read/enter; the display will show mg/L Lead
- 9.1.5 Fill a sample cell with 25 ml of sample bomb washing.
- 9.1.6 Put 100ml of bomb washing into a 250 ml beaker add 1 ml of pPb-1 acid preservative and mix. Depress shift timer, a two minute reaction period will begin.
- 9.1.7 Add 2 ml of pPb-2 fixer and swirl to mix..
- 9.1.8 Set up a new column extractor and place a cotton plug saturated with deionized water into the extractor. Compress the plug to the bottom with the plunger.
- 9.1.9 Pour the prepared sample slowly into the extractor keeping the level just above the plug (about 2 drops per second)
- 9.1.10 After flow has stopped fully compress the plug with the plunger.
- 9.1.11 Place a clean sample cell under the extractor and add 25 ml of pPb-3 eluant into the extractor. Compress the pad with the plunger after flow stops.
- 9.1.12 Add 1 ml of pPb-4 neutralizer to the cell and swirl to mix. Add one pPb-5 indicator powder pillow to the sample and swirl to mix.
- 9.1.13 Touch the timer for a two minute reaction period. Place the cell into the cell holder and depress zero. The display will show 0ug/l Pb.
- 9.1.14 Remove the cell and add 6 drops of pPb-6 decolorizer to the cell and swirl to mix.

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9.1.15 Place the cell into the holder and press Read the results will appear in ug/l Pb.

9.1.16 This result should be multiplied by the sample dilution factor from Method PC-6.

10.0 CALCULATION OR INTERPRETATION

10.1 Lead.

10.1.1 The Lead results are read directly from the Hach LED display. If any additional dilution was made on the sample bomb washing, then the result from Step 9.1.15 must be multiplied by the dilution factor.

11.0 REPORTING

11.1 The calculated result should be recorded to the nearest ug/l. The result should be recorded, qualification sheets, or other appropriate paperwork.

12.0 PRECISION AND BIAS

12.1 Precision - No statement is made about the precision at this time.

12.2 Bias - No statement is made about the bias at this time.

13.0 REFERENCES

13.1 Hach DR/2000 Spectrophotometer Handbook,

PC-18 Standard Method for Fluoride Determination by Ion-Selective Electrode

1.0 SCOPE

- 1.1 This method describes the total Fluoride determination of cement kiln feed stream materials by using the Orion Fluoride Selective Electrode.
- 1.2 **This method may involve hazardous materials, operations or equipment. This method does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices.**
- 1.3 This method produces waste that is considered hazardous unless proven otherwise. Use good laboratory techniques to minimize the amount of waste generated and to prevent pollution.

2.0 SUMMARY OF PROCEDURE

- 2.1 The sample is prepared by Method PC-6. The total solubilized fluoride is determined potentiometrically using a fluoride combination ion-selective electrode (ISE), and a pH meter with an expanded millivolt scale.
- 2.2 Standards and samples are mixed 1:1 with total ionic strength adjustment buffer (TISAB). Calibration is performed by analyzing a series of standards and plotting mV vs. fluoride concentration on a semi log spreadsheet. Sample concentration is calculated from the standard curve.

3.0 SIGNIFICANCE AND USE

- 3.1 The determination of fluoride concentration in feedstreams may be required by operating permits. Cement plants may also have maximum fluoride limits because of the effect on kiln operating conditions.

4.0 APPARATUS

- 4.1 Orion pH/mV meter Model 420A
- 4.2 Orion combination fluoride ISE model 96-09
- 4.3 Thermally isolated magnetic stirrer, polytetrafluoroethylene coated stir bar.
- 4.4 Polyethylene lab ware
- 4.5 Analytical Balance capable of reading 0.0001g

5.0 REAGENTS AND MATERIALS

- 5.1 Purity of Reagents- Reagent grade chemicals shall be used. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 5.2 Purity of water- Unless otherwise indicated, references to DI water shall be understood to mean meeting the numerical requirements of Type II water as defined by ASTM D 1193.
- 5.3 Sodium hydroxide solution (5M NaOH): Dissolve 200g of NaOH in sufficient Reagent water to make 1 L of solution. Store in tightly sealed polyethylene bottle.
- 5.4 Glacial acetic acid
- 5.5 Sodium Chloride
- 5.6 CDTA or 1,2-cyclohexanedinitrilo-tetraacetic acid
- 5.7 To approximately 500ml of reagent water add 57.0ml of glacial acetic acid, 58.0g of sodium chloride, and 4.00g of CDTA. Stir to dissolve and cool to room temperature. Adjust pH to between 5.0 and 5.5 with 5M NaOH. Transfer solution to a 1L volumetric flask and dilute to the mark with reagent water. Transfer solution to a clean polyethylene bottle.
- 5.8 **Fluoride calibration stock solution** (1,000 mg/L): Dissolve 0.2210g of sodium fluoride (NaF, dried two hours at 110C and stored in a desiccator) in reagent water and dilute to 100ml in a polyethylene volumetric flask. Store in a clean polyethylene bottle. Prepare an **Alternate Source Check Stock Solution** from a different Sodium Fluoride source as described above.
- 5.9 General instruction for making the calibration standards (100, 10, 1, 0.5, 0.25, 0.10 mg/L) are as follows:
 - 1) 100 mg/L Standard:
Using a 100 ml volumetric flask, measure 10.00 ml of the 1,000 mg/L Fluoride calibration stock solution and dilute to 100ml using reagent water. Shelf life is equal to 1 month.
 - 2) 10 mg/L Standard:
Using a 100ml volumetric flask, measure 10.00ml of the 100 mg/L Fluoride Standard Solution and dilute to 100ml using reagent water. Shelf life is equal to 1 month.

- 3) 1 mg/L Standard / ICV CCV:
Using a 100ml volumetric flask, measure 10.00ml of the 10 mg/L Fluoride Standard Solution and dilute to 100ml using reagent water. Shelf life is equal to 1 month.
- 4) 0.5 mg/L Standard:
Using a 100ml volumetric flask, measure 50.00ml of the 1.0 mg/L Fluoride Standard Solution and dilute to 100ml using reagent water. Shelf life is equal to 1 month.
- 5) 0.25 mg/L Standard:
Using a 100ml volumetric flask, measure 50.00ml of the 0.5 mg/L Fluoride Standard Solution and dilute to 100ml using reagent water. Shelf life is equal to 1 month.
- 6) 0.10 mg/L Standard:
Using a 100ml volumetric flask, measure 40.00ml of the 0.25 mg/L Fluoride Standard Solution and dilute to 100ml using reagent water. Shelf life is equal to 1 month.
- 7) 2mg/L ASC
Using a dedicated 100 ml volumetric flask, measure 10ml of the **1,000 mg/L ASC Stock Solution** and dilute to 100 ml with reagent water. Using a 100ml volumetric flask, measure 2.00ml of Working ASC Stock Solution and dilute to 100ml using reagent water. Shelf life is equal to 1 month.

Larger volumes of standards may be prepared, but the user must be mindful of the shelf life of each solution. These recommended solution concentrations may be modified if necessary, and the above directions are only given as a guide. Alternatively, commercially prepared standards and solutions may be used.

6.0 INTERFERENCES

- 6.1 Polyvalent cations from iron and aluminum interfere by forming complexes with fluoride, which are not measured by the fluoride ISE. As the cation concentration increases, more fluoride is consumed to form metal-fluoride complex ions. Adding TISAB, which contains a strong chelating agent, eliminates this interference by complexing with polyvalent cations.
- 6.2 Sample pH is critical. Hydroxide is a significant interference at concentrations ten times the fluoride concentration. This interference is avoided by adding TISAB, which buffers the sample at a pH of 5-5.5. At

low pH values, fluoride forms bifluoride, which is not detected by the fluoride ISE. Again adding TISAB prevents this interference by buffering the pH.

- 6.3 Temperature changes affect electrode potentials. The analyst must let standards and samples equilibrate to the same temperature.

7.0 SAMPLE

- 7.1 The sample is prepared by Method PC-6.

8.0 QUALITY CONTROL

- 8.1 An Initial Calibration Verification standard (ICV): After performing the calibration step, verify calibration by analyzing an ICV. The ICV contains a known fluoride concentration and should agree within 10% of the known value. If not, terminate the analysis, correct the problem and repeat calibration.
- 8.2 A Continuing Calibration Verification standard (CCV) at low or mid range of calibration must be run to verify the instrument calibration at a frequency of every 10 samples or at the end of each batch if the batch is less than 10 samples. The results of the check standard should agree within 10% of the known value.
- 8.3 An Alternate Source Check standard (ASC): After performing the calibration step, verify calibration by analyzing an ASC. The ASC contains a known fluoride concentration and is from a different source than the ICV. The ASC should agree within 10% of the known value. If not, terminate the analysis, correct the problem and repeat calibration
- 8.4 Reagent Blank: After the ICV and after every CCV, a reagent blank must be analyzed. A reagent blank is reagent water mixed 1:1 with TISAB. The indicated reagent blank concentration must be less than 0.1 mg/L Fluoride. If not, the contamination source must be corrected. All samples analyzed since the last acceptable reagent blank will need re-analyzed.
- 8.4 Matrix Spike: To a 25ml portion of sample add 25ul of 1,000mg/L Fluoride Calibration Stock Solution. Spike recovery must be 75%-125%. If not, a new sample will need prepared and reanalyzed.

9.0 PROCEDURE

- 9.1 Ensure that the ISE is filled with the solution recommended by the manufacturer. Change the solution if the ISE has not been used for a week. Prior to sample analysis, equilibrate the electrode for 24 hours in a 10.0 mg/L Fluoride standard.
- 9.2 Allow samples and standards equilibrate to room temperature.
- 9.3 Before and between sample analyses, rinse the electrode thoroughly with reagent water and gently wipe off excess.
- 9.4 Turn on the pH/mV meter and press the mode button to read mV. Calibrate the ISE using the prepared standards mixed 1:1 with TISAB. Add 10ml of standard and 10ml of TISAB to a plastic beaker with a PTFE coated stir bar. Place the beaker on a magnetic stir plate and stir at low speed. Immerse the electrode tip to just above the stir bar. Record the meter reading as soon as it stabilizes. The reading should not be longer than five minutes. Repeat for all standards. Prepare a calibration curve by plotting the measured mV as a function of the logarithm of Fluoride concentration. The slope must be 54-60 mV per 10X Fluoride concentration. If the slope is unacceptable, refer to the ISE instruction manual for corrective actions.
- 9.5 Quality Control and unknown samples are tested in exactly same manner as the standards listed above. The Fluoride concentrations of Quality Control and unknown samples are determined from the calibration curve.
- 9.6 When analyses have been completed, drain the filling solution from the ISE and rinse with reagent water. Store the ISE in its shipping box to prevent damage to the ISE.

10. CALCULATIONS:

10.1 The percent Fluoride concentration of a sample is to be calculated as follows:

$$\% \text{ Fluoride} = (A \times B / 1000 \times C) \times 100$$

Where: A = Fluoride concentration of bomb wash (mg/L)

B = Bomb calorimeter wash volume in liters

C = Sample weight of material used in bomb calorimeter

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11. REFERENCES

- 11.1 U.S EPA, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, December 1996) Method 9214.

PC-19 Standard Method for Sodium Determination by Ion-Selective Electrode

1.0 SCOPE

- 1.1 This method describes the total Sodium determination of cement kiln feed stream materials by using the Orion Sodium Selective Electrode.
- 1.2 **This method may involve hazardous materials, operations or equipment. This method does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices.**
- 1.3 This method produces waste that is considered hazardous unless proven otherwise. Use good laboratory techniques to minimize the amount of waste generated and to prevent pollution.

2.0 SUMMARY OF PROCEDURE

- 2.1 The sample is prepared by Method PC-6. The total solubilized sodium is determined potentiometrically using a sodium ion-selective electrode (ISE), and a pH meter with an expanded millivolt scale.
- 2.2 Calibration is performed by analyzing a series of standards and plotting mV vs. sodium concentration on a semi log spreadsheet. Sample concentration is calculated from the standard curve.

3.0 SIGNIFICANCE AND USE

- 3.1 The determination of sodium concentration in feed streams may be required by operating permits. Cement plants may also have maximum sodium limits because of the effect on kiln operating conditions.

4.0 APPARATUS

- 4.1 Orion pH/mV meter Model 420A
- 4.2 Sodium ISE Orion
- 4.3 Thermally isolated magnetic stirrer, polytetrafluoroethylene coated stir bar.
- 4.4 Polyethylene lab ware
- 4.5 Analytical Balance capable of reading 0.0001g

5.0 REAGENTS AND MATERIALS

- 5.1 Purity of Reagents- Reagent grade chemicals shall be used. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 5.2 Purity of water- Unless otherwise indicated, references to DI water shall be understood to mean meeting the numerical requirements of Type II water as defined by ASTM D 1193.
- 5.3 Storage Solution- for probe storage when not in use. Orion 841101
- 5.4 ISA (Ionic Strength Adjuster)-for pH adjustment / buffering of solutions. Orion 841111
- 5.5 Rinse Solution- this is made by taking 50 ml of rinse stock and diluting it with DI water to 500 ml. This is to be mixed in a squeeze bottle and is to be used to rinse the probe. Only this solution can be used to rinse the probe and the probe is never to be wiped.
- 5.6 1000 ppm Na Standard- Orion 841108
- 5.7 Reference Electrode Fill Solution- for reference solution inside of probe. Fill until coil is covered. Orion 900010
- 5.8 Reconditioning Solution- for restoring electrode response. Orion 841113
- 5.9 General instruction for making the calibration standards (100, 10, 1 mg/L) are as follows:
 - 1) 100 mg/L Standard:
Using a 100 ml volumetric flask, measure 10.00 ml of the 1,000 mg/L Sodium calibration stock solution and dilute to 100ml using reagent water. Shelf life is equal to 1 month.
 - 2) 10 mg/L Standard:
Using a 100ml volumetric flask, measure 10.00ml of the 100 mg/L Sodium Standard Solution and dilute to 100ml using reagent water. Shelf life is equal to 1 month.
 - 3) 1 mg/L Standard / ICV CCV:
Using a 100ml volumetric flask, measure 10.00ml of the 10 mg/L Sodium Standard Solution and dilute to 100ml using reagent water. Shelf life is equal to 1 month.

Larger volumes of standards may be prepared, but the user must be mindful of the shelf life of each solution. These recommended solution concentrations may be modified if necessary, and the above directions are only given as a guide. Alternatively, commercially prepared standards and solutions may be used.

6.0 INTERFERENCES

- 6.1 Lithium, Potassium, Silver, and Titanium are known to interfere. Ammonium and Rubidium at high level also may interfere.
- 6.2 Sample pH is important. pH below 6 has a major effect on low levels of sodium ion.
- 6.3 Temperature changes affect electrode potentials. The analyst must let standards and samples equilibrate to the same temperature.

7.0 SAMPLE

- 7.1 The sample is prepared by Method PC-6.
- 7.2 Weigh 1 gram of sample in a 100ml flask
- 7.3 Dilute to 100ml with DI water, agitate to mix.
- 7.4 Pour 100ml into a 1 l flask and dilute to 1 l with DI water
- 7.5 Filter sample with #4 Whatman filter.
- 7.6 Place 100ml into a 150 ml beaker, pipet in 10ml of ISA mix

8.0 QUALITY CONTROL

- 8.1 An Initial Calibration Verification standard (ICV): After performing the calibration step, verify calibration by analyzing an ICV. The ICV contains a known sodium concentration and should agree within 10% of the known value. If not, terminate the analysis, correct the problem and repeat calibration.
- 8.2 A Continuing Calibration Verification standard (CCV) at low or mid range of calibration must be run to verify the instrument calibration at a frequency of every 10 samples or at the end of each batch if the batch is less than 10 samples. The results of the check standard should agree within 10% of the known value.

- 8.3 An Alternate Source Check standard (ASC): After performing the calibration step, verify calibration by analyzing an ASC. The ASC contains a known sodium concentration and is from a different source than the ICV. The ASC should agree within 10% of the known value. If not, terminate the analysis, correct the problem and repeat calibration
- 8.4 Reagent Blank: After the ICV and after every CCV, a reagent blank must be analyzed. A reagent blank is reagent water mixed 1:1 with ISA. The indicated reagent blank concentration must be less than 0.1 mg/L sodium. If not, the contamination source must be corrected. All samples analyzed since the last acceptable reagent blank will need re-analyzed.
- 8.4 Matrix Spike: To a 25ml portion of sample add 25ul of 1,000mg/L sodium Calibration Stock Solution. Spike recovery must be 75%-125%. If not, a new sample will need prepared and reanalyzed.

9.0 PROCEDURE

- 9.1 Ensure that the ISE is filled with the solution recommended by the manufacturer. Change the solution if the ISE has not been used for a week. Prior to sample analysis; equilibrate the electrode for 2 hours in a Sodium electrode storage solution.
- 9.2 Allow samples and standards equilibrate to room temperature.
- 9.3 Before and between sample analyses, rinse the electrode thoroughly with rinse solution.
- 9.4 Place 100 ml of DI water into a 150ml plastic beaker with a PTFE coated stir bar, pipet 10ml of ISA Turn on the pH/mV meter and press the mode button to read mV. Place the beaker on a magnetic stir plate and stir at low speed. Immerse the electrode tip to just above the stir bar. Record the meter reading as soon as it stabilizes. The reading should not be longer than five minutes. Repeat for all standards.
- 9.5 Prepare a calibration curve by plotting the measured mV as a function of the logarithm of Sodium concentration. The slope must be 54-60 mV per 10X sodium concentration. If the slope is unacceptable, refer to the ISE instruction manual for corrective actions.
- 9.5 Quality Control and unknown samples are tested in exactly same manner as the standards listed above. The sodium concentrations of Quality Control and unknown samples are determined from the calibration curve.

10. CALCULATIONS:

- 10.1 The percent sodium concentration of a sample is to be calculated as follows:

$$\% \text{ sodium} = (A \times B / 1000 \times C) \times 100$$

Where: A = sodium concentration of bomb wash (mg/L)

B = Bomb calorimeter wash volume in liters

C = Sample weight of material used in bomb calorimeter

11. REFERENCES

- 11.1 Orion User Guide Sodium Ion Selective Electrode

12. PRECISION AND BIAS

- 12.1 Precision - No statement is made about the precision at this time.
- 12.2 Bias - No statement is made about the bias at this time.

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PC-20 Standard Method for Potassium Determination by Ion-Selective Electrode

1.0 SCOPE

- 1.1 This method describes the total Potassium determination of cement kiln feed stream materials by using the Orion Potassium Selective Electrode.
- 1.2 **This method may involve hazardous materials, operations or equipment. This method does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices.**
- 1.3 This method produces waste that is considered hazardous unless proven otherwise. Use good laboratory techniques to minimize the amount of waste generated and to prevent pollution.

2.0 SUMMARY OF PROCEDURE

- 2.1 The sample is prepared by Method PC-6. The total solubilized potassium is determined potentiometrically using a potassium ion-selective electrode (ISE), and a pH meter with an expanded millivolt scale.
- 2.2 Calibration is performed by analyzing a series of standards and plotting mV vs. potassium concentration on a semi log spreadsheet. Sample concentration is calculated from the standard curve.

3.0 SIGNIFICANCE AND USE

- 3.1 The determination of potassium concentration in feed streams may be required by operating permits. Cement plants may also have maximum potassium limits because of the effect on kiln operating conditions.

4.0 APPARATUS

- 4.1 Orion pH/mV meter Model 420A
- 4.2 Potassium ISE Orion
- 4.3 Thermally isolated magnetic stirrer, polytetrafluoroethylene coated stir bar.
- 4.4 Polyethylene lab ware
- 4.5 Analytical Balance capable of reading 0.0001g

5.0 REAGENTS AND MATERIALS

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- 5.1 Purity of Reagents- Reagent grade chemicals shall be used. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 5.2 Purity of water- Unless otherwise indicated, references to DI water shall be understood to mean meeting the numerical requirements of Type II water as defined by ASTM D 1193.
- 5.3 Storage Solution- for probe storage when not in use up to 3 days use 100 ppm Potassium standard. For longer storage disassemble in accordance with manufacturer's instructions
- 5.4 ISA (Ionic Strength Adjuster)-for pH adjustment / buffering of solutions. Orion 931911
- 5.5 Rinse - this is DI water in a squeeze bottle and is to be used to rinse the probe. Only DI water can be used to rinse the probe and the probe is never to be wiped.
- 5.6 1000 ppm K Standard- Orion 921906
- 5.7 Reference Electrode Fill Solution- for reference solution inside of probe. Fill until coil is covered. Orion 900200
- 5.8 General instruction for making the calibration standards (100, 10, 1 mg/L) are as follows:
- 1) 100 mg/L Standard:
Using a 100 ml volumetric flask, measure 10.00 ml of the 1,000 mg/L Potassium calibration stock solution and dilute to 100ml using reagent water. Shelf life is equal to 1 month.
 - 2) 10 mg/L Standard:
Using a 100ml volumetric flask, measure 10.00ml of the 100 mg/L Potassium Standard Solution and dilute to 100ml using reagent water. Shelf life is equal to 1 month.
 - 3) 1 mg/L Standard / ICV CCV:
Using a 100ml volumetric flask, measure 10.00ml of the 10 mg/L Potassium Standard Solution and dilute to 100ml using reagent water. Shelf life is equal to 1 month.

Larger volumes of standards may be prepared, but the user must be mindful of the shelf life of each solution. These recommended solution concentrations may be modified if necessary, and the above directions are

only given as a guide. Alternatively, commercially prepared standards and solutions may be used.

6.0 INTERFERENCES

- 6.1 Lithium, Sodium, and Silver, are known to interfere. Titanium, Ammonium and Cesium at high levels also may interfere.
- 6.2 Sample pH is important. pH below 3 has a major effect on low levels of potassium ion.
- 6.3 Temperature changes affect electrode potentials. The analyst must let standards and samples equilibrate to the same temperature.

7.0 SAMPLE

- 7.1 The sample is prepared by Method PC-6.
- 7.2 Weigh 1 gram of sample in a 100ml flask
- 7.3 Dilute to 100ml with DI water, agitate to mix.
- 7.4 Pour 100ml into a 1 l flask and dilute to 1 l with DI water
- 7.5 Filter sample with #4 Whatman filter.
- 7.6 Place 100ml into a 150 ml beaker, pipet in 10ml of ISA mix

8.0 QUALITY CONTROL

- 8.1 An Initial Calibration Verification standard (ICV): After performing the calibration step, verify calibration by analyzing an ICV. The ICV contains a known potassium concentration and should agree within 10% of the known value. If not, terminate the analysis, correct the problem and repeat calibration.
- 8.2 A Continuing Calibration Verification standard (CCV) at low or mid range of calibration must be run to verify the instrument calibration at a frequency of every 10 samples or at the end of each batch if the batch is less than 10 samples. The results of the check standard should agree within 10% of the known value.
- 8.3 An Alternate Source Check standard (ASC): After performing the calibration step, verify calibration by analyzing an ASC. The ASC contains a known potassium concentration and is from a different source than the

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ICV. The ASC should agree within 10% of the known value. If not, terminate the analysis, correct the problem and repeat calibration

- 8.4 Reagent Blank: After the ICV and after every CCV, a reagent blank must be analyzed. A reagent blank is reagent water mixed 2ml ISA in 100 ml of DI water. The indicated reagent blank concentration must be less than 0.1 mg/L potassium. If not, the contamination source must be corrected. All samples analyzed since the last acceptable reagent blank will need re-analyzed.
- 8.4 Matrix Spike: To a 25ml portion of sample add 25ul of 1,000mg/L potassium Calibration Stock Solution. Spike recovery must be 75%-125%. If not, a new sample will need prepared and reanalyzed.

9.0 PROCEDURE

- 9.1 Ensure that the ISE is filled with the solution recommended by the manufacturer. Change the solution if the ISE has not been used for a week. Prior to sample analysis; equilibrate the electrode for 2 hours in a 100 ppm Potassium standard solution.
- 9.2 Allow samples and standards equilibrate to room temperature.
- 9.3 Before and between sample analyses, rinse the electrode thoroughly with DI water.
- 9.4 Place 100 ml of DI water into a 150ml plastic beaker with a PTFE coated stir bar, pipet 2 ml of ISA Turn on the pH/mV meter and press the mode button to read mV. Place the beaker on a magnetic stir plate and stir at low speed. Immerse the electrode tip to just above the stir bar. Record the meter reading as soon as it stabilizes. The reading should not be longer than five minutes. Repeat for all standards.
- 9.5 Prepare a calibration curve by plotting the measured mV as a function of the logarithm of Potassium concentration. The slope must be 54-60 mV per 10X potassium concentration. If the slope is unacceptable, refer to the ISE instruction manual for corrective actions.
- 9.5 Quality Control and unknown samples are tested in exactly same manner as the standards listed above. The potassium concentrations of Quality Control and unknown samples are determined from the calibration curve.

10.0 CALCULATIONS:

- 10.1 The percent potassium concentration of a sample is to be calculated as follows:

$$\% \text{ potassium} = (A \times B / 1000 \times C) \times 100$$

Where: A = potassium concentration of bomb wash (mg/L)

B = Bomb calorimeter wash volume in liters

C = Sample weight of material used in bomb calorimeter

11.0 REFERENCES

- 11.1 Orion User Guide Potassium Ion Selective Electrode

12.0 PRECISION AND BIAS

- 12.1 Precision - No statement is made about the precision at this time.
- 12.2 Bias - No statement is made about the bias at this time.

Standard Procedure for the Analysis of Vapor Monitor Badges by Gas Chromatography

1.0 SCOPE

- 1.1 This procedure describes desorption and GC-FID analysis of organic vapor monitor badges (VMB). It is not applicable to standard sorbent tubes.
- 1.2 This procedure is designed to be quantitative and semi-quantitative, depending on the specific organic compound identified in the VMB extract.
- 1.3 This procedure is not a comprehensive instructional guide for organic vapor sampling with VMBs. Some sampling is given for edification and is geared toward a more complete understanding of the total process.
- 1.4 *This procedure does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user of this procedure to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 The vapor monitor badge (s) is desorbed with carbon disulfide and decanted to a crimp top GC vial. The extract is then analyzed quantitatively or semi-quantitatively by GC-FID.

3.0 SIGNIFICANCE AND USE

- 3.1 Organic vapor monitoring is generally conducted for personnel and work areas in order to assess and evaluate the level of vapor exposures and concentrations. The analytical results of the VMBs are converted to a compound specific time-weighted averages and are judged against ACGIH, OSHA, and internal limits.

4.0 APPARATUS

- 4.1 Hewlett-Packard 5890 Gas Chromatograph.
 - 4.1.1 Equipped with an autosampler, flame ionization detector (FID), and ChemStation data handling system, or equivalent system. The gas chromatograph should be set with the following parameters:
Oven Temperature Profile

<u>Initial Temp.</u>	<u>Time</u>	<u>Ramp</u> <u>CE/min.</u>	<u>Final</u> <u>Temp.</u>	<u>Final</u> <u>Time</u>
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35	3.00	12.0	95	0.00	Method M-1
		20.0	200	0.00	
		10.0	250	5.58	

Detector and Injection Port Temperatures

<u>Inject. A</u>	<u>Inject. B</u>	<u>Detector A</u> <u>FID</u>	<u>Detector B</u> <u>ECD</u>
250	250	275	300

Injection Volumes

<u>FID</u>	<u>ECD</u>
1 ul	1 ul

4.1.2 Attenuation Setting: This setting should be set in order to obtain 50 - 75% peak deflection for a standard of 100 ppm toluene. The typical setting for this instrumentation is 2E5.

4.1.3 Capillary GC Column: The column should be one of the following:

- J&W Scientific, 30m x 0.53mm fused silica with 5um DB-1 film thickness.
- Supelco, 60m x 0.75mm glass with 1um SPB-1 film thickness.

4.2 Hewlett-Packard 5890 Gas Chromatograph/5971 Mass Selective Detector.

4.2.1 Equipped with cool on-column injection port and ChemStation data handling system, or equivalent. Recommended system parameters are as follows:

Oven Temperature Profile

<u>Initial Temp.</u>	<u>Time</u>	<u>Ramp</u> <u>CE/min.</u>	<u>Final</u> <u>Temp.</u>	<u>Final</u> <u>Time</u>	<u>Total</u> <u>Time</u>
30	6.00	5.00	100	4.00	24.00
		15.0	200	4.00	34.67
		20.0	280	26.00	64.67
		20.0	300	4.33	70.00

Scan Parameters

<u>Start</u> <u>Time</u>	<u>Low</u> <u>Mass</u>	<u>High</u> <u>Mass</u>	<u>Scan</u> <u>Threshold</u>	<u>a/d Samples</u> <u>(2^N)</u>	<u>Scans per</u> <u>Second</u>	
	0.01	20.0	150.0	500	3	1.65

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					Method M-1
30.00	20.0	250.0	500	2	1.86
50.00	28.0	425.0	500	1	2.16

4.2.2 Capillary GC Column:
J&W Scientific, 60m x 0.25mm fused silica with 0.25um DB-1 film thickness.

5.0 REAGENTS

- 5.1 Purity of Reagents - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 5.2 Organic Vapor Monitor Badges - 3M OV-3500. Badges must be used prior to manufacturer specified expiration date.
- 5.3 Carbon disulfide, CS₂. Must be low benzene grade. This typically is defined as <1 ppm. If this grade is not available, it may be necessary to purify the CS₂ by reflux distillation.

6.0 INTERFERENCES AND LIMITATIONS

- 6.1 This procedure is generally limited to the determination of volatile and some semivolatile organic compounds as limited by the VMB sampling.
- 6.2 GC-FID:
- 6.2.1 Coelution of compounds can occur. The user should be mindful of peak shape irregularities, shoulders, etc. This is particularly true when performing VMB analyses. Applying Sytech Analytical Method GC-4 can be useful in clarifying possible coelutions. If GC-4 is used, it is essential that a small quantity of the original extract be reserved in case a re-analysis is necessary.
- 6.2.2 Ammonia, ethylene oxide, formaldehyde, CO₂, H₂S, isocyanates, methane, ethane, propane, methanol, methyl chloride, methyl, dimethyl, and trimethylamines have insufficient sorbent interactions and are not expected to be present in VMB extracts.
- 6.2.3 Methylene chloride and possibly other low molecular weight compounds that have limited adsorption may be present in the VMB extract, but may be under-represented.

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- 6.2.4 Special attention will need to be given to the area around CS₂ in order to detect coeluting or masked analyte peaks. The CS₂ peak on VMBs should be compared to that of the blank to assess peak shape and area differences.

6.3 GC/MS:

- 6.3.1 Some low boiling compounds may show a lower than normal response.
- 6.3.2 Compounds eluting near the solvent peak may not be visible on the Total Ion Chromatogram. Because compounds are extracted with CS₂, there is little latitude for the use of other appropriate solvent. It may be useful to more narrowly define the solvent peak time window.
- 6.3.3 The background ions from the carrier solvent and/or capillary column liquid phase may need to be subtracted from the peak of interest's spectrum prior to performing spectral matching or interpretation.

7.0 SAMPLE PREPARATION

7.1 Vapor Monitor Badge.

- 7.1.1 Following air sampling with VMBs, the diffusion film is removed and is replaced with a translucent plastic dome cover that seals the adsorbent from the outside atmosphere. Make a note if any type of "splash" or other irregularity is present on the badge.
- 7.1.2 Properly sealed VMBs can be kept at ambient (approximately 25EC) for 30 days. If they are not processed within this time, they should be stored under refrigeration.
- 7.1.3 The VMB dome cover has a center and side plugged opening. Through the center opening, deposit 1.5 ml CS₂ by pipet or gas tight syringe.
- 7.1.4 Reseal the center opening, agitate the VMB to evenly distribute the CS₂ and allow to sit for 30 minutes. It is advisable to re-agitate the VMB during this 30-minute period.
- 7.1.5 While the VMB is desorbing, prepare the 1.5 ml crimp-top GC vials by arranging in a vial rack and labeling each vial with the control number from the back of each VMB. It is also advisable to prepare the necessary pipettes for the transfer of the CS₂ from the VMB to the GC vial.
- 7.1.6 After the 30-minute time period, transfer the CS₂ from the VMBs to their respective GC vials. A separate pipette must be used for each VMB.

Directly after the transfer of each extract, seal the vial by applying a crimp-top seal.

7.1.7 The extract is now ready for analysis.

7.1.8 Following analysis, it may be necessary to recap the vials to prevent evaporation of the extract.

8.0 QUALITY CONTROL

8.1 GC Analysis.

8.1.1 An Analytical Blank must be processed with each batch of badges. A blank for this procedure is considered to be an unexposed, sealed VMB that has been desorbed with the exposed VMBs. If an unexposed VMB is not supplied by the sampler(s), a Reagent Blank of CS₂ should be substituted. Make a note that the reported blank values are reagent blanks. The analytical blank should be analyzed with the extracts of the exposed VMBs.

8.1.2 A Reagent Blank of CS₂ should be analyzed immediately after the last standards calibration run (prior to extracts of VMBs).

8.1.3 A Quality Control Standard must be analyzed with each batch of badges. This is typically a 100 ppm toluene standard, however it is acceptable to use a multi-element, mid-range calibration mix containing toluene. The QC standard should be $\pm 10\%$ (peak area or height) of the calibration standard.

8.1.4 The quality control requirements that are listed in the Maintenance and Optimization Log - Gas Chromatograph are as follows:

<u>Item</u>	<u>Frequency</u>
Run FID Blank	Daily
Run aliphatics Group Mix	Weekly

8.1.5 Verification of detector performance by weekly determination of the correlation coefficient (r) using a blank and three standard concentrations of benzene, or equivalent compound.

8.1.6 Instrument and related maintenance items are listed in the Maintenance and Optimization Log.

8.2 GC/MS Analysis.

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- 8.2.1 GC/MS analysis of VMBs is generally qualitative, so QC requirements are not as extensive.
- 8.2.2 The MS must be tuned to perfluorotributylamine (PFTBA) at the start of each operating day. This should be done at an oven temperature of 100EC. The tune criteria is as follows:

<u>Ion m/z</u>	<u>Abundance or Range</u>
69	100
219	54 - 70
502	2 - 5

Typically, m/z 219 and 502 are indicators of the condition of the MS source. When the abundance of these ions begin to rise, it usually indicates that the source is getting dirty. Additionally, the presence of m/z 28 indicates an air leak in the system.

- 8.2.3 Generally, excessive m/z 207, 281, and 355 indicate larger than normal column bleed. When this is observed, it is advisable to cut about 2 - 3 feet of column from the injection port end and reconnect with a new ferrule. Other possible masses from column bleed are m/z 73, 147, 221, 295, and 429.
- 8.2.4 Large abundances of m/z 18, 28, 32, 40, and 44 are indicative of an air leak in the system. Air leaks are most common at the column connections, but may also be in the MS interface. Also when H₂O, O₂, and/or hydrocarbon traps are spent, these ions can be more abundant than normal.
- 8.2.5 Abundances of m/z 170, 262, 354, and 446 indicate the use of improper diffusion pump "oil".
- 8.2.6 The Electron Multiplier Voltage (EM Volts) should be closely monitored. A sudden or gradual rise over time may be an indicative of a PMT problem. This usually requires replacement.

9.0 CALIBRATION AND STANDARDIZATION

9.1 GC Analysis

- 9.1.1 The calibration standards are prepared as a multi-component mixture in CS₂ followed by serial dilution to 3 concentrations of 25, 50 and 100.
- 9.1.2 The components of a typical standard mixture are (in order of elution):

a. isopropanol e. toluene

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- | | |
|---------------------------|-----------------------|
| b. hexane | f. n-butyl acetate |
| c. 1,1,1-trichloroethane | g. methyl amyl ketone |
| d. benzene | h. butyl cellosolve |
| e. methyl isobutyl ketone | |

Compounds should be selected to cover the typical families of compounds seen in waste-derived fuel. It is acceptable to use other compounds as additions or replacements on a permanent or temporary basis.

- 9.1.3 The sequence of serial dilutions is as follows:

10,000 ppm => 1000 ppm => 200 ppm => 100 ppm => 50 ppm => 10 ppm

Following preparation of the calibration standards, discard the unused concentrations.

- 9.1.4 New standard mixtures should be compared against the previous mixtures to screen for gross error only.

- 9.1.5 New standard mixtures should be prepared at least monthly. The mixtures are to be refrigerated.

- 9.1.6 Because evaporation of these mixtures is a problem, it may be necessary to replace the polyseal caps with each new preparation.

10.0 PROCEDURE

- 10.1 Prepare the VMBs as described in 7.0.

- 10.2 The vials should be arranged in the autosampler in the following sequence:

<u>Position</u>	<u>Item</u>
1	Reagent Blank
2	25 ppm Mix
3	50 ppm Mix
4	100 ppm Mix
5	Reagent Blank
6	QC Blank
7	Sample 1
8	Sample 2
.	.
.	QC Standard
.	.
99	.

- 10.3 For large batches of badges, it is useful to run QC Blanks, Reagent Blanks and QC Standards at a greater frequency than specified in 8.0.

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- 10.4 Initiate analysis using the VAPOR program.
- 10.5 If excessive noise or contamination is observed in the initial Reagent Blank, it may be necessary to "bake-out" the GC system at 250EC for about 5 to 30 minutes, depending on level of contamination. Severely contaminated systems may require a complete system cleaning prior to using.

11.0 CALCULATION OR INTERPRETATION OF RESULTS

- 11.1 GC-FID: The determination of the organic composition of the extract is generally accomplished by using some or all of the following techniques:
 - 11.1.1 Matching of peak retention time and shape with known chemical standard or chemical Group Mix chromatograms.
 - 11.1.2 Utilizing relative retention times and patterns of known GC peaks.
 - 11.1.3 Referencing information on chemical composition of the material that was being handled during the monitoring episode.
 - 11.1.4 Utilizing Method GC-4 to remove most oxygen, nitrogen, silicon-bearing compounds, and double-bonded aromatics/aliphatics from the badge extract.
 - 11.1.5 Use of a confirmation column (i.e., Carbowax 20M).
 - 11.1.6 The chromatographic peaks found in the extract are normally measured quantitatively or semi-quantitatively by GC-FID. All are measured by external standard bracketing as is required in the Lotus spreadsheet (see 11.3) for the determination of the time weighted vapor exposure/concentration.
 - 11.1.7 Quantitative measurements are by external standards bracketing with the same chemical as the actual vapor contaminant peak. For example, a peak identified as toluene in the VMB extract would be quantified with 2 concentrations of toluene standards as described in 9.1.2.
 - 11.1.8 Semi-quantitative measurements are by external standards bracketing with a surrogate chemical that is similar to the actual vapor contaminant. For example, a peak identified as isobutyl acetate in the VMB extract would be quantified with 2 concentrations of n-butyl acetate as described in 9.1.2.
 - 11.1.9 Similar semi-quantitative measurements are made for specific blends of chemicals, such as mineral spirits or Stoddard Solvent. For example,

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Stoddard Solvent is composed of straight and branched aliphatics, and can be measured semi-quantitatively by totaling the total peak area or height of the Stoddard Solvent peaks, and comparing that total to 2 concentrations of a representative surrogate (i.e., n-decane or n-hexadecane) that approximately bracket the lowest and highest observed peak(s) in the Stoddard Solvent.

11.1.10 GC-MS analyses: It is recommended that at least 1 badge out of each batch (monitoring episode) receive MS analysis. The individual badge chosen is usually the one that shows the highest and most diverse concentrations of organics.

11.2 GC-MS: Compound identification or classification is usually accomplished by some or all of the following techniques:

11.2.1 Accessing the probability based matching for the NBS43K or TD2K spectral library. The NBS43K library contains over 43,000 reference spectra from numerous sources. The TD2K library contains between 400 - 600 reference spectra and was created from acquired spectra specifically from our 5971 unit.

11.2.2 Matching of peak retention time and shape with known chemical standard or chemical Group Mix chromatograms.

11.2.3 Referencing information on chemical composition of the waste material that was being handled during the monitoring episode.

11.3 The Lotus spreadsheet for entering chromatographic data and calculating the time-weighted exposures contains the following information:

<u>Column*</u>	<u>Item</u>	<u>Column*</u>	<u>Item</u>
1	VMB ID. #	10	Std. Au
2	Sampling Time	11	Std. mass/AU
3	Sampling Temp.	12	Contaminant mass
4	Chemical Name	13	Contaminant Ave. mass
5	Contaminant AU	14	Molecular weight
6	Blank Contamination AU	15	Recovery Efficiency <input type="checkbox"/>
7	Net AU	16	Sampling Rate <input type="checkbox"/>
8	Spec. gravity	17	Contaminant Conc.-mg/m ³
9	Std. Conc.	18	Contaminant Conc.-ppm

* Boldface indicates that this item is automatically calculated.

☐ This information is found in the 3M Analysis Guide (see References).

12.0 PRECISION AND ACCURACY

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12.1 Precision - The precision of this procedure has not been determined.

12.2 Accuracy - The accuracy of this procedure has not been determined.

13.0 REFERENCES

13.1 Sampling/Analysis Guide for Organic Vapor Monitors #3500, Occupational Health and Safety Products Division, St. Paul, MN.

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Method M-2

Standard Procedure for the Determination of Method Detection Limits

1.0 SCOPE

- 1.1 This procedure describes the determination of Method Detection Limits (MDL) applicable to various analytical laboratory tests and measurements.
- 1.2 A minimum of 5 analyses or measurements are required for this procedure.
- 1.3 MDL samples will be run during normal production runs and will not all be analyzed on the same day.

2.0 TERMINOLOGY

- 2.1 *Method Detection Limit* - the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix type containing the analyte.

3.0 SUMMARY OF PROCEDURE

- 3.1 The MDL is determined by multiplying the appropriate t-statistic by the standard deviation obtained from a minimum of five analyses of a matrix spike containing the analyte of interest at a concentration three to five times the estimated MDL. For many analytes, the analyte concentration is selected as the lowest non-zero standard in the calibration curve.

4.0 SIGNIFICANCE AND USE

- 4.1 MDL is typically used as a numerical tool in reporting analyte data that is not detected by the analytical technique being used. Because it is incorrect to report a result of "zero", non-detected results are generally reported as "<MDL" to indicate that the analyte may be present but not at a concentration at or above the MDL.

5.0 PROCEDURE

- 5.1 Estimate the MDL for the analyte of interest. This is usually done by one of two different methods. Each method is described below by example.
 - 1) Example: Estimating the MDL for Cd in an acidic aqueous matrix.
 - a) Analyze the acid blank for Cd. Obtain the results in absorbance units. Serially dilute the low concentration standard (S1) containing Cd to a

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point that is about 2.5 to 5.0 times the absorbance (noise level) of the acid blank. For example:

<u>Element</u>	<u>Average Absorbance</u>	<u>2.5X Absorbance</u>	<u>5.0X Absorbance</u>
Cd	0.0008	0.0020	0.0040

- b) The S1 standard should be diluted until the absorbance readings fall in the area of the 2.5 to 5.0 range (0.002 - 0.004 absorbance units). This concentration of Cd serves as the estimated MDL.

2. Example: Estimating the MDL for the Heptachlor in hexane.

- a) Serial dilute the lowest concentration of Heptachlor until it is at the lowest visible concentration on the chromatogram while retaining a distinct peak shape. For example:

The low concentration Heptachlor standard is at 0.1 mg/L. The standard is serially diluted to concentrations of 0.05 mg/L, 0.025 mg/L, 0.01 mg/L and 0.005 mg/L. Each concentration is analyzed by GC and it is determined that 0.01 mg/L is the lowest concentration that is clearly visible with a distinct peak shape.

- 5.2 Calibrate the instrument for the analyte of interest. For metals, a normal 3 point calibration curve would be required. For organics (FID/ECD), a minimum 3 point curve should be established. This can be done electronically (HP data system, Lotus, etc.) or can be drawn on standard graphing paper as area units vs. concentration.
- 5.3 Analyze the estimated MDL concentration of the analyte of interest. There should be between 5 and 9 replicate analyses. For a metals parameter, this would mean replicate reading of a single aspiration; and other analytes (e.g. organics, chlorine, etc.) this would mean replicate analyses of the solution. For metals select readings to be given in "concentration".
- 5.4 Determine the standard deviation (s) for the analyte.
- 5.5 Calculate the MDL by the formula below. Refer to Table 1 for t-statistic values.

$$MDL = t_{(n-1)}(s)$$

where: s=standard deviation.

t=t-statistic. See Table 1.

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Table 1. Student t Variate ($\alpha=.99$)

<u>Number of Replicates</u>	<u>t-statistic</u>	<u>Number of Replicates</u>	<u>t-statistic</u>
5	3.747	8	2.998
6	3.365	9	2.896
7	3.143		

- 5.6 The calculated MDL from 5.5 must be multiplied by the sample dilution factor that occurs in sample preparation. For example, metals are normally prepared at a 1% sample concentration and therefore the MDL would be multiplied by 100. The dilution from sample preparation is directly related to the MDL.

6.0 REFERENCES

- 6.1 U.S. Environmental Protection Agency, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (3rd Ed., Vol. 1A, Chapter 1).

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Method M-3

Standard Procedure for Field Sampling Bulk Trucks and Railcars

1.0 SCOPE

- 1.1 This procedure describes the process for field sampling of bulk waste-derived fuel from tanker trucks and railcars. This procedure applies only to bulk shipments.
- 1.2 This procedure applies only to liquids.
- 1.3 *This procedure does not purport to address all of the safety considerations associated with its' use. It is the responsibility of the user to use appropriate health and safety measures as specified by the Health and Safety Manager, Site Safety Officer or other source. Specific caution statements and requirements are given in Section 7.0. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 A Coliwasa sampling tube is flushed with the material being sampled by inserting and draining to reduce the possibility of cross-contamination. The sampling tube is then inserted into the material, allowed to fill and the ball valve closed to prevent release of sampled material. The tube is removed, placed over the lab sample container and the ball valve is opened releasing the material into the container. This procedure is then repeated.

3.0 SIGNIFICANCE AND USE

- 3.1 The goal in the lab analysis of received material is to accurately measure physical/chemical parameters. Field sampling is the first important step in the analytical process.

4.0 APPARATUS

- 4.1 Coliwasa Sampler - The sampling tube is usually made of copper or galvanized metal with a manually operated ball valve at the lower end. Other construction materials are acceptable as long as the components pose no risk of sample contamination (e.g. PVC is unacceptable because of potential chlorine contamination). The complete sampler is about 8 feet in length. See Appendix A for a sampler diagram.

5.0 REAGENTS AND MATERIALS

- 5.1 Mineral spirits, naphtha or other suitable solvent may be needed for occasional cleaning of sampler.

6.0 INTERFERENCES AND LIMITATIONS

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- 6.1 To prevent contamination from previous sampling, the rod should be rinsed 1 to 3 times before taking the sample. The rinsing procedure is described in 8.1. If cross-contamination is suspected, the rod should be flushed and cleaned with a solvent rinsate (5.1).
- 6.2 The insertion of the sampler into the liquid to be sampled should be done slowly. As general guidance, the sample rod is to be inserted at a rate of about 1 foot per second, or approximately 10 seconds from top to bottom. Failing to do this may result in a non-representative sample.
- 6.3 Every effort should be made to obtain a representative sample of any solid material on the bottom of the truck or railcar. Depending on the physical properties of the solid material, this can be very difficult. Some types of solid material (e.g. hardness, stickiness, etc.) preclude completely representative sampling.

7.0 QUALITY CONTROL

- 7.1 Our quarterly Quality Control Program includes an intrafacility truck sampling exercise. This exercise is done to detect sampling problems.

8.0 PROCEDURE

- 8.1 Open the ball valve and insert the Coliwasa sampler into the bulk liquid at a rate of 1 foot per second (see 6.2). Remove the sampler from the liquid and allow the liquid in the tube to drain back into the truck or railcar.
- 8.2 Repeat the steps in 8.1 one to two more times.
- 8.3 Slowly insert the sampler into the bulk liquid and allow the tube to fill for 10 seconds. Close the ball valve using the bottom of the truck or railcar to move the position of the ball valve handle. If significant levels of solid material on the bottom of the truck /railcar prevent the closing of the ball valve, use the side of the truck (as close to the bottom as possible) to close the ball valve.
- 8.4 Remove the sampler from the bulk liquid. While pulling out the sampler, use a gloved hand to loosely grip the sampling tube so to clean off the exterior of the sampler. It is acceptable to use rags or other wipers if it is first ascertained that they will not serve as a source on cross-contamination.
Note: The specific glove type specified by the Health & Safety Manager must be worn.
- 8.5 Place the end of the rod over the lab sample container and open the ball valve to release the material in the tube into the container.
- 8.6 It may be necessary to repeat steps 8.3 to 8.5 if the volume of a single core is insufficient.

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- 8.7 If significant material is left on the sampler, it should be cleaned with mineral spirits, or other suitable solvent.

9.0 **MAINTENANCE**

- 9.1 Any abnormality (leaking ball valve, unsecure tube/valve union, etc.) of the sampler should be corrected prior to use.

10.0 **REFERENCES**

- 10.1 U.S. EPA, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd Ed., Vol. II) Chapter 9.

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Method M-4

Standard Procedure for Field Sampling of Drums, Systanks and Roll Off Containers

1.0 SCOPE

- 1.1 This procedure describes the process for field sampling of waste from drums, Systanks and roll offs. This procedure applies only to containerized waste.
- 1.2 This procedure applies to liquids/sludges, solids/sludges and dry solids.
- 1.3 *This procedure does not purport to address all of the safety considerations associated with its use. The standard safety equipment required is an air purifying full face respirator, Nitrile, Neoprene or equivalent gloves and Saranex apron with Saranex sleeves or equivalent. Other protective equipment may be required as specified by the Health and Safety Manager, Site Safety Officer or other source. It is the responsibility of the user to use appropriate health and safety measures as specified by the Health and Safety Manager, Site Safety Manager or other source. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 Liquids/Sludges: A coliwasa sampling tube is flushed with the material being sampled by inserting and draining to reduce the possibility of cross-contamination. The sampling tube is then inserted to depth into the material, allowed to fill and capped/sealed at the top to prevent release of sampled material. The tube is removed, placed over the lab sample container and the material is released into the container. This procedure is described in Section 8.0.

Solids/Sludges: A core sampling rod is inserted to depth into the sample material. The sample rod is removed and the core sample is removed from the rod into the lab sample container. Grab samples should be taken from multiple areas within the waste container if there is significant variance in the waste material or if core samples are not physically possible. This procedure is described in Section 8.0.

Dry Solids: A multi-zone sampler (commonly known as a grain sampler) in the closed position is inserted to depth into the sample material. The outer sheath of the sampler is rotated to open and allowed to fill with sample. The sampler is removed and the inner sheath of the sampler is removed and the sample deposited in the lab sample container. Grab samples should be taken from multiple areas within the waste container if there is significant variance in the waste material or if core samples are not physically possible.

3.0 SIGNIFICANCE AND USE

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- 3.1 The goal in the lab analysis of received material is to accurately measure physical/chemical parameters. Field sampling is the first important step in the analytical process.

4.0 APPARATUS

- 4.1 Coliwasa Sampler - The sampling tube is usually made of copper or galvanized metal. In some cases, it may be necessary to use a sampler made of hardened steel. Other construction materials are acceptable as long as the components pose no risk of sample contamination for the analytes of interest (e.g. PVC should not be used if the material severely attacks the PVC or if low level chlorine analysis is to be performed). The complete sampler is about 5 feet in length. Core samples from solids and sludges can also be taken using a coliwasa with a plunger rod to extrude the sample from the coliwasa.
- 4.2 Grab samples may be taken using a variety of tools as necessary to sample the waste (e.g. scoop, scissors, etc.). Before using alternate tools for sampling it should first be ascertained that the construction materials of the tools do not pose a risk of contamination or a safety hazard.
- 4.3 Multi-zoned Sampler - The sampler is usually made of brass or anodized aluminum and consists of a smaller tube in a larger tube. Rotation of the inner tube opens (for filling) or closes (for sealing) the sample collection zones. This sampler is appropriate for dry powders and other flowable solids.

5.0 REAGENTS AND MATERIALS

- 5.1 Mineral spirits, naphtha or other suitable solvent for occasional cleaning of sampler.

6.0 INTERFERENCES AND LIMITATIONS

6.1 Liquids/sludges

- 6.1.1 To prevent contamination from previous sampling, the sampling device must be rinsed in the material being sampled at least two times before taking the sample. The rinsing procedure is described in Section 8.0.
- 6.1.2 The insertion of the sampling device into the liquid to be sampled should be done slowing, allowing more viscous materials opportunity to enter the sampling device. Failing to do this may result in a non-representative sample. Following insertion of the sampling device, it should stay immersed in the liquid for at least five seconds to allow material adequate time to migrate into the sampler.

6.2 Solids/sludges

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- 6.2.1 Sampling tools should be cleaned by wiping and rinsing with suitable solvent to prevent cross contamination.
- 6.2.2 Every effort should be made to obtain a representative sample of any solid material. Depending on the physical properties of the solid material, this can be difficult. Some types of solid material (e.g. hardness, stickiness, etc.) may preclude complete representative sampling. In some cases, it may be appropriate to apply external force (e.g. hammering) to the sampler in order to penetrate to the depth of the container. The use of external force can only be done when sampling non-flammable/combustible materials or when using non-sparking sampling equipment.

6.3 Dry powders/solids

- 6.3.1 Sampling tools should be cleaned by wiping with a clean cloth or brush. It may be necessary to rinsing with suitable solvent to prevent cross contamination.
- 6.3.2 It is not appropriate to apply external force when using this type of sampler. The sample material must be in a dry and/or flowable.

7.0 **QUALITY CONTROL**

- 7.1 Our quarterly Quality Control Program includes a sampling exercise. This is done to detect sampling problems.

8.0 **PROCEDURE**

8.1 Liquids/Sludges

- 8.1.1 Insert the coliwasa into the container liquid to depth slowly at a rate of approximately 1 foot per second and allow the tube to fill as it is lowered. The time required may vary with viscosity of the materials to be sampled. Remove the coliwasa from the container and allow the material to flow back into the container. This rinse should be repeated twice. Insert the coliwasa a third time, placing a gloved thumb over the open end of the coliwasa to form a seal and remove the coliwasa from the container. Remove the thumb and allow the sample to flow from the coliwasa into lab sample container.
- 8.1.2 If significant material is left on the coliwasa, it should be cleaned with mineral spirits or other suitable solvent.

8.2 Solids/Sludges

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- 8.2.1 The core sampling colliwasa and rod should be cleaned prior to use. A core sample is taken by pushing the colliwasa through the waste to the bottom of the container. It may be appropriate to apply external force (e.g. hammering) to the sampler in order to penetrate to the depth of the container. The use of external force can only be done when sampling non-flammable/combustible materials or when using non-sparking sampling equipment. Remove the colliwasa and use a smaller diameter solid rod to push the sample out of the colliwasa and into the lab sample container.
- 8.2.2 Grab samples are taken by selecting portions from different areas in the container for homogenous appearing materials. For unhomogenous appearing materials a portion should be taken from each of the different appearing materials. Every effort should be used to obtain as representative a sample as possible. Sampling tools needed to remove portions may vary depending upon the physical properties of the material (e.g. scoops, spatulas, Shears, etc.).

8.3 Dry powders/solids

- 8.3.1 With the multi-zoned sampler in the closed position, insert the sampler to depth into the sample material. Rotate the outer sleeve of the sampler to open and allow at least 10 seconds for the sample to flow into the sampler slots. Close the sampler by rotating the outer sleeve and remove. Place the sampler in or over an appropriate sample container, open the sampler slots and deposit into the container.
- 8.3.2 Samples should be taken from multiple areas within the waste container if there is significant variance in the waste material or if core samples are not physically possible.

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9.0 REFERENCES

- 9.1 U.S. EPA, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd Ed., Vol. II) Chapter 9.

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Standard Method for the Toxicity Characteristic Leachate Procedure on Cement Kiln Dust

1.0 SCOPE

- 1.1 The toxicity characteristic leachate procedure (TCLP) is designed to determine the mobility of compounds/elements present and in waste materials.
- 1.2 This method applies only to cement kiln dust (CKD).
- 1.3 This method applies only to inorganic analytes.
- 1.4 This is an extraction and extraction preparation procedure. The applicable analytical methods are S-5, S-6, S-7 and S-8.
- 1.5 *This method may involve hazardous materials, operations or equipment. This method does not purport to address all of the safety considerations associated with its use. It is the responsibility of the user to use good laboratory safety practices. Refer to Systech Health and Safety Guideline: Laboratory Safety for additional information.*

2.0 SUMMARY OF PROCEDURE

- 2.1 A 100 g portion of CKD and 2000 ml of extraction fluid are placed in a polyethylene extraction vessel and are secured in a rotary tumbler. The tumbler is engaged and the samples are allowed to extract for 18 hours (\pm 2 hours). The sample extract is filtered and prepared by microwave acid digestion. The extract is then analyzed.

3.0 SIGNIFICANCE AND USE

- 3.1 The TCLP test is designed to simulate a materials degradation and behavior if placed in a landfill environment over time. TCLP testing is normally performed to test wastes for leachable target components or to verify that a waste material does not exhibit toxic characteristics as defined by 40 CFR 261 (Identification and Listing of Hazardous Waste).
- 3.2 The TCLP extract metals health-based limits are given below.

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Constituent	Limit (mg/L)	Constituent	Limit (mg/L)
Ag	5	Hg	0.2
As	5	Ni	70
Ba	100	Pb	5
Be	0.007	Sb	1
Cd	1	Se	1
Cr	5	Tl	7

4.0 APPARATUS

4.1 Extraction

- 4.1.1 Rotary Tumbler, capable of holding and tumbling end-over-end the required sample vessels at 30 ± 2 rpm.
- 4.1.2 Extraction Sample Bottles, wide-mouth, high-density polyethylene body with screw-type lid, 2 L capacity.
- 4.1.3 Filter Holder. A stainless steel pressurized filtration unit specifically designed for TCLP is the Millipore # YT30142HW (142 mm) and XX1004700 (47 mm). For CKD extracts, an appropriate sized polyethylene or borosilicate glass funnel placed over the collection vessel can be used.
- 4.1.4 Filters: Filters shall be made of borosilicate glass fiber, contain no binder materials and shall have an effective pore size of 0.6 to 0.8 μm . Examples are Millipore #AP40; Whatman #GFF; and Gelman #66256 & 66257. Filters must be acid washed with 1N HNO_3 prior to use.
- 4.1.5 pH meter, ion exchange type. Orion 501, 610, SA720 or equivalent unit. The meter should have the following capabilities:
- Two point calibration.
 - Automatic temperature compensation.
- 4.1.6 Laboratory Balance, capable of weighing to 0.001 g.

4.2 Extract Preparation.

- 4.2.1 CEM 2000 or 2100 microwave digestion unit with built-in pressure and/or temperature controller and automatic turntable, or equivalent unit.

4.2.2 CEM ACV digestion vessels, or equivalent.

5.0 REAGENTS AND MATERIALS

- 5.1 Purity of Materials - Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, all reagents shall conform at a minimum to the specifications of the American Chemical Society (ACS), where such specifications are available.
- 5.2 Purity of Water - Unless otherwise indicated, references to water shall be understood to mean meeting the numerical requirements of Type II water as defined by ASTM D 1193.
- 5.3 Nitric acid solution, 1N, HNO_3 .
- 5.4 Acetic Acid, $\text{CH}_3\text{CH}_2\text{OOH}$.
- 5.5 Extraction Fluid - Dilute 5.7 ml acetic acid with water to a volume of 1 L. When correctly prepared, the pH of this fluid will be 2.88 ± 0.05 .

Note: This extraction fluid should be monitored frequently for impurities. The pH should be checked prior to use to ensure that the fluid is made correctly. If impurities are found or the pH is not within the specification in 5.5, the fluid shall be discarded and fresh extraction fluid prepared.

- 5.6 Volumetric Flask, 2000 ml.

6.0 INTERFERENCES AND LIMITATIONS

- 6.1 All reusable glassware and plasticware should be scrupulously cleaned and acid washed to prevent low level metals contamination.

7.0 SAMPLE

- 7.1 Although CKD is generally homogenous, the sample should be thoroughly mixed by shaking or stirring prior to weighing out the 100 g sub-sample.

8.0 QUALITY CONTROL

- 8.1 Extraction

- 8.1.1 The following quality control measures are to be done with each batch of extracted samples:

1. Extraction Fluid Blank - This is a 2000 ml aliquot of the extraction fluid that has been tumbled along with the samples. It is treated in the same manner as a sample.

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2. Reference Material - This is a material with certified values for Cd and Pb. No reference material currently exists that has all of the metals of interest. The most common CRM used for TCLP is available from Resource Technology Corp., Laramie, WY. (Municipal Incinerator Ash, Cat. #CRM203-225). The sample is certified by the U.S. EPA. This reference material is to be done in duplicate to generate accuracy and precision statistics.

9.0 PROCEDURE

9.1 Extraction

- 9.1.1 Using a weigh boat, weigh-out a 100 g portion of the well mixed CKD sample and add to the extraction sample bottle
- 9.1.2 Using the 2000 ml volumetric flask, fill to volume with extraction fluid and add to the extraction sample bottle.
- 9.1.3 Firmly affix the lid to the top of the extraction sample bottle.
- 9.1.4 Repeat steps 9.1.1 through 9.1.3 for all remaining samples.
- 9.1.5 Place all of the prepared extraction sample bottles in the slots of the rotary tumbler. Engage the rotary tumbler and allow to tumble for about 5 minutes.
- 9.1.6 Disengage the tumbler and release the built-up pressure from each extraction sample bottle by loosening the lid.
- 9.1.7 Firmly re-tighten the lids and engage the tumbler for a time period of 18 hours (+ or - 2 hours). The ambient temperature shall be kept at $23 \pm 2^\circ\text{C}$. It is advisable to repeat the pressure release step after 30 to 60 minutes. If an extraction sample bottle is observed to be leaking, disengage the tumbler; remove the lid; wrap Teflon tape around the bottle threads; re-tighten the lid and engage tumbler.
- 9.1.8 Allow the extraction sample bottles to sit upright and settle for about 15 to 30 minutes.
- 9.1.9 Prepare the filtration apparatus by washing contact parts with 1 N HNO_3 . Insert the filter and wash with 1 N HNO_3 .
- 9.1.10 Pour the sample extraction fluid (directly from the bottle) into the filtering apparatus and allow to gravity feed through the filter. The filtrate should pass directly into the glass or polyethylene sample bottle. A minimum of 200 ml should be collected.

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9.1.11 If the filtered extract is not going to be immediately prepared, acidify the extract with HNO_3 to a pH of < 2 . If precipitation is observed upon the initial addition of HNO_3 to a small aliquot of the extract, then the remaining portion of the extract shall not be acidified and the extract shall be prepared and analyzed as soon as possible. If the extracts are not prepared immediately, acidified extracts should be stored under refrigeration.

9.2 Extraction Preparation

- 9.2.1 Volumetrically transfer 45 ml of the extract directly to the PFA digestion vessel liner.
- 9.2.2 Place the liner with sample in the digestion vessel body and with a pipet unit, or equivalent device, add 5 ml HNO_3 .
- 9.2.3 Place the PFA and polymer pressure controller cap on the vessel body, and hand tighten to achieve a firm fit. Do not overtighten because this can damage the sealing surface and threads.
- 9.2.4 Be sure the pressure relief/rupture membrane fitting houses a new rupture membrane and is tightened to finger-tightness. Do not overtighten because this can damage the rupture membrane and impede its performance.
- 9.2.5 Place the vessel in the microwave turntable. Insert the pressure sensing line from the pressure controller into the pressure cap assembly and tighten to finger-tightness. Be sure the pressure sensing line is completely filled with water prior to inserting line.
- 9.2.6 Repeat steps 9.2.1 through 9.2.4 for additional samples. Cap these vessels with standard cap assemblies. Evenly distribute the digestion vessels in the turntable to ensure even heating of all vessels.
- 9.2.7 The quality control steps in 8.0 are to be followed.
- 9.2.8 The samples are ready for microwave processing. Process the samples by the following program.

For 5 Vessels

<u>STAGE</u>	<u>(1)</u>	<u>(2)</u>	<u>(3)</u>
% Power	55	35	0
PSI	80	100	0
Time (min)	20.00	20.00	10.00

<u>STAGE</u>	<u>(1)</u>	<u>(2)</u>	<u>(3)</u>
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TAP	10.00	10.00	10.00
TEMP °C			
FAN SPEED %	100	100	100

9.2.9 For each additional vessel, increase the power settings in stages 1 and 2 by 5%.

9.2.10 Following the cooling step, the vessels should be cool to the touch. Additional cooling time may be necessary if vessels are still hot. Vent the pressure control vessel in the microwave cavity. Remove the turntable or the individual vessels to a fume hood and vent. Remove the vessel cap assemblies.

9.2.11 Flush the pressure sensing line with water to remove any trace acid.

9.2.12 Quantitatively transfer the digested extract to a clean 50 ml volumetric flask and bring to volume with water.

10.0 PRECISION AND ACCURACY

10.1 Precision - No statement is made about the precision since this procedure does not produce a specific test result.

10.2 Accuracy - No statement is made about the accuracy since this procedure does not produce a specific test result.

11.0 REFERENCES

11.1 40 CFR, Part 266, Appendix VII: Metals - TCLP Extract Concentration Limits.

11.2 U.S. Environmental Protection Agency, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd Ed., Vol. 1A) Method 3051.

11.3 U.S. Environmental Protection Agency, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 3rd Ed., Vol. 1C) Method 1311.

SECTION IV PROCESS INFORMATION

4.1 Waste Co-Processing Using Cement Manufacturing Technology

The Lafarge cement plant is a two-kiln, wet-process plant. The wet process uses water as a slurry medium in which limestone and other minerals are finely ground and then transported to the kiln. The slurry water evaporates as the mineral feedstock migrates down to the hot end of the kiln. Here the feedstock undergoes thermochemical reactions, converting it into cement clinker.

Systech receives prequalified waste materials from regulated hazardous waste generators or marketers. The facility temporarily stores and treats these materials until they can be blended, processed, or used directly in the cement-manufacturing process. All these materials are blended, processed and controlled so that their physical and chemical characteristics are compatible with the material and/or process requirements of cement manufacturing.

All constituents of liquid and semi-solid organic waste materials are destroyed during the energy recovery process. The mineral and metallic constituents in the inorganic wastes are metered into the raw mix and become incorporated into the product.

4.6 Appendix 4 contains the engineering figures and drawings for this section. Figure 4.1 illustrates the layout and location of the major features of the facility. Figure 4.2 presents dimensions of these features. The facility piping layout is shown in Figures 4.3 and 4.4C.

4.1.1 Overview of Waste Management Units

Systech manages the prequalified waste materials in both tank and container systems. The following discussion furnishes a description of these two types of management systems.

The facility uses tank management areas to manage organic liquid hazardous materials. Treatment is done on wastes going into the tank systems by processing the waste streams through a series of grinders. The purpose of this step is to reduce the size of solids that may be contained in the waste stream, making the solids readily suspendable and more amenable to being fed to Lafarge's cement kiln.

The first tank system consists of tanks OL-1 to 4, which were originally constructed and placed into service prior to June 1986 and subsequently replaced in 2011, and tanks OL-5 and 6, which were replaced with new tanks in 1997. The second system consists of existing tank OL-7, which was constructed in 1986 and

subsequently replaced in 2014. Also included in the second system are tanks OL-8 and 9, which were built in 1998, and tanks OL-10 and 11, which have not been built yet. A USEPA Part B Permit under the RCRA was issued for Tanks OL-1 to OL-6. Tanks OL-7 to OL-11 are used to store the waste-derived fuels. Tank assessments for all storage tanks are retained at the facility. These include: Tanks OL1-OL4-2011, Tanks OL5-OL6-2007, Tank OL7-2014, Tank OL8-2009, and Tank OL9-2010.

There are separate areas for managing wastes which are shipped in containers: the container process building, the direct-burn unloading pad and the drop and hook pad. All containers holding ignitable waste are located at least fifty feet from the facility's property line. These areas have been designed to maintain compliance with the applicable federal and state hazardous waste storage regulations.

The container processing building is used to store and, in some instances, treat organic liquids, solids, and sludges. The direct-burn unloading pad is used to store containers, up to and including bulk tanker trucks, in which the contents will be fed directly to the cement kilns without any additional blending or subsequent tank storage. The drop and hook pad is a storage area, separate from the other facility operations, which is designed for the staging and storage of bulk tankers and cargo boxes that contain hazardous waste.

The organic liquids, solids, and sludges received in containers are chemically the same materials as those managed in the tank systems and are compatible with those wastes and storage systems, with the exception of some of the materials that are received that will be directly fed to the kilns via the direct-burn pad. The primary difference is that these materials may be more viscous in nature and often require mixing with lower viscosity solvents in order to make a pumpable liquid fuel.

The following subsections present more details on the tank and container management activities conducted at this facility. Also presented are the engineering details and other specific information which are required to permit these tank and container management systems.

4.2 Introduction to Tank Management Systems

The purpose of this section is to demonstrate how Systech complies with the regulations pertaining to tank management.

	Design of Tanks
	Design/Installation of New Tank Systems or Components
40 CFR 264.192 and OAC 3745-55-92	In accordance with §270.11(d), certification provided by an independent, registered, professional engineer.

	Containment and Detection of Releases
40 CFR 264.193 and OAC 3745-55-93	Section 4.2.2 presents information on secondary containment and leak detection.
	General Operating Requirements
40 CFR 264.194 and OAC 3745-55-94	The Waste Analysis Plan in Section III discusses how incompatibility reactions will be avoided. Spill and overflow prevention are covered in the pertinent discussions on secondary containment for the tank and container management systems.
	Inspections
40 CFR 264.195 and OAC 3745-55-95	The inspection schedules are covered in detail in Section V, Procedures to Prevent Hazards.
	Response to Leaks or Spills/Disposition of Leaking or Unfit Tanks
40 CFR 264.196 and OAC 3745-55-96	In the event of a leaking or damaged tank system, Systech will follow all of the appropriate requirements set forth in §264.196 for repairing and returning the tank systems to service.
	Closure and Post-Closure Care
40 CFR 264.197 and OAC 3745-55-97	This topic is discussed in detail in Section VIII, Closure Plan.
	Special Requirements for Ignitable or Reactive Wastes
40 CFR 264.198 and OAC 3745-55-98	This discussion can be found in Section V, Procedures to Prevent Hazards.
	Special Requirements for Incompatible Wastes
40 CFR 264.199 and OAC 3745-55-99	These requirements are also discussed in Section V, Procedures to Prevent Hazards.

Table 4.1
Tank Systems Design Summary

Tank ID#	Tank Volume: gallons	Dimensions d x h in ft.	Thickness(in inches) w, b, t	Construction Materials	Waste Types
OL-1	25,000	12x30	3/8,*,3/8	Mild Steel	OL
OL-2	25,000	12x30	3/8,*,3/8	Mild Steel	OL
OL-3	25,000	12x30	3/8,*,3/8	Mild Steel	OL
OL-4	25,000	12x30	3/8,*,3/8	Mild Steel	OL
OL-5	30,000	12x35	3/16,1/2,1/4	Mild Steel	OL
OL-6	30,000	12x35	3/16,1/2,1/4	Mild Steel	OL
OL-7	150,000	30x30	1/2,+,1/2	Mild Steel	OL
OL-8	150,000	30x30	**,+,1/4	Mild Steel	OL

OL-9	150,000	30x30	**,+,1/4	Mild Steel	OL
OL-10	150,000	30x30	1/4,+,1/4	Mild Steel	OL
OL-11	150,000	30x30	1/4,1/2,1/4	Mild Steel	OL

- * Tanks 1-4, Bottom thickness (primary 3/8", secondary 1/4")
- **Tanks 8 & 9, Wall thickness varies from 1/2" at bottom to 1/4" at top ring
- + Tanks 7-9, Bottom thickness (primary 1/2" secondary 1/4")

4.2.1 Management of Tank Systems

All tank systems and ancillary system components at the facility will not be in routine contact with soil or water. Rust-preventative paints have been or will be applied to all exterior metal tank system surfaces to prevent rusting from atmospheric exposure. The materials of construction for the various tank systems have been selected specifically to be compatible with the wastes to be stored or processed in those systems. All ancillary equipment (e.g. pumps, gaskets, seals etc.) are selected per manufacturer specifications to be compatible with the wastes they will encounter.

Table 4.1 lists the materials of construction for all of the tanks at the facility and the types of waste that would be stored or processed. Only compatible wastes will be stored in mild steel tanks. Waste stream compatibility with tank systems will be verified on a case-by-case basis during the qualification analysis.

As required by 40 CFR 264.192(b) and OAC 3745-55-92(B), Systech will ensure that proper handling procedures are adhered to in order to prevent damage to the system as it is being installed. As a general provision of the installation contract, the contractor will be required to provide the certification of a qualified inspector or professional engineer, indicating that the tank systems have been inspected, tested and verified suitable for their intended use, in accordance with 40 CFR 264.192(g) and OAC 3745-55-92(G). This certification will be kept on file at the facility.

As a means of checking erosion, all metal tanks will be tested for shell thickness using a non-destructive, ultrasonic thickness gauge. Readings will be recorded and updated annually to develop a corrosion history. The rate of tank erosion and corrosion is expected to be less than 0.001 inches per year. The tanks are expected to last at least twenty years.

Tanks OL 1-4 were replaced in 2011. Tank OL 7, was replaced in 2014. Tanks OL 5 and 6 were replaced with new tanks in 1997, major repair work and assessment in 2007. Tanks OL 8-9 were constructed in 1999, with major repairs in 2009 and 2010 respectively.

When tanks OL10 and OL11 are built, Systech will comply with all state and federal requirements for installation.

These items will include:

- an independent, qualified installation inspector or an independent, qualified, registered professional engineer will inspect each new tank system prior to covering, enclosing, or placing the new tank(s) and components in use. The inspection will determine if there is the presence of weld breaks, punctures, scrapes of protective coatings, cracks, corrosion and other structural damage or inadequate construction/installation (and all discrepancies shall be remedied before the tank system is covered, enclosed, or placed in use)
- a description of how the new tank systems or components that are placed underground are backfilled will be provided with a backfill material that is a noncorrosive, porous, homogeneous substance and that is installed so that the backfill is placed completely around the tank and compacted to ensure that the tank and piping are fully and uniformly supported
- a description of how all new tanks and ancillary equipment will be tested for tightness prior to being covered, enclosed, or placed in use
- a description of how ancillary equipment will be supported and protected against physical damage and excessive stress due to settlement, vibration, expansion or contraction
- A statement that the owner or operator will obtain and keep on file at the facility written statements by those persons required to certify the design of the tank system in accordance with the requirements of OAC 3745-55-92 (B) through (F), that attest that the tank system was properly designed and installed and that repairs, pursuant to paragraphs (B) and (D) of OAC Rule 3745-55-92 were performed. These written statements shall also include the certification as required in paragraph (D) of OAC Rule 3745-50-42.

4.2.2 Tank Systems Secondary Containment

Each of the tank systems is equipped with secondary containment that meets the requirements of 40 CFR 264.193 and OAC 3745-55-93. Table 4.2 presents a summary of the dimensions, volumes and effective containment provided for tank systems. The aboveground concrete secondary containment systems are designed to prevent migration of wastes or accumulated liquid out of the system. All concrete

surfaces will be treated or coated to make them impermeable to and compatible with the wastes which will be placed in the tanks. The surface area of the secondary containment system will be prepared and the coatings and sealants will be applied as per manufacturer's specifications. The containment systems have sufficient strength to prevent failure and are inspected on a daily basis to ensure that any leak into the secondary containment facility will be detected within 24 hours.

It can be observed from Table 4.2 that the containment areas are designed to contain both the volume of precipitation which might occur during a major storm (25-year, 24-hour rainfall for Paulding County is 4.6 in) and the volume of waste resulting from a total failure of the largest tank in the containment system. The effective containment volume has also been corrected for the area footprint of the smaller tanks in the system. This area and associated small tank volume is assumed to be unavailable for containment of spilled wastes or precipitation. The containment volume calculations are conservative in that they do not take into account available volumes associated with sloped floors or sumps.

All tank secondary containment systems are sloped to drain to sumps. Collecting precipitation or leaking waste moves to the sump and is automatically or manually pumped from the sump to an appropriate storage tank. For containment or collection systems with manual sumps, routine, daily inspections would detect any spilled or accumulated liquids within 24 hours of any accumulation. Any liquids would be immediately pumped off to an appropriate storage system.

All major pump and valve systems are contained within concrete containment structures. All plumbing systems connecting the various tank systems are aboveground and will be inspected daily for any indications of leaks. They are therefore exempt from the requirements of 40 CFR 264.193(f) and OAC 3745-55-93(F).

Stormwater accumulated in the secondary containment areas of the facility are collected and tested prior to being discharged from the facility. A GC scan is run on the samples to test for organic content to determine its hazardous characteristics and dispose of it with appropriate standards. The organics specifically looked at are the major constituents in the waste fuel which are acetone, methyl ethyl ketone, ethylbenzene, methylene chloride, methyl isobutyl ketone, toluene and xylene. An annual sample is also collected and sent off to an independent laboratory for testing for the same constituents as listed above and also identified in Systech's General Storm Water Permit.

Permitted Burn Tank Area - The permitted containment area of permitted tanks 7,10 and 11 are connected to the containment area of tanks 8 and 9 with only a short wall dividing them. This allows the total area to act as containment for any of these 5 storage tanks. All 5 tanks and foundation pads are subtracted from the effective containment calculation to adequately account for the piping and pumps in the containment area. As shown in the table below, there is 197,040 gallons of containment which exceeds the requirement of the largest tank which is 150,000 gallons.

Table 4.2
Tank System Secondary Containment Structure

Burn Tank Area	Width (ft)	Length (ft)	Height (ft)	Cubic ft	Gallons containment	*Subtract gallons rainwater	Subtract tank area displacement	Effective containment
Tank 7,10,11	50	120	5	30,000	224,416	17,205	84,648	122,563
Tank 8&9 Middle	40	80	4.55	14,560	108,916	9,176	56,432	43,308
Tank 8&9 NW Tri	40	17	4.55	3,094	23,145	1,950	N/A	21,195
Tank 8&9 NE Tri	40	8	4.55	1,456	10,892	918	N/A	9,974
Total Gallons								197,040

*Gallons rainwater is from a 25 year 24-hour rainfall of 4.6 inches.

As currently constructed (9/15/14) Burn Tank Area - The containment area of permitted tank 7 is connected to the containment area of tanks 8 and 9 with only a short wall dividing them. This allows the total area to act as containment for any of these 3 storage tanks. All 3 tanks and foundation pads are subtracted from the effective containment calculation to adequately account for the piping and pumps in the containment area. As shown from the table below, there is 198,215 gallons of containment which exceeds the requirement of the largest tank which is 150,000 gallons.

Burn Tank Area	Width (ft)	Length (ft)	Height (ft)	Cubic ft	Gallons containment	*Subtract gallons rainwater	Subtract tank area displacement	Effective containment
Tank 7	50	88	5	22,000	164,571	12,617	28,216	123,738
Tank 8&9 Middle	40	80	4.55	14,560	108,916	9,176	56,432	43,308
Tank 8&9 NW Tri	40	17	4.55	3,094	23,145	1,950	N/A	21,195
Tank 8&9 NE Tri	40	8	4.55	1,456	10,892	918	N/A	9,974
Total Gallons								198,215

*Gallons rainwater is from a 25 year 24-hour rainfall of 4.6 inches.

Blend Tank Area - The containment area of tanks 1 through 4 are connected to the containment area of tanks 5 and 6 with only a short wall dividing them. This allows the total area to act as containment for any of these six storage tanks. As shown from the table below, there is 38,763 gallons of containment which exceeds the requirement of the largest tank which is 30,000 gallons.

Blend Tank Area	Width (ft)	Length (ft)	Height (ft)	Cubic ft	Gallons containment	*Subtract gallons rainwater	Subtract tank area displacement	Effective containment
Tanks 1-4	24	72	3.5	6048	45,239	4,912	13,893	26,434
Tanks 5-6	24	37	3.0	2664	19,927	2,525	5,073	12,329
Total								38,763 gal

*Gallons rainwater is from a 25 year 24-hour rainfall of 4.6 inches.

Tank assessments for all storage tanks are retained at the facility. These include: Tanks OL1-OL4-2011, Tanks OL5-OL6-2007, Tank OL7-2014, Tank OL8-2009, and Tank OL9-2010.

There are two trenches located on the facility. One trench runs from the Container Building to the tank farm where the six smaller tanks are located. This trench is approximately three to five feet deep and two feet wide. The other trench runs from the blend tank farm to the burn tank farm. Both are covered with steel plates to allow vehicular and pedestrian traffic to cross unimpeded. The trenches are open at both ends. There are two 3" FQW pipes that allow for the movement of FQW between the blend tanks and the container offloading operation or between the blend tanks and the burn tanks. There is also electrical conduit located in each trench. The trenches are open at both ends to allow for inspections. The trenches are also slopped to one end to facility the collection and removal of any liquid. The trenches are also inspected as part of the daily inspection procedure. While there are steel plates over the top of the trenches, there is ample opportunity for inflow and outflow of vapors around the steel plates and the openings on the ends to minimize the collection of flammable vapor in the trench. Given their depth and width, neither trench is considered a confined space.

4.2.3 Bulk Organic Liquids

4.2.3.1 Receiving Procedures for Organic Liquids

Tank trucks delivering bulk organic liquids first stop at the truck sampling area (Figure 4.1), where manifests are checked for completeness and consistency with the anticipated contents of the scheduled shipment. Samples of the truck's contents are taken to the lab for the receiving analysis, as discussed in the Waste Analysis Plan. After sampling, the trucks go to the truck scale for the initial weight determination and then proceed to the truck staging area. All trucks remain in paved areas during sampling and unloading. Once the analysis confirms the contents of the shipment, the trucks are directed to one of the organic liquid unloading areas indicated on Figure 4.1 or, if the waste is to be fed directly to the kiln, they are directed to the direct-burn unload pad.

In certain situations trucks, upon arrival at the facility, may be sent directly to the drop and hook pad, indicated on Figure 4.1, where the trailer will be placed into a specially designated storage area (see **Section 4.3** for further discussion of this area). All trailers that contain hazardous waste that are stored in this area will be sampled within 24 hours of arrival on-site during normal business hours. Trailers arriving either on weekends or holidays will be sampled the following business day. All trailers placed in this area will be included in the facility's RCRA daily inspection and inspected for leaks. The volumes of the hazardous waste being stored in this area will be counted against Systech's permitted volume capacity for container storage.

The contents are then off-loaded into one of the six organic liquid receiving, storage and blending tanks, numbered OL-1-6 or one of the five burn tanks OL 7-11 on Figure 4.1, or fed directly to the kiln from the direct-burn unload pad. The empty trucks will then return to the truck scales for a tare weight, so that the manifest forms and other paperwork, can be completed prior to leaving the facility.

To better facilitate the off-loading process when wastes are unloaded to tanks, a tank truck's cargo section can be agitated to better suspend solids that have settled during transportation. The agitation is accomplished by submerging a dedicated hydraulic powered recirculating pump into the cargo section of the tanker, through the tanker's dome hatch, while the tanker is being off loaded. As shown in Figure 4.8, the truck agitation systems are located at both the front and back unloading areas. Both pumps are suspended from the top of existing fall protection columns.

Systech will visually ensure that the truck agitation device is properly aligned with the tanker's dome hatch when lowering the device into the tanker as shown in Figure 4.38. Systech will capture any drips from the truck agitation device while it is being removed from the tanker. When the device is not in use it will be stored in a container which is capable of both capturing any drips of hazardous waste which were in contact with the agitation device as well as any preventing the accumulation of any precipitation. If the container contains any hazardous waste, it will be labeled with the words "Hazardous Waste" and be covered when not in use. Any hazardous waste accumulated in this container will be removed and managed properly at the end of each period of use. Inspection of the agitator container will be included in the RCRA daily inspection, as defined in Section V of this Part B application. Any liquids observed during the inspection will be removed within 24 hours and managed as a hazardous waste.

Rail car shipments of organic liquids first go to the rail scales. They are then staged on one of the two rail spurs adjacent to the organic storage tanks (tank numbers OL-1 through 6). The contents of the cars are sampled and analyzed, as described in the Waste Analysis Plan, and the results of the analysis are compared to the anticipated contents of the shipment and the manifest descriptions. Once the contents of the shipment are confirmed, the cars are positioned over one of the two rail unloading zones, illustrated on Figure 4.1. The contents are pumped off into one of the seven organic liquid receiving, blending and storage tanks. Figures 4.3 and 4.4B illustrate schematically the major organic system components, ancillary equipment, and the flow of organic wastes from receiving stations to the kiln.

To better facilitate the off-loading process, a rail car can be agitated to better suspend solids that settled during transport. This is accomplished by a rail car agitation system located in this area. The rail agitator system, similar to the truck agitator system, is a hydraulic powered recirculating pump with retractable arms, with agitator blades on each end, that open up when lowered into a rail car. A hydraulic crane is used to lower the rail car agitator through the rail car hatch. Specific details of the rail car agitator can be seen in Figures 4.30, 4.31A, 4.31B and 4.32. As shown in Figure 4.8, the agitation system is located completely inside the concrete off-loading area.

Systech will capture any drips from the rail car agitation device during the removal from the rail car. When not in use, the rail car agitation device will be stored in a container which is capable of ; (1) preventing precipitation from coming into contact with hazardous waste, and; (2) capturing any drips from the agitation device which has come into contact with hazardous waste. If the container contains hazardous waste, it will be labeled with the words "Hazardous Waste" and be covered when it is not used. Any hazardous waste that accumulates in the pan will be removed and managed properly at the end of each period of use. Inspection of the agitator drip pan will be included in the RCRA daily inspection, as defined in Section V of this Part B Application. Any liquids observed during the inspection will be removed within 24 hours and managed as a hazardous waste.

Systech will visually ensure that the rail car agitation device is properly aligned with the rail car when lowering the device into the rail car as shown in Figure 4.30. The agitation device will be clamped and sealed to the rail car manway when operating.

Rail cars containing hazardous waste which arrive on-site during normal facility operating hours will be processed within 24 hours of arrival on-site. Rail cars containing hazardous waste which arrive on-site during weekends or holidays, and therefore may be on-site more than 24 hours, will be staged on the concreted rail car off-loading area as shown in Figure 4.8. Rail cars containing hazardous waste which remain on-site on weekends or holidays will be included in our RCRA daily inspection and inspected for leaks. Any problems will be noted on the inspection form. Rail cars containing hazardous waste which were staged on-site on weekends or holidays will be processed the following working day.

The area surrounding the three OL unloading stations is completely paved with concrete and surrounded with a concrete berm. As illustrated in

Figure 4.4, the two stations which currently exist at the western end of the two rail spurs are provided with an accumulation trench and sump which would provide for removal of any spilled material. Any spilled material recovered from the sump is pumped to a nearby OL storage tank. The rail unloading area secondary containment is discussed in more detail in Section 4.3.3.

Systech has installed a groundwater accumulation sump to more efficiently drain groundwater associated with heavy rains. The construction of the sump is such that ground water is isolated from any potential spills or contained rainwater by having raised sides as well as a top cover. The operation of this sump is covered by Systech's General Stormwater Permit #OHR000005. The location of this sump is shown in Figure 4.8.

For both tank-truck and rail car loads, Systech may utilize a nitrogen system for the off-loading of those wastes in which odors could be a problem. Nitrogen gas will be introduced into the cargo compartment of selected tank-trucks and rail cars during unloading. As shown in Figure 4.8, the nitrogen system is located in the rail off-load area and utilizes either dewars of liquid nitrogen, which will run through a vaporizer system that will bring the nitrogen to a gaseous state, or a back-up bank of cylinders of nitrogen gas.

4.2.3.2 Solids Reduction in Organic Liquids

As illustrated in Figure 4.4, bulk shipments of organic liquids are ground as they are off-loaded from trucks and rail cars into storage tanks. This grinding diminishes the debris and foreign materials which might obstruct the burner nozzle or auxiliary equipment. The grinding reduces the size of solids so they will remain suspended in the agitated tanks and can thus be fired directly as liquid fuels.

The facility typically grinds incoming solids down to <1" particle diameter. This is done by using in-line grinders during the unloading process and the feed from the burn tanks to the kiln. For truck unloading each pad may utilize a primary grinder and a secondary grinder. Though both grinders are in series, the facility could run the process so that only one of the two, or both grinders are used, depending on the solids content of the incoming stream. A bypass may be used for streams that do not have significant solids. The primary grinder, currently being used is a 7-tooth cam cutter, can process the solids from the truck to an average particle size of 2" to 3/4". The secondary grinder, currently being used is a 13-tooth cam cutter, can process solids to an average particle size to 1/8" to 1/4". The rail car unloading area utilizes only one grinder. The one currently being used is a 7-tooth cam cutter, which

processes solids the same as the primary grinder used for unloading trucks.

Waste that is being fed from the facility's burn tanks (OL7-11) to the cement kiln may undergo further grinding, as illustrated in figure 4.4B. The grinders that are currently being used for feed to the cement kiln utilize a plate grinder which uses plates that can process solids down to an average particle size of 6-10 millimeter.

Any residuals separated during the off-loading process will be routinely processed through the container management facility. Occasionally there will be non-processable materials, such as large rags, ball bearings, or nuts and bolts, which must be removed from the system. These residuals will be accumulated in containers, put into the proper storage area, marked with the date accumulation begins, and managed at an approved off-site waste management facility.

4.2.3.3 Organic Tank Systems

Liquid fuels are stored in a system of seven tanks. There are four 25,000 gal tanks OL-1 to 4, two 30,000 gal tanks OL-5 and 6, and five 150,000 gal tanks OL-7-11. The liquid fuel tanks are located west of the Systech laboratory in two separate spill containment areas. USEPA first permitted these tanks for storage in August 1984.

Detailed drawings of the tanks are provided as Figures 4.5(1) and (2). A summary of the tank dimensions, volumes and materials of construction is presented in Table 4.1. All of these tanks are constructed of mild steel, in accordance with API 650 standards. Each tank sits on top of a sheet of checker plate metal which allows for rapid detection of leaks in the bottom of the tank. See Figure 4.5 (1), 4.5 (2) and (4.9A).

The six small tanks are structurally supported on a concrete ring foundation within a spill containment area. The rings are 12" thick and 5' deep, extending above grade approximately 6 in each. A double row of vertical No. 4 steel reinforcing bars (rebars) at 18" center-to-center are used in each ring, as well as double rows of 4 rebars running horizontally at 13" center-to-center. Tanks 5 and 6 are secured to the ring foundations by four 1" diameter anchor bolts imbedded 2' into the concrete. Tanks 1-4 have an additional 6 in concrete cap on the concrete ring foundations. These caps are secured to existing rings by vertical No. 4 steel rebars at 12" center to center 2" into existing foundation and 2" into cap. T-shape water stops are between rings and caps. Caps are reinforced with No. 4 steel rebar on 12" centers

horizontally both ways. Tanks 1-4 are secured to the foundations by six 1.25" diameter anchor bolts imbedded 12" into the concrete. All tanks are equipped with either a 20" or 24" manhole, 2 top vents, a liquid level transmitter, agitator, sample ports, an inlet, an outlet, and spare nozzles.

The output of the level indicating device in each tank is converted to a level indicator in the supplemental fuel laboratory or at the fuel tank farm. The level indicators sound an audible alarm to prevent overfilling. The overfill alarm is set to first sound when the tank reaches 90% of capacity. The overflow alarm sounds again when the tank reaches less than or equal to 95% of its capacity, automatically shutting off the transfer pump(s). Fuel quality waste can also be transferred between tanks to aid management of tank levels. An inventory of the volume added to each tank and consumed as fuel is maintained on a daily basis.

In the event the automatic level indicators are unavailable due to scheduled or un-scheduled maintenance Systech will operate receiving and transferring of waste in the following manner: While transferring fuel between tanks or unloading of truck or rail an operator will monitor the manual level indicators. The tanks will be maintained at volume no greater than 90 % of its volume until automatic interlocks and level alarms are restored.

One operator will be tasked with watching the level indicators to ensure that the 90% levels are not exceeded. A second operator will maintain positive control of the pump switches. Operators will maintain radio contact.

Organic liquid storage tanks OL-8 and OL-9 have been installed according to conditions set forth by Ohio's Hazardous Waste Facility Board (HWFB). Specifically, Systech has performed an Emergency Equipment Assessment conducted by an independent, qualified consultant.

Organic liquid storage tanks OL-10 and OL-11 have been approved by OEPA and the HWFB but have not been constructed. When they are constructed, the following conditions will apply:

- a) Systech will perform an additional Emergency Equipment Assessment and enter into Emergency Agreements with emergency authorities as required by the HWFB condition in the proceeding paragraphs. This will be done at least thirty (30) days prior to the operation of these tanks.
- b) Systech will provide Tank Installation Certifications and "as built drawings" in accordance with OAC Rule 3745-55-92(B) to the director at

least thirty (30) days prior to the operation of these tanks.

c) Systech will submit to the director (by certified mail) documentation establishing Financial Assurance for Closure of the modified portion of the permitted facility in accordance with OAC Rule 3745-55-43 at least 60 days prior to the storage of hazardous waste in these tanks.

4.2.3.4 Emission Control of Tank Systems

The tanks are operated at ambient temperature and pressure. Under normal operating practice, no portion of the vapor from these tanks is going to the atmosphere. Systech has installed a closed vent system on all eleven tanks which is shown in Figure 4.27. The system is designed to vent working and standing (breathing) losses to the kiln or approved backup control device. The control efficiency for the closed vent system is conservatively estimated at 95%.

The VOC collection and control system is designed for safety and reliability. First, it is a closed vent system that contains a central manifold that is connected to each tank through separate flame arresters and detonation checks. Each tank branch line has an isolation valve pressure-vacuum (P-V) vent. The valve permits tank maintenance without taking the VOC control system out of service and the P-V vent protects the tank from over or under pressure in the event of failure of other systems or during isolation from the main line.

The VOC vapors are delivered to the kiln or backup control device area using steel piping. Motive power for vapor flow is material vapor pressure and tank liquid displacement, rather than a separate compressor or similar device. This approach simplifies operation and minimizes the potential for failure. Piping is sized so that the pressure drop through the system is less than the P-V vent relieving pressure when flow to the tanks is at maximum pumping rate.

VOC control is achieved in the kilns where either kiln can be selected as the control device or in the backup control device. Injection into the kiln is through the pulverized coal firing system or through the primary air fan. For safety, mechanical flame arrestors are used at each kiln. The backup system will have a flame arrestor between the control device and the storage tanks. Additionally, when VOC's are being vented to the kiln(s), instrumentation is in place to monitor VOC line pressure, coal mill fan inlet temperature and draft, and hydraulic flame arrestor liquid level. If an out of range condition occurs, the system is switched to the other kiln. If both kilns are out of range,

the system is switched to the backup control device.

The closed vent system and control devices will adhere to proper regulations at all times including downtime and monitoring requirements.

4.2.3.5 Organic Liquids Secondary Containment

Table 4.2 summarizes the secondary containment volumes which have been provided for the organic tank systems. Engineering details of secondary containment for tanks OL 1-6 are presented in Figures 4.8, 4.9 and 4.9(a), 4.10, and 4.11. Details for secondary containment for tanks OL 7-11 are presented in Figures 4.12, 4.13, and 4.14. Details of truck and rail off-loading containment and truck heel removal containment are provided in Figures 4.15 and 4.16, respectively. All concrete containment structures are treated or coated with materials impervious to and compatible with organic solvents, such as epoxy coatings, and provide a containment base which is free of cracks and gaps.

4.2.3.6 Direct Firing of Organic Liquid Fuels

Organic liquid fuels can be pumped directly to the burner on the kiln floor from any one of the eleven receiving, blending and storage tanks as well as directly from containers being processed on the direct-burn unload pad, details of which are in Section 4.3.5.2. Figures 4.17, 4.43, 4.44 and 4.45 show the details of the aboveground piping system through which the fuel will be pumped. The five 150,000 gal tanks (Number OL 7-11) are considered to be the primary burn tanks, with the contents of the other six tanks being directed to the kiln via the larger tanks. In general, this provides for better blending of the waste fuels and produces a more consistent fuel quality. On occasion, direct firing may occur from one of the six receiving tanks if the material received is appropriate for burning without further blending.

4.3 Introduction to Container Management Systems

The purpose of this section is to show how Systech complies with the regulations concerning the management of containers.

	Condition of Containers
40 CFR 264.171 and OAC 3745-55-71	If a container is identified which is not in good condition or which has begun to leak, the hazardous waste will be transferred to a container which is in good condition.
	Compatibility of Wastes with Containers
40 CFR 264.172 and OAC	Systech will ensure that incoming wastes are stored in containers that are

3745-55-72	compatible with their physical and chemical characteristics.
	Management of Containers
40 CFR 264.173 and OAC 3745-55-73	Containers holding hazardous waste will remain closed during storage, except when materials are added or removed. The containers will not be handled or stored in a way which might cause the containers to rupture or leak.
	Inspection of Containers
40 CFR 264.174 and OAC 3745-55-74	Each container storage area will be inspected weekly, as described in Section 5.2.2.
	Secondary Containment
40 CFR 264.175 and OAC 3745-55-75	Details of secondary containment areas for wastes which may contain free liquids are summarized in Table 4.3.
	The containment volumes for the three warehouse bays in the organic container storage area were calculated by multiplying the floor area by the height of the perimeter curbs. Any volume associated with sloped floors or sumps has been intentionally ignored. In all cases more than the required 10 percent of maximum inventory has been provided. All container management areas requiring secondary containment within enclosed buildings have not included corrections for containment of a major storm.
	The containment volume for the rail car storage area was calculated by using the data obtained from plotting the elevations in the subject area and using a computer program to calculate the volume of the secondary containment areas. Corrections have been made to account for a major storm event.
	The containment volume for the direct-burn unload pad was calculated by multiplying the area of the floor of the pad by the average slope of the containment. Corrections have been made to account for a major storm event as well as the contents of a flush tank and nitrogen gas tank.
	The containment volume for each storage area in the drop and hook pad was calculated by multiplying the area of the floor of pad by the average slope of the containment. Corrections have been made to account for a major storm event.
	Special Requirements for Incompatible Wastes
40 CFR 264.176 and OAC 3745-55-76	A discussion of how Systech meets these requirements can be found in Section V, Procedures to Prevent Hazards.
40 CFR 264.177 and OAC 3745-55-77	This subject is covered in Section V, Procedures to Prevent Hazards.

4.3.1 Management of Container Systems

In addition to receiving bulk liquids in tankers and railcars that are unloaded into the tank system, Systech will receive and process the same type of materials in containers, i.e., tankers for direct burn, drums (primarily 55 gallon), and totes (generally around 300 gallons). These containers will typically be held for some period of time in permitted storage areas. Systech will accept any of these types of containers provided they comply with the requirements of 49 CFR, Part 178, Subparts A, B, D, E, and H. All containers will be marked and labeled in accordance with all applicable U.S. EPA and Department of Transportation regulations.

Since there is usually some time lapse between the receipt of these containers and when they can be processed, these containers will be held in one of the three permitted storage areas depending on the type and size of container, i.e., container process building, direct burn pad, or the drop and hook pad. The container processing building is designed not only to allow for storing the drums but also to process the drums. The direct burn pad is designed to hold the tanker while it is being unloaded which may take several hours to complete. The drop and hook pad is designed to be permitted storage to hold several tankers waiting processing at the direct burn pad. Systech decided that it was in the best interest of the customer and the environment to provide an appropriately designed permitted storage area allowing the customer to remove the material from its facility and store it in a safe and secure storage area.

4.3.2 Maximum Container Storage Capacity

Table 4.3 lists the maximum number of pallets and the total storage capacity in gallons that could be safely stored in each area of the container storage building. Table 4.3A lists the maximum storage capacity for the direct-burn unload pad and Table 4.3B lists the maximum storage capacity of each storage area of the drop and hook pad.

The maximum storage capacity for each area in the container storage building was calculated by determining the number of 4' x 4' pallet-sized areas that could be safely arranged in each area. It was assumed that pallets carrying 4 drums or individual portable containers would be stacked two high, that a minimum of four feet of aisle spacing would be maintained between rows of pallets, that eight-foot aisles would be maintained for major passageways, and that every container in storage could be directly accessed for identification and inspection. Since it was also assumed that palletized drums and portable containers could be stored interchangeably in the same areas, the maximum storage capacity was based on one 500-gallon portable container for each pallet in the storage area. The maximum storage capacity for the direct-burn unload pad is the size of the largest container, in this case a tanker truck, could be stored/staged in that area, 6,000 gallons. The maximum storage capacity for each area of the drop and hook pad is based upon the staging of four(4) tanker trucks in each of the two(2) areas for a total volume of 24,000 gallons per area.

Though the total maximum storage capacity for all three(3) areas that manage containers is greater than the amount for container storage in Table 2.1 of **Section II**, the facility is still limited to no more than 228,000 total gallons of container storage at any one time. It should be stressed that some of these maximum capacity assumptions do not reflect how the facility would be operated on a routine daily basis. These assumptions reflect the storage conditions which might arise during annual kiln maintenance programs when routine fuel processing and use might be temporarily

interrupted. During normal operations, neither palleted drums nor portable containers would be routinely stacked, and major aisles would be maintained far in excess of 8 feet. Figures 4.18, 4.19, 4.39 and 4.40 illustrate typical storage layouts during routine operations for the container storage areas.

Table 4.3
Container Management Summary
Container Process Building

	<u>ORGANICS</u>		
	<u>West Bay</u>	<u>Middle Bay</u>	<u>East Bay</u>
Maximum number of 4'x4' pallets	126	240	90
Maximum capacity in gallons (pallets x 500 gal)	63,000	120,000	45,000
<u>Containment Dimensions:</u>			
Length (ft)	90	90	50
Width (ft)	40	75	50
Area (sq ft)	3,600	6,750	2,500
Average depth (ft)	0.5	0.5	0.5
Volume (cu ft)	1,800	3,375	1,250
Volume (gal)	13,464	25,245	9,350
% Containment	21.4%	21.0%	20.8%

Table 4.3A
Container Management Summary
Direct Burn Unload Pad

Maximum container capacity in gallons	6,000
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Containment Dimensions:

Length (ft)	50
Width (ft)	39.5
Area (sq ft)	1,975
Average depth (ft)	0.834
Volume (cu ft)	1,647.15
Volume (gal)	12,320.68

Correction Factors:

25-year, 24 hour storm event (gal)	5,662.95
Flush Tank and Nitrogen Tank volume (gal)	244.98

Effective Containment:

Corrected Volume (gal)	6,412.72
% Containment	107%

Table 4.3B
Container Management Summary
Drop and Hook Pad

	<u>North Lot</u>	<u>South Lot</u>
Maximum number of trailers	4	4
Maximum capacity in gallons (trailers x 6,000 gal)	24,000	24,000
<u>Containment Dimensions:</u>		
Length (ft)	59.34	59.34
Width (ft)	48	48
Area (sq ft)	2,848.32	2,848.32
Average depth (ft)	0.67	0.67
Volume (cu ft)	1,899.83	1,899.83
Volume (gal)	14,210.72	14,210.72
<u>Correction Factor:</u>		
25-year, 24 hour storm event (gal)	8,167.08	8,167.08
<u>Effective Containment:</u>		
Corrected Volume (gal)	6,043.64	6,043.64
% Containment	25.2%	25.2%

4.3.3 Secondary Containment

Storage of containers is only permissible in those areas that meet the regulatory requirements for permitted storage. One of the requirements is that there be sufficient secondary containment in the event of a spill or leak. Figures 4.20, 4.22, and 4.23 illustrate the layout and details of the permitted secondary containment provided in the container processing building. Figures 4.41 and 4.42 illustrate the layout and details for the secondary containment provided for the direct-burn unload pad and the drop and hook pad, respectively. The containment area in all three storage areas is constructed of concrete. The containment must be impervious to prevent the migration of the materials into and through the construction material to avoid a release to the environment. To comply with this requirement, the concrete is made impervious by using an epoxy coating. The specific epoxy coating chosen for the containment areas was partially based on the manufacturer specifications and some compatibility testing to ensure that the epoxy coating can resist the hazardous waste received at the facility. The specific epoxy coating and supporting

specifications are retained at the facility. Whenever the concrete needs to be recoated, usually due to physical wear, the same epoxy coating will be used unless it is no longer available. In which case, a different epoxy coating will be selected again based on the manufacturer's specifications, recommendations, and compatibility testing using a sample of the material received at the facility.

The rail car unloading area and the tanker truck unloading areas are constructed of concrete. These areas are not designed as permitted storage, and due to heavy traffic volume, it is not practical to coat these surfaces with the epoxy coating.

The containment areas are designed with multiple sumps and also coated with an epoxy coating. The concrete floors will be sloped to ensure that leaking containers or spills will be contained. Each of the containment sumps can accommodate ~90 gallons. If this capacity were exceeded due to multiple spills in the containment area, excess materials would flow into an adjacent spill containment area. Any sumps containing spilled materials would be manually drained immediately upon detection.

Storm water is excluded from some of the storage areas by enclosing them within a building. Storm water will be diverted and flow overland to the cement plant process water pond. A major storm event was taken into account when determining the minimum secondary containment capacity for the direct-burn unload pad, drop and hook pad, and the rail unload areas.

4.3.4 Container Receiving Procedures

Systech will accept any container which meets the requirements of 49 CFR, Part 178, Subparts A, B, D, E, and H. All containers will be marked and labeled in accordance with all applicable U.S. EPA and Department of Transportation regulations.

Truckloads of containers first stop at the receiving checkpoint, where the manifests are checked for completeness and consistency with the anticipated contents of the scheduled shipment. The contents of the load are visually inspected, to the extent possible, to check for leaky or damaged containers and to verify that the contents of the load agree with the manifest information. The trucks are then directed to the container unloading docks, the direct-burn unload pad, or the drop and hook pad. The location, layout and details of these unloading facilities are illustrated on Figures 4.1, 4.18, 4.19, 4.39 and 4.40.

As containers are transferred from the trucks to the appropriate container sampling area, each incoming container is inspected to verify its integrity and

adequacy. The contents of leaky or damaged containers will be transferred to an appropriate container, or the damaged container will be placed in an overpack as soon as possible.

The attached labels are checked for proper identification, including the origin, contents and conformance with the accompanying manifest. If inadequacies or discrepancies cannot be effectively resolved, the container will be returned to the generator. The trucks leave the facility when the manifest documents have been completed.

Each container will be given a unique, coded label to aid in tracking its identity, location and progress through the facility. Containers will be sampled and analyzed, as described in the Waste Analysis Plan. Containers which are accepted for processing will be moved to the appropriate staging/storage area to await processing.

4.3.5 Container Processing

4.3.5.1 Container Building

There are two separate container processing areas proposed for emptying the contents of waste shipping containers. Figure 4.19 shows the location of the processing area designed for organic liquids and sludges.

The specific processing requirements depend upon the type of container and upon the physical form of the waste material. Low viscosity, pumpable liquids will simply be pumped off.

It is common to have some non-pumpable, semi-solid organics remaining in the bottom of some containers. These viscous semi-solids can frequently be broken up and dissolved or re-suspended in the fuel solvents by using appropriate mechanical mixing and agitating devices. Once liquefied or suspended, these drum bottom residuals can be pumped out of the drums, through filters and additional size reduction equipment. Industrial dispersers are inserted directly into the container along with low viscosity solvents. The disperser homogenizes the solvent/viscous waste mixture until the contents can be pumped off to a mixing vessel.

Drums containing viscous materials that are not pumpable will have their contents removed using a mechanical device such as an auger. This material will then be sheared, if necessary, and conveyed to the mixing vessels for final processing.

The contents of the mixing vessels are recirculated until in-line grinders have eliminated all sizeable particles. The grinders being used for container processing are similar to the ones used for bulk truck unloading: a primary grinder (currently a 7-tooth cam cutter) which grinds the solids down to an average particle size of 2"-3/4" followed by a secondary grinder (currently a 13-tooth cam cutter) which further grinds the solids to an average particle size of 1/8"-1/4". Like the truck unloading area, the facility may operate none, one, or both grinders in series depending on the solids content of the incoming stream. The contents of these vessels are transferred to one of the OL storage tanks when enough material has been accumulated and/or at the end of each workday.

4.3.5.2 Direct-Burn Unload Pad

Containers of hazardous waste that will be pumped directly from the containers to the kiln will be staged on the direct-burn unload pad, shown in Figures 4.1 and Figure 4.39.

Figure 4.43 illustrates the process that is involved with the direct-burn unload pad. A pump is used to remove hazardous wastes from the container, which are then transported through a 1" stainless steel pipe which runs over a pipe bridge, Figure 4.45, to the kiln. The 1" pipe is further sheathed in a heat traced and insulated 2" carbon steel pipe, which acts as containment for the smaller pipe, see Figure 4.44. In order to prevent the release of any fugitive emissions and/or odors Systech will either empty containers with all top covers closed, in which case a vacuum relief valve will be used to equalize the container's inner pressure, or maintain a nitrogen blanket in the empty headspace of the container.

The average flow rate to the kiln from this process would be on average 8 gallons per minute. After the container was emptied of all hazardous waste, the direct-burn piping system would then be purged with a flush solvent, typically kerosene, which is stored in a tank on the direct-burn unload pad. The amount of flush solvent used would be about 100 gallons per container.

An in-line grinder may be used during the process to reduce the size of any debris or solid materials that might obstruct the piping or the burner nozzle. As with the tank system, Systech typically grinds incoming solids to <1" particle diameter. This is done by using a 7-tooth cam grinder than can process solids down to 2 to 3/4 of an inch in particle diameter.

Any residuals separated during this process will be routinely processed through the container storage building area. Occasionally there will be non-processable materials, such as large rags, ball bearings, or nuts and bolts, which must be removed from the system. These residuals will be accumulated in containers and managed at an approved off-site waste management facility.

4.3.6 Organic Container Management

Organic liquids and sludges are received into the container storage area south of the railroad tracks or at the drop and hook pad, as shown in Figure 4.1. Containers can be received by truck or by rail. Unloading is accomplished using the same dock area for truck or rail delivery. Drums may be managed using a forklift. Samples of container shipments will be collected and analyzed to determine which of the three warehouse areas, shown in Figure 4.18, should be used to store each container. For those containers which are bulk tankers that will be placed in either the direct burn unload pad or in the drop and hook pad, Section 4.3.2 contains the specific management steps.

After analysis and acceptance, organic materials in containers are segregated according to their physical and chemical properties and processing requirements and staged to await processing. The layout of the storage area is detailed in Figures 4.18, 4.39 and 4.40. Figure 4.18 illustrates one possible layout arrangement for containers in the container processing building. (See Section 4.3.2, Maximum Container Storage Capacity.)

Systech has carefully considered safety standards and fire protection codes established for storage of flammable materials, in addition to state and federal regulations. Warehousing of containers of NFPA Class I flammable organic materials will be limited to pile sizes of 5,000 gal in drums and 20,000 gal in containers. Fire walls are used between each of the three warehouses to segregate these storage areas. The NFPA requirements will be observed at all times the management of maximum pile sizes, aisle spacing, and stacking height. The container storage facility conforms to these specifications, and drums of flammable liquids will not be stacked over two high.

The organic container storage processing building will be enclosed to exclude precipitation. All three (3) container areas have been designed to have a concrete base free of cracks or gaps and will be coated to make them impervious to organic waste spills.

4.3.7 Emission Control

All volatile organic compounds (VOCs) generated during the processing activities conducted in the container processing building area are vented to a control device in accordance with the requirements of 40 CFR 264 Subpart CC. The control device is a carbon adsorption canister with an efficiency of 95%. Breakthrough of VOC is monitored each day processing takes place.

The containers that are processed on the direct-burn unload pad are done either under a nitrogen blanket or with the container lid shut, using a vacuum relief valve to prevent the container from collapsing during unloading. This prevents the release of any VOCs from the container during off-loading. All other equipment (pumps, piping, etc) is subject to 40 CFR 264 Subpart BB and is appropriately tagged and monitored for leaks.

4.4. Air Emission from Equipment Leaks

A fugitive emissions detection program has been implemented at Systech in accordance with 40 CFR Part §264, Subpart BB. Subpart BB is applicable to equipment that contains or contacts hazardous wastes with organic concentrations of at least ten (10) percent-by-weight and that are managed in a hazardous waste management unit. Generally, the equipment subject to the requirements of this subpart are valves, pumps, compressors, pressure relief devices, sampling connection systems, open-ended valves or lines, flanges, and other connectors. The FQW within the Systech facility is assumed to contain more than ten (10) percent organics and is in a light liquid or vapor service; therefore, equipment associated with FQW is subject to the Subpart BB requirements. In addition, all FQW-associated equipment subject to the Subpart BB standards is assumed to be in contact with the hazardous waste for more than 300 hours per year.

4.6 Appendix 1 is an example list of the Systech equipment subject to the Leak Detection and Repair Program (LDAR) of Subpart BB. Each piece of equipment at Systech that is subject to Subpart BB is marked with an identification number that corresponds with this list.

All of this equipment may be found associated with FQW unloading, storage and feed operations at the bulk, container, or kiln areas. The property line between the Lafarge and Systech properties forms the basis for determining whether a particular item is considered to belong to Lafarge or Systech and to be included in this list. The table includes the following information:

Area: Whether the component is in the bulk, container, or kiln areas.
Sub Area: The specific area identified, such as container processing or back offloading pad.
Tag ID: The identification number tag for the component.
Description: The specific description for the component.
Equipment Type: The type of unit subject to Subpart BB.
If the tag is difficult or unsafe to monitor:

Changes to this table are maintained in the facility's operating record and permit application modifications will not be made to update this table in the application.

The method of compliance for each type of equipment is discussed as follows:

- Pumps in light liquid service – Each pump and grinder pump is visually inspected weekly for indication of liquids dripping from the seal. Each pump is monitored monthly using Method 21 of 40 CFR 60 Appendix A per the requirements of 40 CFR 264.1063(b).
- Open-ended valves or lines – Each open-ended valve or line is equipped with a cap, blind flange, plug, or second valve, which is in place to seal the opening except during operations requiring waste to flow through the line.
- Valves in light liquid service – Each valve in light liquid service is periodically monitored to detect leaks. An instrument reading of 500 ppm or greater above the background identifies a leak. Valves are monitored monthly until no leaks are detected for two successive months, at which time the valves are monitored the first month of each quarter.
- Flanges and other connectors – These items are monitored within 5 calendar days if evidence of a potential leak is found by visual, audible, olfactory, or other detection methods. The monitoring is conducted using Method 21 of 40 CFR Part 60 Appendix A, and a leak is detected if an instrument reading of 500 ppm or greater above the background is measured.
- Pressure relief devices in light liquid service – These devices are monitored within 5 calendar days if evidence of a potential leak is found by visual, audible, olfactory, or other detection methods. The monitoring is conducted using Method 21 and a leak is detected if an instrument reading of 500 ppm or greater above the background is measured.

Documentation of the required periodic monitoring is conducted by Systech personnel. The results are kept in the Systech Operating Record.

Pursuant to 40 CFR 264.1064(m), Systech has elected to determine compliance with the applicable portions of Subpart BB by performing the required monitoring and inspections in compliance with the relevant provisions of 40 CFR Part 63, Subpart DD, which is also applicable to the FQW waste management units. The documentation of compliance with 40 CFR 63.691, governing air emissions from equipment leaks is maintained in the facility operating record as allowed by 40 CFR 264.1064(m).

4.5 Air Emission Standards for Tanks, Surface Impoundments, and Containers

With certain exceptions, 40 CFR Part 264 Subpart CC is applicable to facilities that treat, store, or dispose of hazardous waste in containers, tanks, or surface impoundments subject to the provisions of 40 CFR Part 264, Subparts I, J, or K, respectively. Systech's FQW storage facility includes containers and tanks subject to the provisions of Subparts I and J, respectively. Systech does not have any surface impoundments.

Systech operates a hazardous waste facility in which FQW is received in containers and after unloading is stored in tanks until used by the adjacent cement plant. The management of the containers is subject to 40 CFR Part 264 Subpart I. The management of FQW in the tanks is subject to 40 CFR Part 264 Subpart J. Both the containers and the tanks are also subject to the requirements of 40 CFR Part 264 Subpart CC. In addition to these requirements, these containers and tanks also are subject to regulations promulgated pursuant to the Clean Air Act (CAA), 40 CFR Part 61, Subpart FF (National Emission Standard for Benzene Waste Operations). Systech's Title V permit conditions B.2.a) and B.2.b) on page 17 of 39 apply these control requirements to tanks and containers, respectively. Pursuant to 40 CFR 264.1080(b)(7), the requirements of Subpart CC do not apply to those tanks and containers otherwise subject to Subpart CC, provided Systech certifies that the tanks and the containers are equipped with and operating with air emissions controls in accordance with an applicable 40 CFR Parts 60, 61, or 63 regulations. As required by 40 CFR 264.1089(j)(1), the most recent certification that Systech complies with the standards of 40 CFR 61.340 *et seq.* governing air emissions from tanks and containers is included as 4.6 Appendix 4.3.

4.6 Appendix 1

Example Subpart BB Tags

Area	Sub Area	Tag ID	Description	Equipment Type	Difficult	Unsafe
BULK	BACK PAD	2601	VLV TOUNLOAD HOSE BACKPAD	VLV	No	No
BULK	BACK PAD	2601A	FLG FOR 2601 VLV	FLG	No	No
BULK	BACK PAD	2601B	FLG FOR 2601 VLV	FLG	No	No
BULK	BACK PAD	2601C	FLG FOR CAMLOK FITTING FOR HOSE	FLG	No	No
BULK	BACK PAD	2601D	FLG FOR CAMLOK FITTING FOR HOSE	FLG	No	No
BULK	BACK PAD	2602	VLV FOR NITROGEN HOOKUP	VLV	No	No
BULK	BACK PAD	2602A	FLG FOR 2602 VLV	FLG	No	No
BULK	BACK PAD	2602B	FLG FOR 2602 VLV	FLG	No	No
BULK	BACK PAD	2602C	CONNECTION TO PIPE FOR 2602 VLV	FLG	No	No
BULK	BACK PAD	2603	VLV FOR INLET GAUGE TOMAG BOX BP	VLV	No	No
BULK	BACK PAD	2603A	FLG FOR 2603 VLV	FLG	No	No
BULK	BACK PAD	2603B	FLG FOR 2603 VLV	FLG	No	No
BULK	BACK PAD	2603C	CONNECTION TO PIPE 2603 VLV	FLG	No	No
BULK	BACK PAD	2603D	FLG FOR COUPLING FOR GAUGE	FLG	No	No
BULK	BACK PAD	2603E	FLG FOR COUPLING FOR GAUGE	FLG	No	No
BULK	BACK PAD	2604A	FLG FOR CROSS INLET TOMAG BOX BP	FLG	No	No
BULK	BACK PAD	2604B	FLG FOR CROSS INLET TOMAG BOX BP	FLG	No	No
BULK	BACK PAD	2605	VLV FOR FLUSH LINE ON BP	VLV	No	No
BULK	BACK PAD	2605A	FLG FOR 2605 VLV	FLG	No	No
BULK	BACK PAD	2605B	FLG FOR 2605 VLV	FLG	No	No
BULK	BACK PAD	2606	INLET VLV TOMAG BOX BP	VLV	No	No
BULK	BACK PAD	2606A	FLG FOR 2606 VLV	FLG	No	No
BULK	BACK PAD	2606B	FLG FOR 2606 VLV	FLG	No	No
BULK	BACK PAD	2607	LID FORMAGNET BOX ON BP	FLG	No	No
BULK	BACK PAD	2607A	BLEEDER VLV ON G BOX BP	VLV	No	No
BULK	BACK PAD	2607A1	FLG FOR 2607A VLV	FLG	No	No
BULK	BACK PAD	2607A2	FLG FOR 2607A VLV	FLG	No	No
BULK	BACK PAD	2607A3	CONNECTION TO PIPE FOR 2607A VLV	FLG	No	No
BULK	BACK PAD	2607B	VLV FOR 2" HOSE ON MAG BOX BP	VLV	No	No

4.6 Appendix 2

Air Emissions Control Certification

Air Emission Control Certification

This is to certify that Systech Environmental Corporation in Paulding, OH, is subject to and in compliance with the Clean Air Act regulations codified under 40 CFR 63, Subpart DD, National Emission Standards for Hazardous Air Pollutants from Off-Site Waste and Recovery Operations.

The following hazardous waste management units are equipped with and operating air emission controls in accordance with the following Subpart DD requirements:

- Bulk FQW containers when present for more than 24-hours with a design capacity of $>0.46 \text{ m}^3$ and in light-material service comply with 40 CFR 63.688(b)(3), which cross-references 40 CFR 63 Subpart PP – National Emission Standards for Containers. Within Subpart PP, 63.923, Standards for Container Level 2 controls are equivalent to the Container Level 2 standards of 40 CFR 264.1086(d). For containers when present for more than 24 hours with a design capacity greater than 0.1 m^3 and less than or equal to 0.46 m^3 will comply with 40 CFR 63.688(b)(1), which cross-references 40 CFR 63 Subpart PP. Container Level 1 controls applicable to these containers in 40 CFR 63.922 are equivalent to the Container Level 1 standards of 40 CFR 264.1086(c).
- FQW tanks (each with a design capacity of greater 151 m^3 and an assumed maximum organic vapor pressure of greater than 5.2 kPa) comply with the Tank Level 2 controls of 40 CFR 63.685(b)(1) and 63.685(d) of 40 CFR 63 Subpart DD. The Tank Level 2 control requirements of 40 CFR 264.1084(d) of Subpart CC are equivalent to the Tank Level 2 control requirements of the referenced Subpart DD standards.
- The closed vent system and control devices associated with the FQW system (venting to the industrial furnace cement kilns or to an off-site regenerated carbon adsorption system) comply with the 40 CFR 63.693 requirements of Subpart DD, which are equivalent to the requirements of 40 CFR 264. 1087 of Subpart BB.

Systech also certifies that it is in compliance with the following requirements of 40 CFR 63

Subpart DD:

- Monitoring requirements of 40 CFR 63.695;
- Inspection requirements of 40 CFR 63.695;
- Recordkeeping requirements of 40 CFR 63.696; and
- Reporting requirements of 40 CFR 63.697.

Through compliance with subpart DD, the § 264 Subpart CC regulations do not apply to the above-listed hazardous waste management units as specified by 40 CFR 264.1080(b)(7).

Signature

Date

David Cheney

President

Printed Name

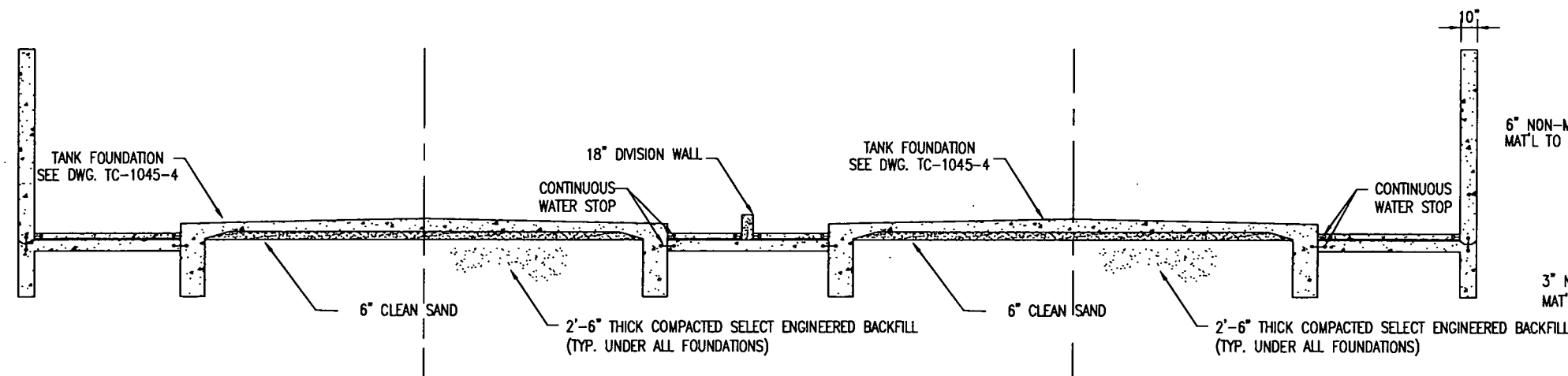
Title

4.6 Appendix 3

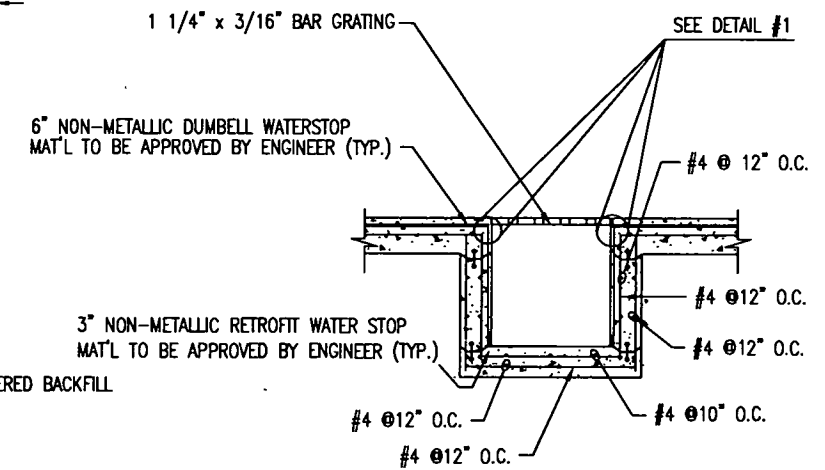
2013 Annual Title V Certification of Compliance

4.6 Appendix 4

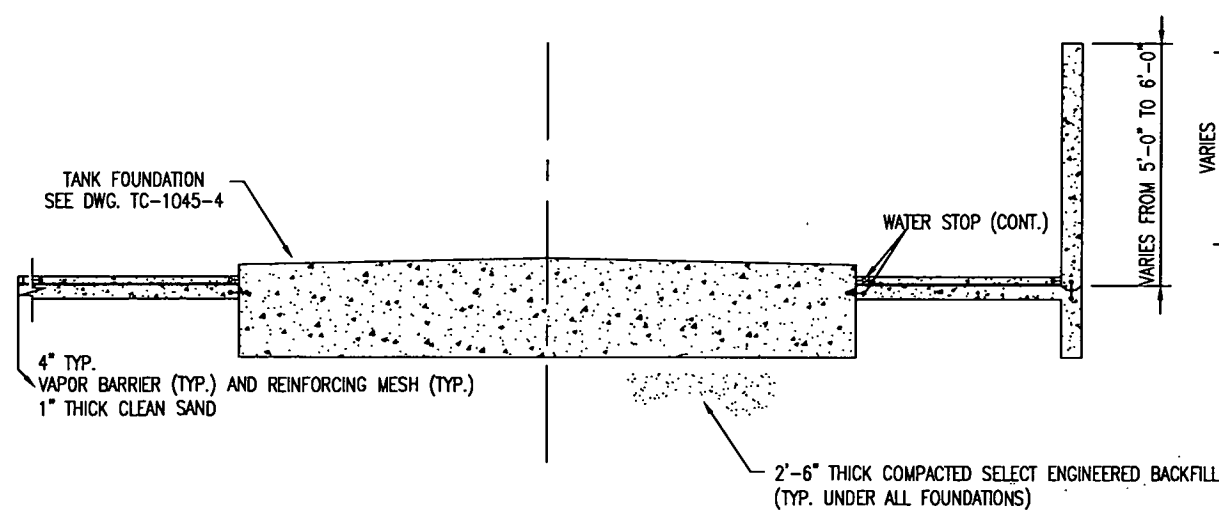
Figures and Drawings



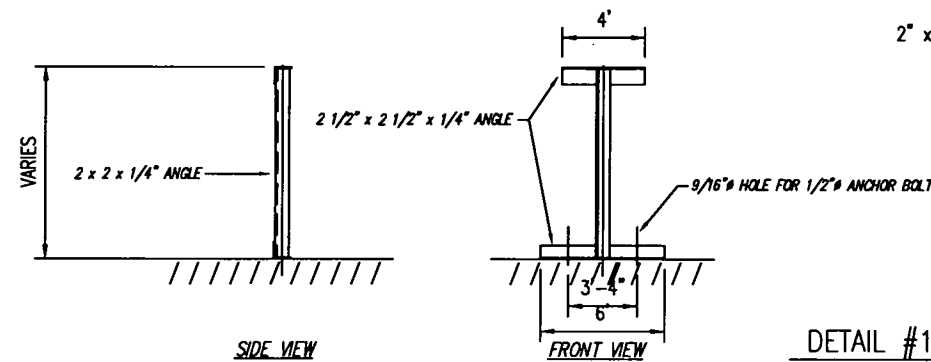
SECTION "A-A" (CONTAINMENT AREA WITH TANK FOUNDATION - LOOKING NORTH)
SCALE: 1/4"=1'-0"



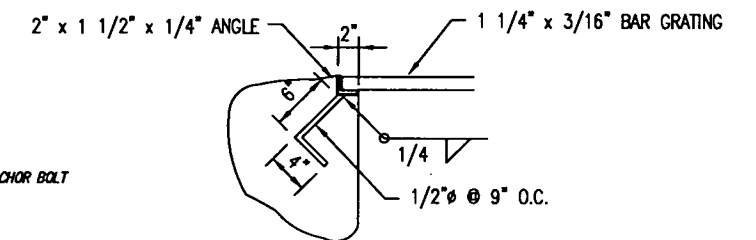
SECTION "C-C" (TYPICAL SUMP DETAIL - LOOKING WEST)
SUMP 2' X 2' X 3' INSIDE DIMENSIONS



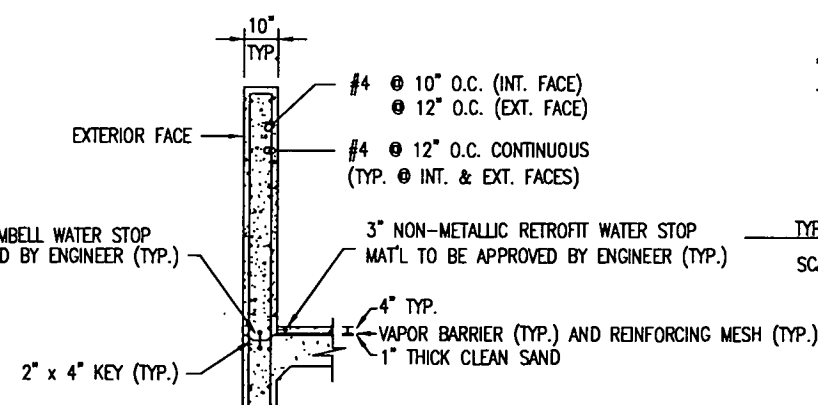
SECTION "B-B" (CONTAINMENT AREA WITH TANK FOUNDATION - LOOKING WEST)
SCALE: 1/4"=1'-0"



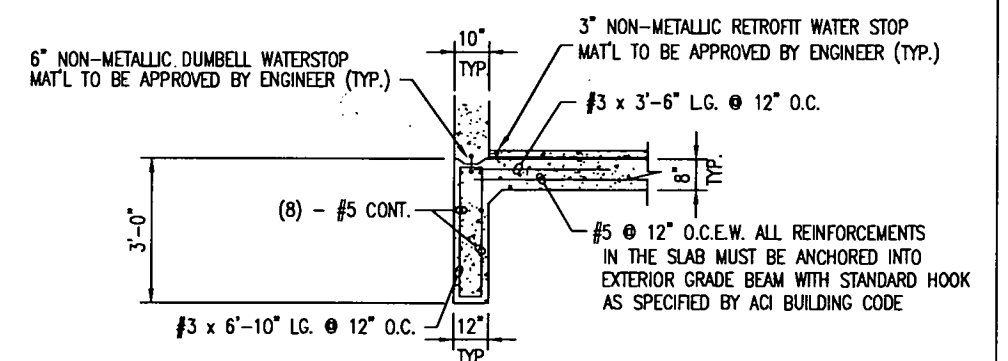
TYPICAL SUPPORT DETAIL



DETAIL #1 (TYPICAL BAR GRATING DETAIL)
SCALE: 1 1/2"=1'-0"

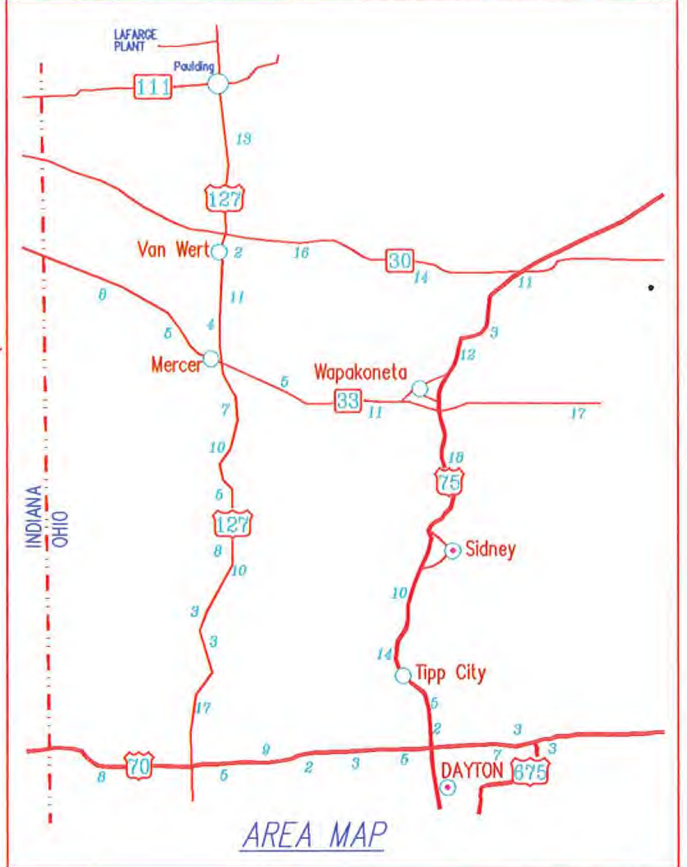
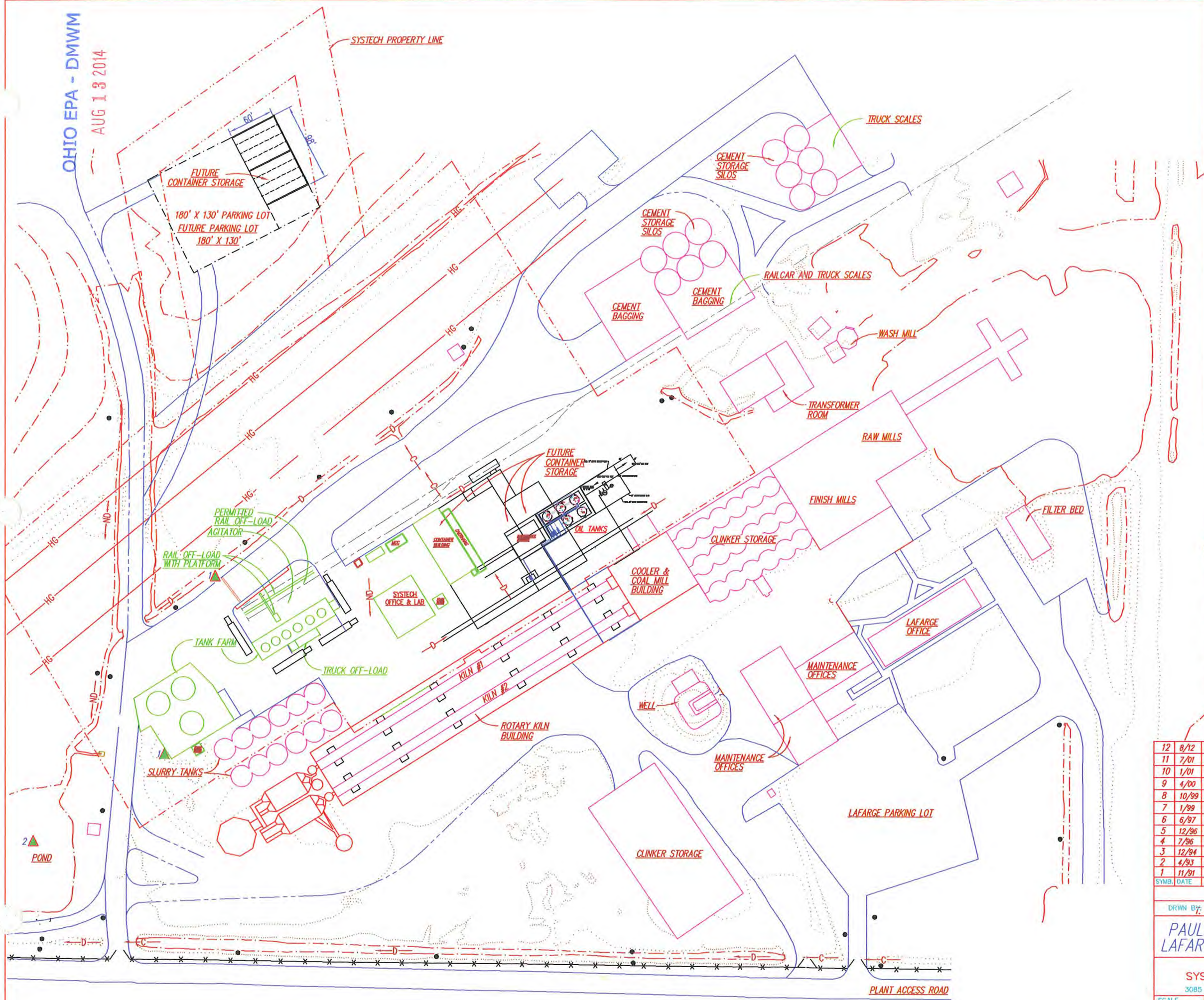


TYPICAL WALL REINFORCEMENT
SCALE: 1/2"=1'-0"



TYPICAL REINFORCEMENT OF 1'-0" X 3'-0" EXTERIOR GRADE BEAM
SCALE: 1/2"=1'-0"

SYMBL	DATE	BY	DESCRIPTION
5	9/14/96	DLD	REVISED LOGO, COLORS AND ADDRESS
4	10/98	NW	CHANGED SUMP DETAIL
3	4/98	NW	ADDED DIVISION WALL
2	1/98	NW	ADDED SUPPORT DETAIL
1	6/97	JW	RELEASED FOR PERMIT
0	9/30/96	TSC	RELEASED FOR PERMIT APPLICATION
CHANGES			
DRWN BY:	T. CABRAL	DATE:	9-10-96
CHKD. BY:		DATE:	
PAULDING CO-PROCESSING FACILITY PROPOSED BURN TANK ADDITIONS FOUNDATION DETAILS FIG. 4.6B			
ENVIRONMENT AND ENERGY SYSTECH ENVIRONMENTAL CORPORATION			
3085 WOODMAN DR. DAYTON, OH 937/643-1240			
SCALE:	AS NOTED	SHEET OF	DWG. NO. 11-05C04
			REV. NO. 6



- LEGEND**
- = PROPERTY LINE
 - - - = GRID MATCHLINE
 - ▭ = CONCRETE PAVING
 - = GRAVEL
 - - - = 10' CONTOURS
 - - - = 2' CONTOURS
 - P - P = PERMIT CONDITIONS
 - M - M = REQUESTED CONDITIONS
 - A - A = APPROVED CAPITAL
 - T - T = TANK FARM
 - C - C = CONTAINER PROCESSING
 - ND = NATURAL DRAINAGE
 - C = STORM CULVERT
 - D = STORM DITCH
 - CW = CITY WATER SUPPLY
 - PW = PROCESS WATER SUPPLY
 - x x x = FENCE
 - = POWER POLE
 - 1 = OUTFALL
 - 2 = RECEIVING WATER (LAFARGE PROCESS WATER POND)

12	8/12	DLD	REVISED FOR PERMIT.
11	7/01	NW	ADDED PARKING LOT AND DIRECT BURN SYSTEM
10	1/01	NW	MODIFIED FOR REPLACEMENT OF TANKS 1-4
9	4/00	NW	MODIFIED AS PER FACILITY COMMENTS
8	10/99	NW	ADDED OIL TANKS AND RAILCAR AGITATOR
7	1/99	NW	ADDED DIMENSIONS
6	6/97	NW	RELEASED FOR PERMIT
5	12/96	BS	RELEASED
4	7/96	BS	RELEASED
3	12/94	TC	ADDED STORM WATER SYSTEM
2	4/93	DK	ADDED TRUCK HEEL REMOVAL
1	11/91	TC	RELEASED AS FINAL FOR DISPLAY

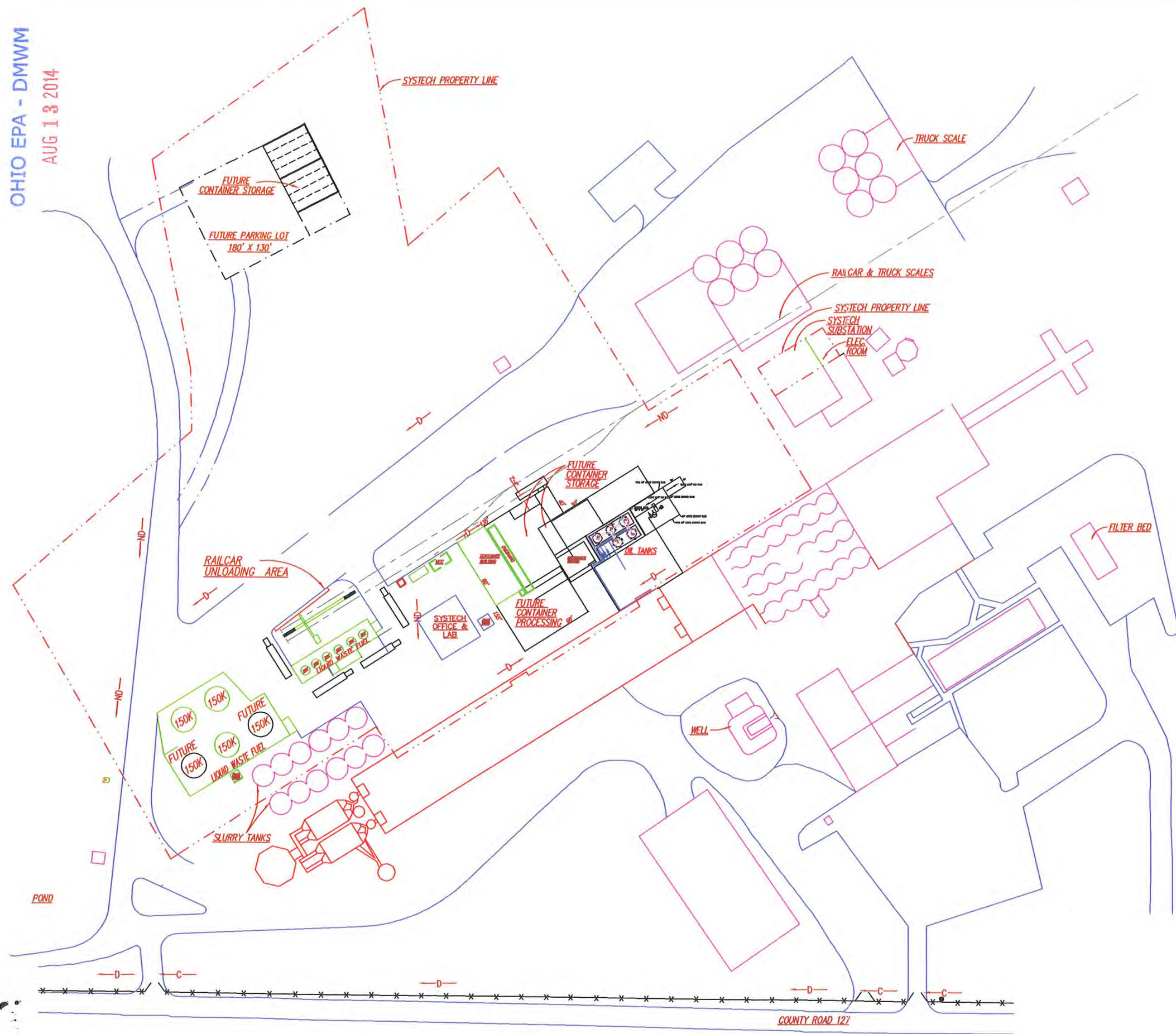
SYMB.	DATE	BY	DESCRIPTION
CHANGES			
DRWN BY	CABRAL	DATE	10/16/91
CHKD. BY		DATE	
PAULDING CO-PROCESSING FACILITY LAFARGE MASTER SITE PLAN - FIG. 4.1			
ENVIRONMENT AND ENERGY			
SYSTECH ENVIRONMENTAL CORPORATION			
3085 WOODMAN DRIVE DAYTON, OHIO 45420 937-643-1240			
SCALE	1"=60'-0"	SHEET	1 OF 1
DWG. NO.	11-00G01	REV. NO.	12

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AUG 13 2014



LEGEND

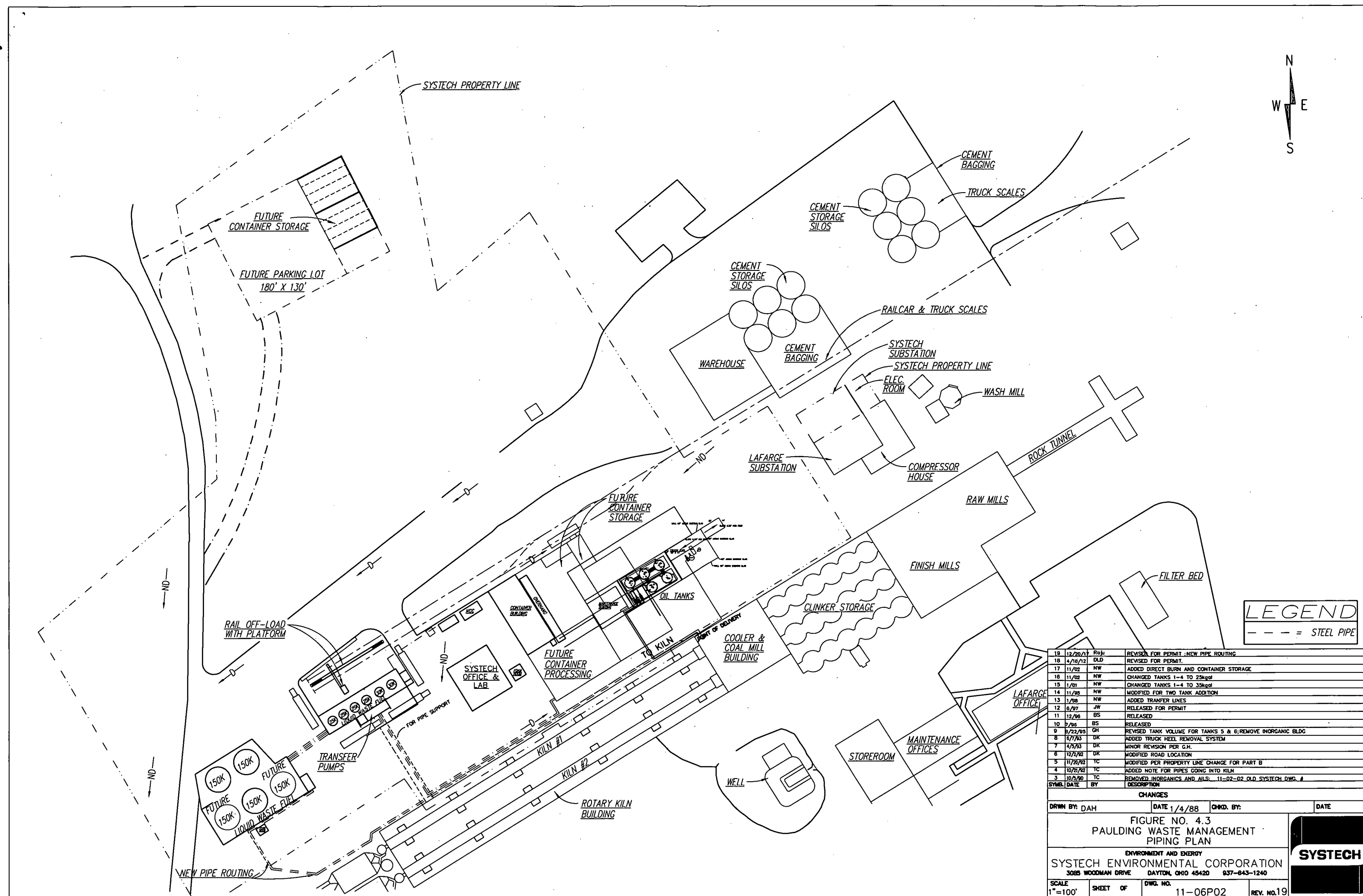
- = PROPERTY LINE
- = GRID MATCHLINE
- = CONCRETE PAVING
- = GRAVEL
- = 10' CONTOURS
- = 2' CONTOURS
- = PERMIT CONDITIONS
- = REQUESTED CONDITIONS
- = APPROVED CAPITAL
- = TANK FARM
- = CONTAINER PROCESSING
- ND = NATURAL DRAINAGE
- C = STORM CULVERT
- D = STORM DITCH
- CW = CITY WATER SUPPLY
- PW = PROCESS WATER SUPPLY
- X X X = FENCE
- = POWER POLE
- 1 = OUTFALL
- 2 = RECEIVING WATER (LAFARGE PROCESS WATER POND)



11	11/18/12	DLD	REVISED FOR PERMIT.
10	11/02	NW	ADDED DIRECT BURN AND CONTAINER STORAGE
9	11/02	NW	CHANGED TANKS 1-4 TO 25kgal
8	11/01	NW	CHANGED TANKS 1-4 TO 35kgal
7	6/97	JW	RELEASED FOR PERMIT
6	12/96	BS	RELEASED
5	7/96	BS	RELEASED
4	8/95	GH	UPDATED TANK VOLUMES FOR TANKS 5 & 6; REMOVED INORGANIC BLDG
3	5/93	DK	ADDED TRUCK WHEEL REMOVAL SYSTEM
SYMB. DATE BY DESCRIPTION			
CHANGES			
DRWN BY: DAH		DATE: 1/4/88	CHKD. BY: DATE:
FIGURE NO. 4.2 PAULDING WASTE MANAGEMENT DIMENSIONAL PLAN			
ENVIRONMENT AND ENERGY			
SYSTECH ENVIRONMENTAL CORPORATION			
3085 WOODMAN DRIVE DAYTON, OHIO 45420 937-643-1240			
SCALE	SHEET	OF	DWG. NO. 11-06G07 REV. NO. 11
1"=50'-0"			OLD DWG# 11-02-03



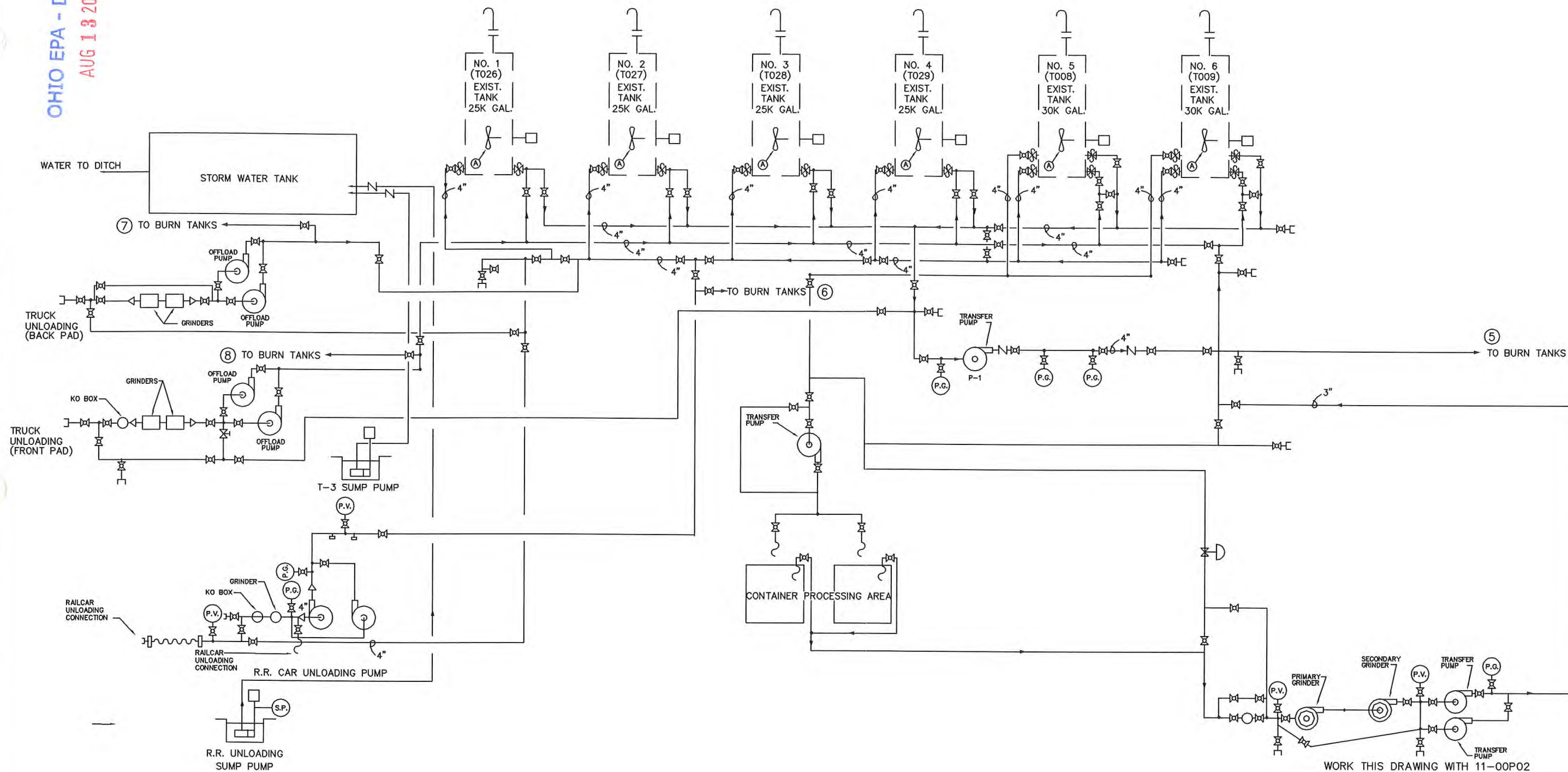
00335



LEGEND
--- = STEEL PIPE

19	12/20/17	Revised	REVISED FOR PERMIT: NEW PIPE ROUTING
18	4/18/12	DLD	REVISED FOR PERMIT.
17	11/02	NW	ADDED DIRECT BURN AND CONTAINER STORAGE
16	11/02	NW	CHANGED TANKS 1-4 TO 25kgal
15	1/01	NW	CHANGED TANKS 1-4 TO 35kgal
14	11/98	NW	MODIFIED FOR TWO TANK ADDITION
13	1/98	NW	ADDED TRANSFER LINES
12	8/97	JW	RELEASED FOR PERMIT
11	12/96	BS	RELEASED
10	7/96	BS	RELEASED
9	8/22/95	GH	REVISED TANK VOLUME FOR TANKS 5 & 6; REMOVE INORGANIC BLDG
8	8/7/93	DK	ADDED TRUCK WHEEL REMOVAL SYSTEM
7	4/5/93	DK	MINOR REVISION PER G.H.
6	12/2/92	DK	MODIFIED ROAD LOCATION
5	11/28/92	TC	MODIFIED PER PROPERTY LINE CHANGE FOR PART B
4	10/21/92	TC	ADDED NOTE FOR PIPES GOING INTO KILN
3	10/5/90	TC	REMOVED INORGANICS AND AILS: 11-02-02 OLD SYSTECH DWG. #
2			
1			
SYMBOL DATE BY DESCRIPTION			
CHANGES			
DRWN BY:	DAH	DATE:	1/4/88
CHKD. BY:		DATE:	
FIGURE NO. 4.3 PAULDING WASTE MANAGEMENT PIPING PLAN			
ENVIRONMENT AND ENERGY SYSTECH ENVIRONMENTAL CORPORATION 3085 WOODMAN DRIVE DAYTON, OHIO 45420 937-843-1240			
SCALE	1"=100'	SHEET OF	DWG. NO. 11-06P02
			REV. NO.19





LEGEND

A	= AGITATOR
P.G.	= PRESSURE GAUGE
P.V.	= PRESSURE / VACUUM GAUGE
⊘	= BALL VALVE
⊘	= GATE VALVE
⊘	= CHECK VALVE
⊘	= PIPELINE DRAIN
⊘	= REDUCER
⊘	= FUSIBLE LINK SAFETY VALVE
⊘	= QUICK DISCONNECT PURGE CONNECTION
⊘	= CONTROL VALVE

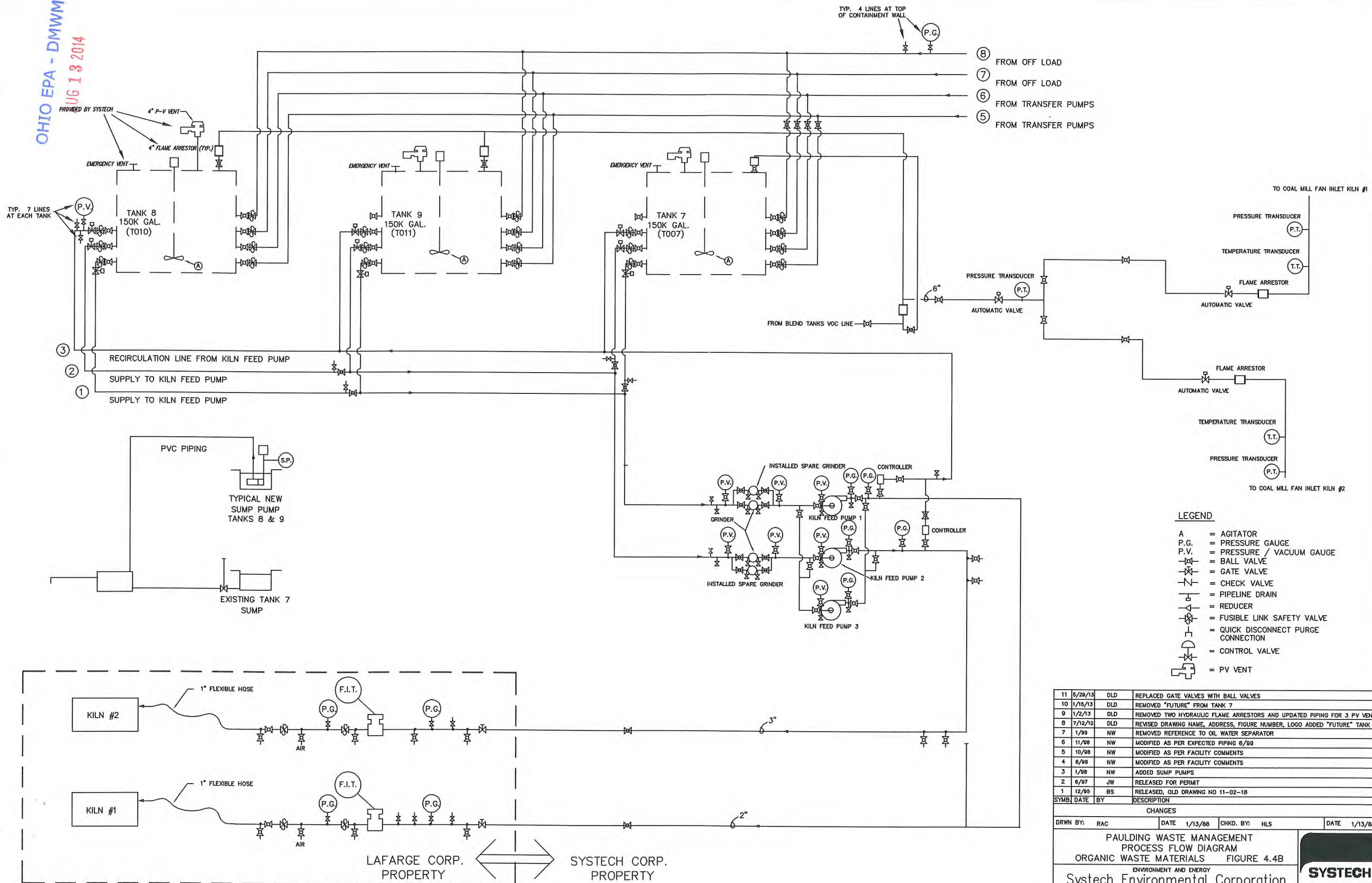
WORK THIS DRAWING WITH 11-00P02

11	9/20/12	DLD	REVISED PIPING IN CONT AREA & REROUTED PIPING FROM TANK 5&6 TO CONT AREA
10	5/3/11	DLD	REVISED PER FACILITY COMMENTS
9	12/02	NW	REVISED PER FACILITY COMMENTS
8	11/02	NW	REVISED TANK SIZE, TANKS 1-4, REVISED PER FACILITY COMMENTS
7	3/01	NW	REVISED TANK SIZE, ORIGINAL DWG NO. WAS 11-00P01
6	6/97	JW	RELEASED FOR PERMIT
5	12/96	BS	RELEASED, ORIGINAL DWG NO. WAS 11-02-18
4	8/22/95	GH	REVISED TANK VOLUME ON TANKS 5 & 6
3	10/3/94	DK	REVISED PER GH REQUEST
2	8/9/94	DK	REVISED PER GH REQUEST
SYMB.	DATE	BY	DESCRIPTION

DRWN BY:	RAC	DATE	1/13/88	CHKD. BY:	HLS	DATE	1/13/88
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PAULDING WASTE MANAGEMENT FIGURE 4.4 PROCESS FLOW DIAGRAM ORGANIC WASTE MATERIALS		ENVIRONMENT AND ENERGY	
Systech Environmental Corporation		3085 WOODMAN DRIVE DAYTON, OHIO 45420 937-643-1240	
SCALE N.T.S.	SHEET 1 OF 1	DWG. NO. 11-06P05	11 REV. NO.

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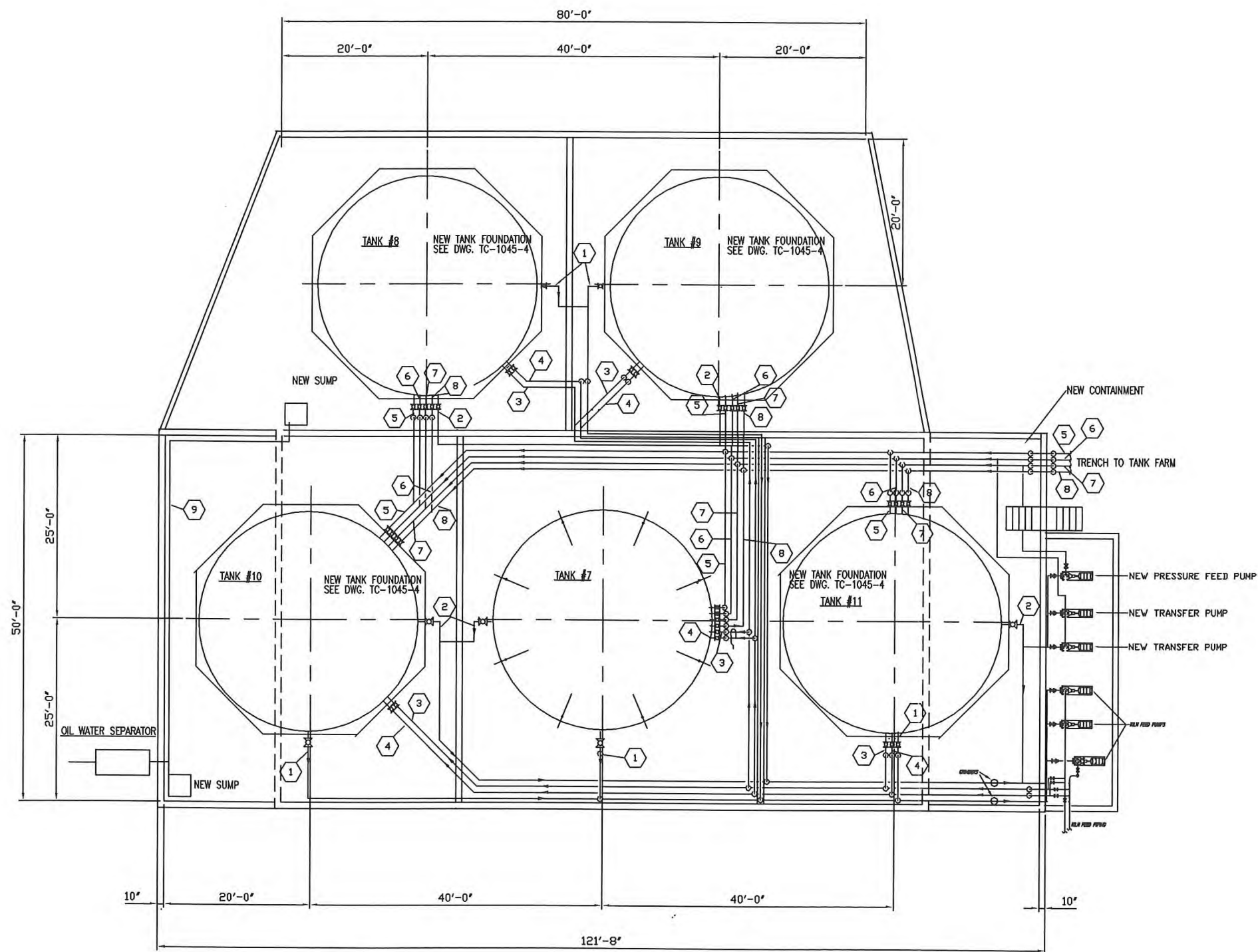


11	5/29/13	DLD	REPLACED GATE VALVES WITH BALL VALVES
10	1/15/13	DLD	REMOVED "FUTURE" FROM TANK 7
9	1/2/13	DLD	REMOVED TWO HYDRAULIC FLAME ARRESTORS AND UPDATED PIPING FOR 3 PV VENTS
8	7/12/12	DLD	REMOVED DRAWING NAME, ADDRESS, FIGURE NUMBER, LOGO ADDED "FUTURE" TANK 7
7	1/99	NW	REMOVED REFERENCE TO OIL WATER SEPARATOR
6	11/98	NW	MODIFIED AS PER EXPECTED PIPING 6/98
5	10/98	NW	MODIFIED AS PER FACILITY COMMENTS
4	8/98	NW	MODIFIED AS PER FACILITY COMMENTS
3	1/98	NW	ADDED SUMP PUMPS
2	8/97	JW	RELEASED FOR PERMIT
1	12/95	BS	RELEASED, OLD DRAWING NO 11-02-1B
SYMB. DATE BY			DESCRIPTION

CHANGES			
DRWN BY:	RAC	DATE	1/13/88
CHKD. BY:	HLS	DATE	1/13/88
PAULDING WASTE MANAGEMENT PROCESS FLOW DIAGRAM ORGANIC WASTE MATERIALS FIGURE 4.4B			
Systech Environmental Corporation 3085 WOODMAN DR. DAYTON, OHIO 45420 937/643-1240			
SCALE	N.T.S.	SHEET 1 OF 1	DWG. NO. 11-00P02
			11 REV. NO.

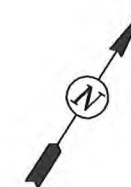
SYSTECH

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AUG 13 2014



PIPING LEGEND:

1. 2" SUPPLY LINE TO KILN FEED PUMP.
2. 2" SUPPLY LINE TO KILN FEED PUMP.
3. 2" RECIRCULATION LINE FROM KILN FEED PUMP.
4. 2" RECIRCULATION LINE FROM KILN FEED PUMP.
5. 4" TRANSFER PIPE FROM SMALL TANKS.
6. 4" TRANSFER PIPE FROM SMALL TANKS.
7. 4" FILL PIPE FROM OFFLOAD AREA.
8. 4" FILL PIPE FROM OFFLOAD AREA.
9. SUMP PUMP LINE TO OIL WATER SEPARATOR



PLAN - GENERAL BURN TANK PIPING ARRANGEMENT

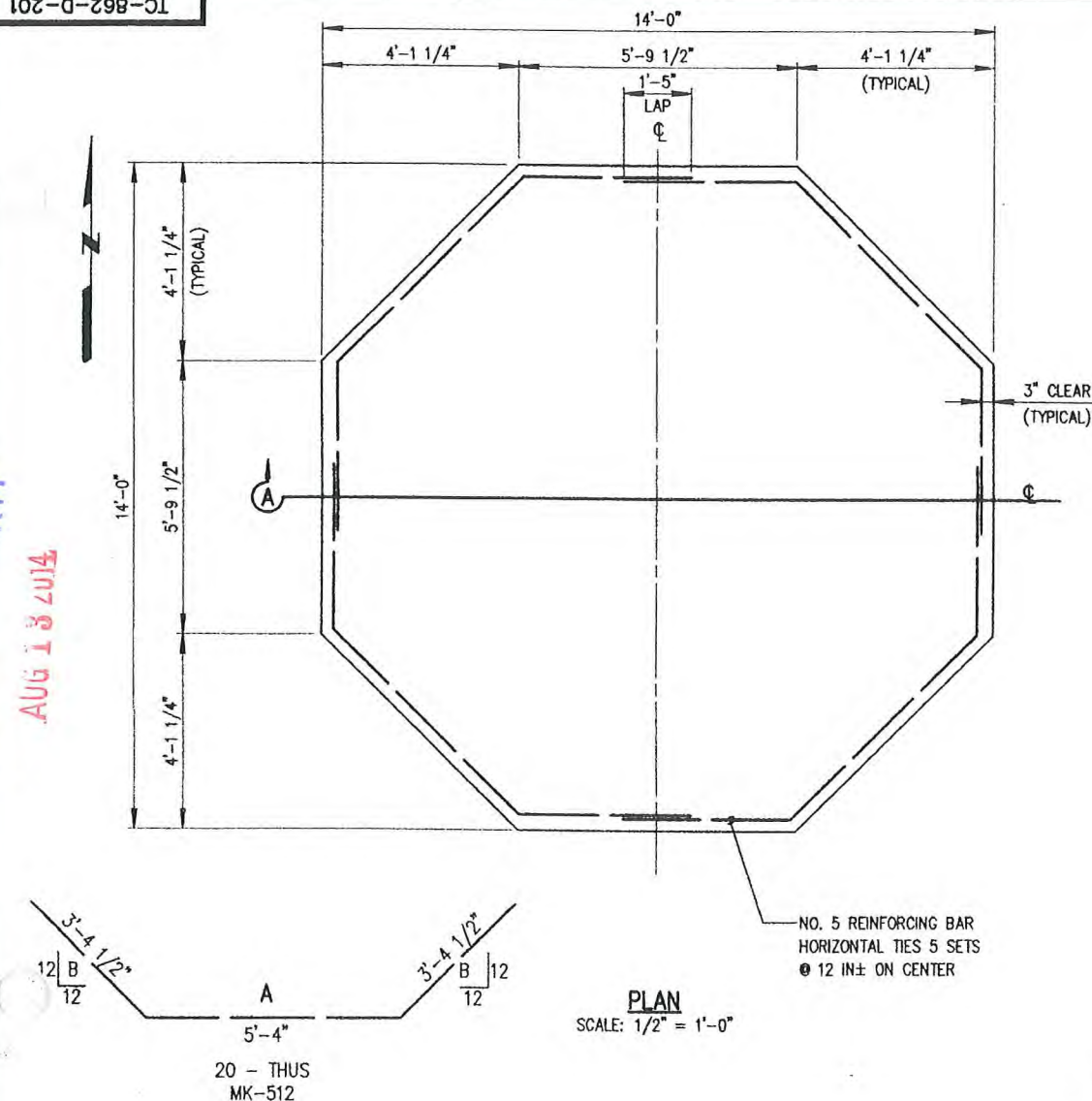
SCALE: 1/8"=1'-0".

5	9/19/12	DLD	UPDATED ADDRESS
4	4/10/98	NW	ADDED DIVISION WALLS
3	1/30/98	NW	ADDED SUMP PUMP PIPING AND GRINDERS
2	5/8/97	NW	REVISED PER FACILITY COMMENTS
1	8/30/96	TSC	RELEASED FOR PERMIT APPLICATION
SYMBL		DATE	BY
DESCRIPTION			
CHANGES			
DRWN BY: T. CABRAL		DATE 9-10-96	CHKD. BY:
			DATE
PAULDING CO-PROCESSING FACILITY PROPOSED BURN TANK ADDITIONS PIPING PLAN FIG. 4.4C			
ENVIRONMENT AND ENERGY SYSTECH ENVIRONMENTAL CORPORATION 3085 WOODMAN DR. DAYTON, OHIO 45420 937/643-1240			
SCALE AS NOTED	SHEET OF	DWG. NO. 11-05P10	REV. NO. 5

SYSTECH

00339

AUG 13 2014

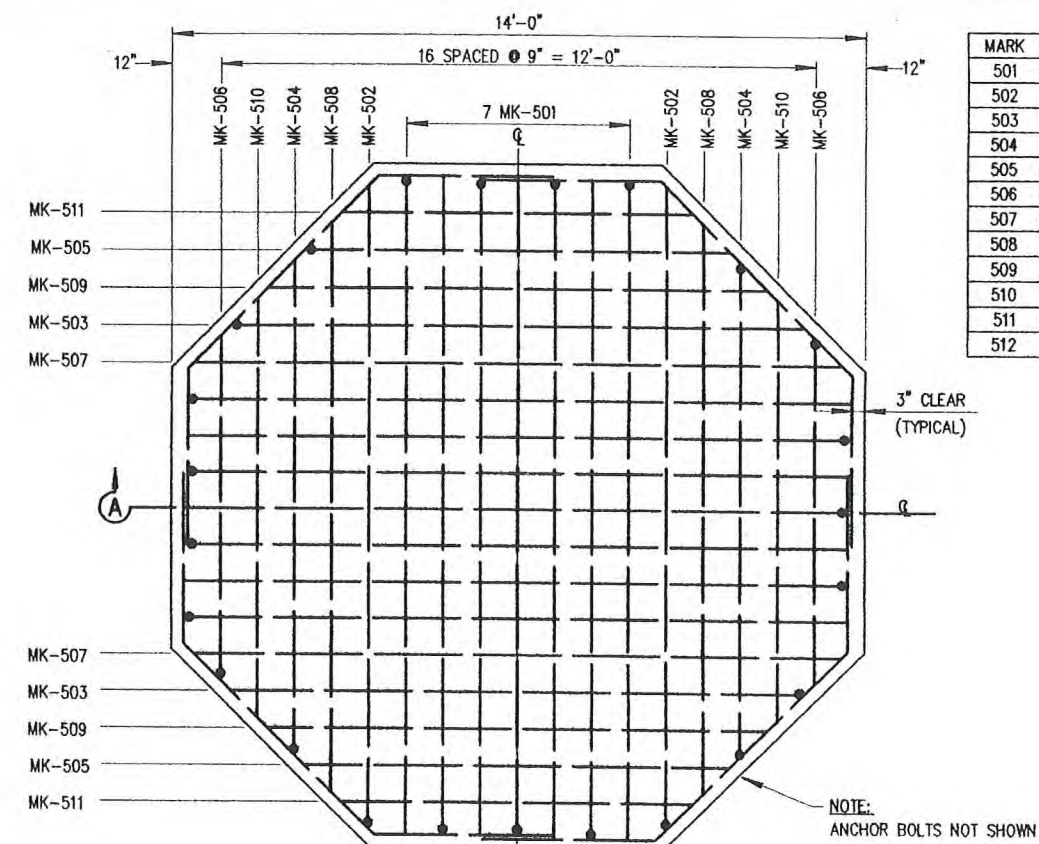
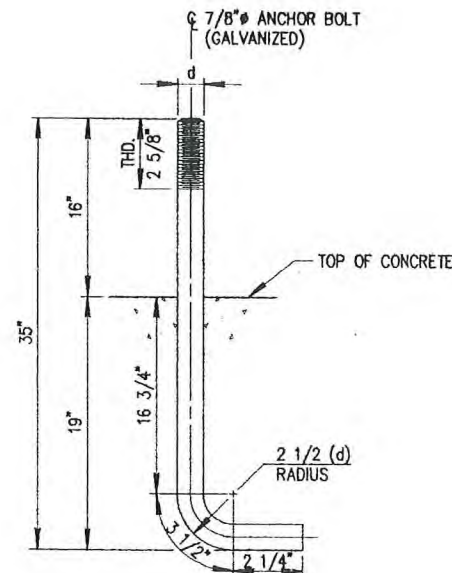


CONCRETE SPECIFICATIONS

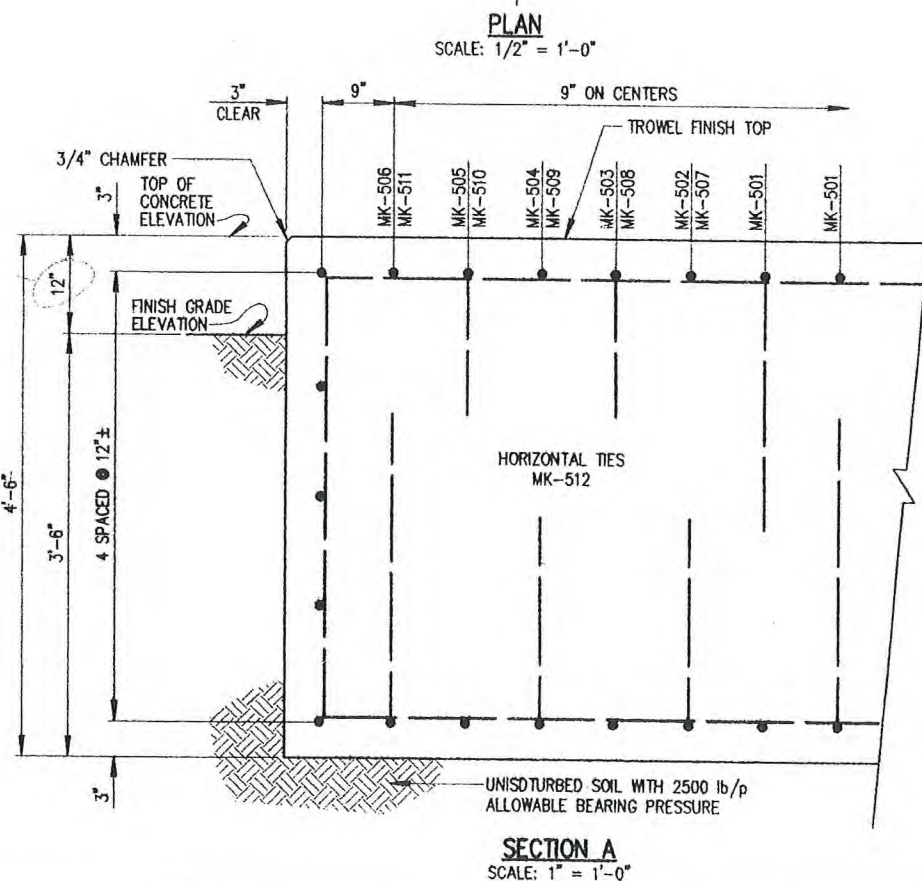
- CONCRETE MATERIAL AND PLACEMENT SHALL BE IN ACCORDANCE WITH ACI-318.
- CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF THREE THOUSAND (3,000) POUNDS PER SQUARE INCH IN STANDARD SIX (6) INCH BY TWELVE (12) INCH CYLINDERS AT TWENTY-EIGHT (28) DAYS.
- CEMENT SHALL CONFORM TO ASTM C150 TYPE I.
- NOT LESS THAN FIVE AND ONE-HALF (5-1/2) SACKS OF CEMENT SHALL BE USED PER CUBIC YARD OF CONCRETE REGARDLESS OF THE STRENGTH OBTAINED. NOT OVER SIX AND ONE-HALF (6-1/2) GALLONS OF WATER PER SACK OF CEMENT SHALL BE USED AND THE CONCRETE MIX SHALL HAVE A MAXIMUM SLUMP OF FOUR (4) INCHES.
- THE AGGREGATE USED IN THE CONCRETE SLAB SHALL BE CLEAN, WELL-GRADED AGGREGATE WITH A MAXIMUM PARTICLE SIZE OF ONE AND ONE-HALF (1-1/2) INCH AND SHALL CONFORM TO ASTM C33.
- THE AGGREGATE USED IN THE CONCRETE WALLS SHALL BE CLEAN, WELL-GRADED AGGREGATE WITH A MAXIMUM PARTICLE SIZE OF THREE-QUARTERS (3/4) INCH AND SHALL CONFORM TO ASTM C33.
- THE WATER USED IN THE CONCRETE MIX SHALL BE POTABLE WATER.
- NO ADDITIVES AND/OR RETARDANTS SHALL BE ADDED TO CONCRETE MIX UNLESS PRIOR WRITTEN APPROVAL IS GIVEN BY THE ENGINEER.
- THE CONTRACTOR SHALL USE THE NECESSARY CONVENTIONAL MEANS TO PROTECT THE PLACED CONCRETE FROM ANY DAMAGING ENVIRONMENTAL ELEMENTS DURING THE CONCRETE'S CURING TIME.
- REINFORCING STEEL SHALL BE DEFORMED REINFORCING BAR WITH A MINIMUM YIELD STRENGTH OF SIXTY THOUSAND (60,000) POUNDS PER SQUARE INCH AND SHALL CONFORM TO ASTM 615, GRADE 60.
- SHOULD THE CONTRACTOR ELECT TO USE READY-MIX CONCRETE, THIS CONCRETE MIX SHALL CONFORM TO ASTM C94.

NOTES:

- BOLTS AND NUTS SHALL CONFORM TO ASTM A307.
- NUTS SHALL BE AMERICAN STANDARD HEAVY HEXAGONAL.
- THREADS SHALL BE UNC. - 2A.

TYPICAL
ANCHOR BOLT
DETAIL
(4 REQUIRED)

MARK	SIZE	A	B	NUMBER
501	NO. 7	13'-5"	4'-0"	28
502	NO. 7	13'-1"	4'-0"	4
503	NO. 7	11'-7"	4'-0"	4
504	NO. 7	10'-1"	4'-0"	4
505	NO. 7	8'-7"	4'-0"	4
506	NO. 7	7'-1"	4'-0"	4
507	NO. 7	13'-1"	-	4
508	NO. 7	11'-7"	-	4
509	NO. 7	10'-1"	-	4
510	NO. 7	8'-7"	-	4
511	NO. 7	7'-1"	-	4
512	NO. 5	5'-4"	3'-4 1/2"	20



GENERAL NOTES

- LOCATION, ORIENTATION, AND ELEVATIONS, SEE FACILITY PLOT PLAN DRAWING, FACILITY EQUIPMENT LOCATION DRAWING, AND CONSTRUCTION DRAWING PLAN DRAWING.
- THE FOUNDATION IS BASED ON AN ASSUMED SOIL BEARING CAPACITY PRESSURE OF 2500 POUNDS PER SQUARE FOOT MINIMUM. SHOULD ACTUAL CONDITIONS AT THE FACILITY REVEAL SOIL BEARING CAPACITY PRESSURE LESS THAN THIS STATED BEARING CAPACITY PRESSURE, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY OWNER AND CONSULTANT.

REVISIONS

NO.	DESCRIPTION	BY	CHECKED	DATE	NO.	DESCRIPTION	BY	CHECKED	DATE
A	ISSUED FOR REVIEW, COMMENT, AND APPROVAL								
B	REVISED TITLE BLOCK, ISSUED FOR REVIEW, COMMENT, AND APPROVAL								
C	REVISED REBAR SCHEDULE, REVISED SECTION A ANCHOR BOLT								
	ORIENTATION NOTE, ISSUED FOR REVIEW, COMMENT, AND APPROVAL								

TCI TANK CONSULTANTS, INC.
1821 EAST 71st STREET, SUITE 200
TULSA, OKLAHOMA 74136

DRAWN: ELH
DATE: 6/95
CHECKED BY:
DATE:
MATERIALS BY:
DATE:
ENGINEER: R. TRACY
DATE: 6/95

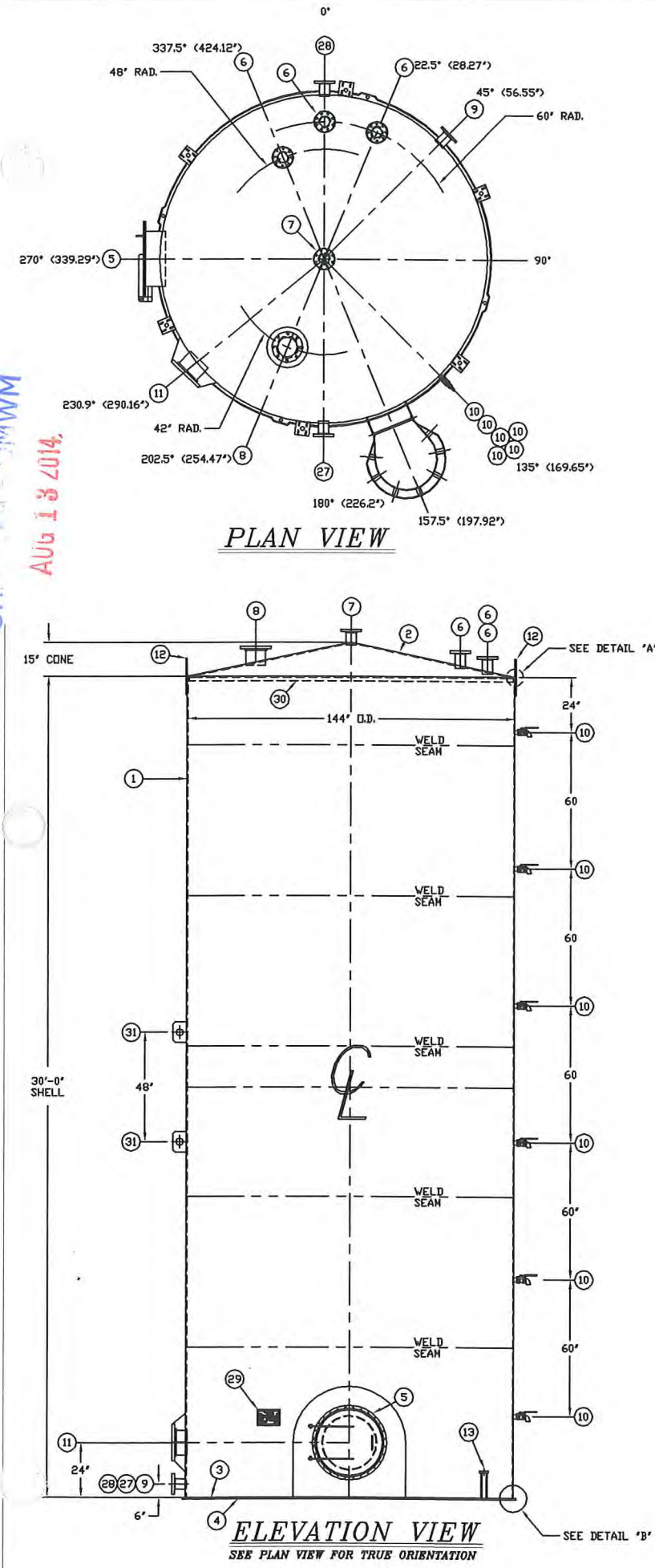
REPLACEMENT TANK 5 AND TANK 6

Fig. 4.5A

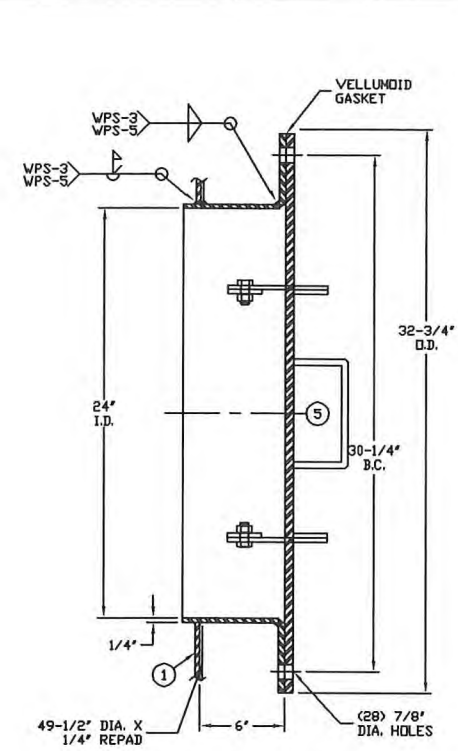
SYSTECH
PAULDING, OHIO
APPROVED BY:
SCALE:
PROJECT NUMBER: TC-862
DRAWING NUMBER: TC-862-D-201
REV.: C

00340

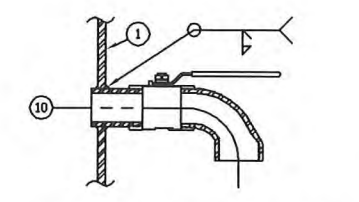
OHIO EPA - DMWM
AUG 13 2014



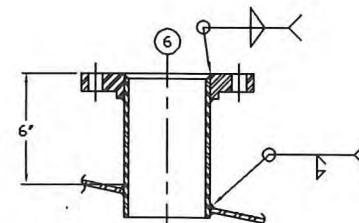
ELEVATION VIEW
SEE PLAN VIEW FOR TRUE ORIENTATION



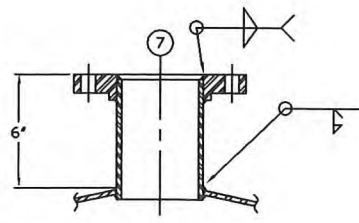
DETAIL OF ITEM #5
SCALE: 3/16"=1"



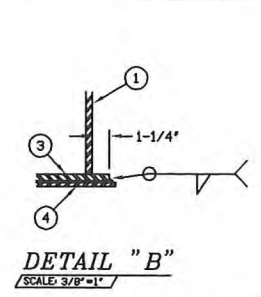
NOTES: VALVE AND ELBOW TO BE SHIPPED LOOSE
DETAIL OF ITEM #10
SCALE: 3/16"=1"



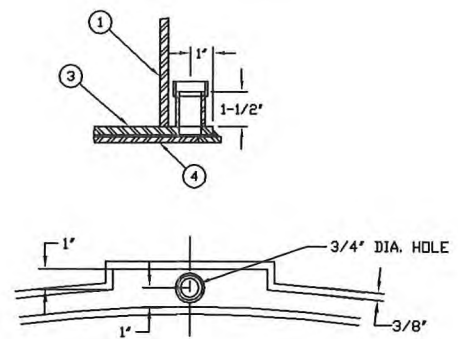
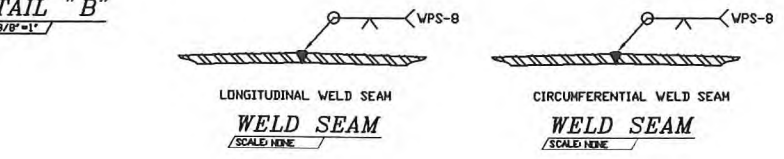
DETAIL OF ITEM #6
SCALE: 3/16"=1"



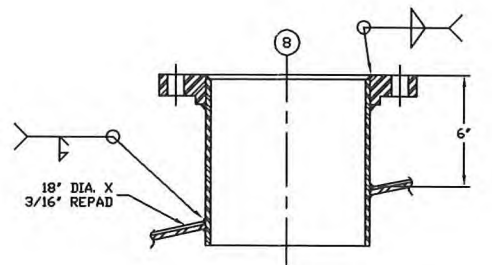
DETAIL OF ITEM #7
SCALE: 3/16"=1"



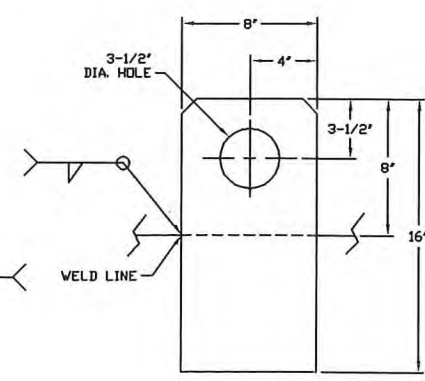
DETAIL "B"
SCALE: 3/8"=1"



DETAIL OF ITEM #36
SCALE: 3/8"=1"

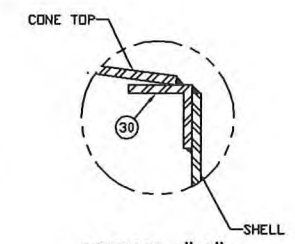


DETAIL OF ITEM #8
SCALE: 3/16"=1"

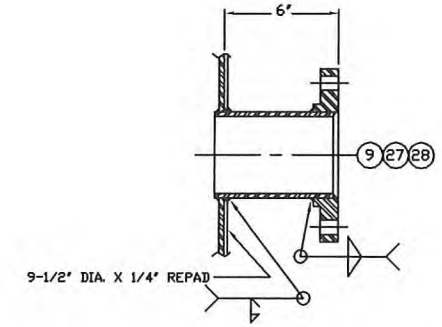


DETAIL OF ITEM #12
SCALE: 3/16"=1"

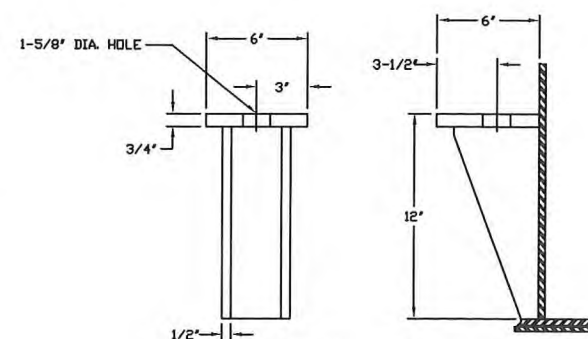
ITEMS SHIPPED LOOSE WITH TANK		
NO.	QTY.	DESCRIPTION
1	1	LADDER AND CAGE ASSEMBLY
13	6	ANCHOR CHAIR
1	1	TOUCH-UP PAINT KIT
6	1	STD STEM FULL PORT VALVE W/ ELBOW
1	1	29" O.D. X 24" I.D. X 1/8" SPIRAL WOUND RING GASKET



DETAIL "A"
SCALE: 3/8"=1"



DETAIL OF ITEM #9, 27, 28
SCALE: 3/16"=1"



NOTE: DO NOT WELD TO TANK
DETAIL OF ITEM #13
SCALE: 3/16"=1"

SCHEDULE		
NO.	QTY.	DESCRIPTION
SA-36	1	66" X 453" X 3/8" PLATE (SHELL)
SA-36	1	1 PCS CUT TO 30" WIDE
SA-36	2	66" X 147" X 3/8" (CONE)
SA-36	1	1 PCS CUT TO 15" WIDE
SA-36	3	66" X 150" X 3/8" PLATE (PRIMARY BOTTOM)
SA-36	1	1 PCS CUT TO 16" WIDE
SA-36	4	66" X 150" X 1/4" DIAMOND PLATED (SECONDARY BOTTOM)
SA-36	1	1 PCS CUT TO 17" LG
SA-36	5	24" HINGED HANWAY
SA-36	1	32-3/4" X 1/2" COVER PLATE W/ (28) 3/4" HOLES @ 30-1/4" B.C.
SA-36	1	32-3/4" O.D. X 24-5/8" I.D. X 3/8" PLATE W/ (28) 3/4" HOLES @ 30-1/4" B.C.
SA-36	1	9-1/2" X 75-1/2" X 3/8" COLLAR ROLLED TO 24" I.D.
SA-36	1	32-3/4" O.D. X 24" I.D. X 1/8" VELLUMOID GASKET
SA-36	1	W/ (28) 3/4" HOLES @ 30-1/4" B.C.
SA-193 B7	28	5/8" BOLT X 2" LG
SA-194 2H	28	5/8" NUTS
SA-36	1	49-1/2" DIA. X 1/4" REPAD
SA-36	2	2" X 20" X 1/4" FLATBAR
SA-36	2	2" X 6" X 1/4" FLATBAR
SA-36	2	2" X 8-1/2" X 1/4" FLATBAR
SA-36	0.04	3/8" ROUND BAR 20' LG (1 PCS CUT TO 9' LG)
ZINC PLATED	2	1/2" BOLT X 1-1/4" LG
ZINC PLATED	2	1/2" NUTS
SA-105	6	4" 150# R.F.S.D. FLANGE
SA-53 GB	3	4" SCH 40 PIPE X 6-5/8" LG PE
SA-36		
SA-105	7	4" 150# R.F.S.D. FLANGE
SA-53 GB	1	4" SCH 40 PIPE X 7-5/8" LG PE
SA-36		
SA-105	8	8" 150# R.F.S.D. FLANGE
SA-53 GB	1	8" SCH 40 PIPE X 8-1/2" LG PE
SA-36	1	18" DIA. X 3/16" REPAD
SA-105	9	4" 150# R.F.S.D. FLANGE
SA-53 GB	1	4" SCH 80 PIPE X 7' LG PE
SA-36	1	9-1/2" DIA. X 1/4" PLATE (REPAD)
C.S.	10	1" 3000# THREADED FULL COUPLING
C.S.	6	1" THREADED CLOSE NIPPLE
C.S.	6	1" 90° STREET ELBOW
C.S.	6	1" THREADED PLUG
SA-105	11	10" 150# R.F.S.D. FLANGE
SA-53 GB	1	10" SCH 80 PIPE X 8-1/2" LG PE
SA-36	2	7" X 7" X 1/2" GUSSET PLATE (4 PCS EACH @ 45°)
SA-36	1	27" DIA. X 1/4" PLATE (REPAD)
SA-36	12	8" X 16" X 3/4" PLATE (LIFT LUG)
SA-36	13	6" X 6" X 3/4" PLATE (ANCHOR CHAIR)
SA-36	12	11-1/4" X 6" X 1/2" PLATE (GUSSET)

- NOTES:
- TANK IS TO BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH API-650 AS SUPPLEMENTED.
 - TANK TO BE OF BUTT-WELDED CONSTRUCTION WITH FULL PENETRATION WELDS INSIDE AND OUT - INTERNAL WELDS TO BE GRIND TO A SMOOTH PROFILE
 - JOINT EFFICIENCY: 85%
 - X-RAY: SPOT
 - SPECIFIC GRAVITY: 1.0
 - TANK IS TO BE AIR TESTED AT 2-1/2 PSI.
 - INTERIOR IS TO BE CLEANED OF DIRT, WELD-SLAG AND ETC.
 - EXTERIOR IS TO BE CLEANED OF DIRT, WELD-SLAG AND ETC.
 - EXTERIOR TO RECEIVE A COMMERCIAL BLAST SSPC-SP6
 - EXTERIOR TO RECEIVE A SHOPE COAT OF CHEMTHANE 3107 WHITE PER MANUFACTURES SPECIFICATIONS
 - HANHOLE GASKET TO BE SPIRAL WOUND FLEXITALLIC STYLE CG RING GASKET (CUSTOMER TO SPECIFY)
 - CLAWSON TANK CANNOT BE RESPONSIBLE FOR THE PERFORMANCE OF ANY CUSTOMER SPECIFIED GASKET MATERIAL.
 - ALL BOLT HOLE PATTERNS ARE TO STRADDLE FLANGES NATURAL CENTER LINES.
 - NO FITTINGS TO BE PLACED IN ANY HORIZONTAL OR VERTICAL WELD SEAMS.
 - ALL FITTINGS TO BE COVERED PRIOR TO SHIPPING.

TANK NO.:
APPROXIMATE TANK EMPTY WEIGHT: 27,000 LBS.

5	10-12-11	DRAWING NUMBER 11-05T16 ADDED	DD
4	9-07-11	CHANGED PAINT FROM SHERWIN WILLIAMS TO CHEMTHANE	LL
3	7-25-11	UPDATED HANRAIL, UPDATED SCHEDULE	DR
2	7-22-11	UPDATED DETAIL OF #36, REVISED #13 IN SCHEDULE	LL
1	7-14-11	ADDED DETAILS, WELD SYMBOL, AND UPDATED SCHEDULE	DR

NO.	DATE	DESCRIPTION	BY

CLAWSON
TANK

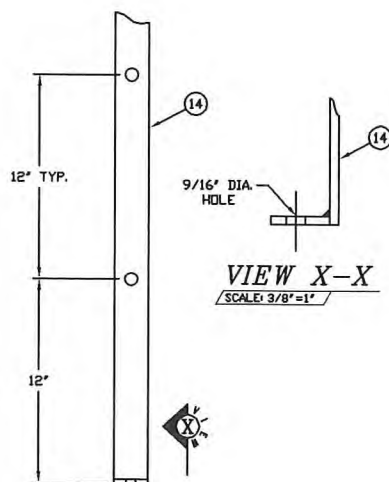
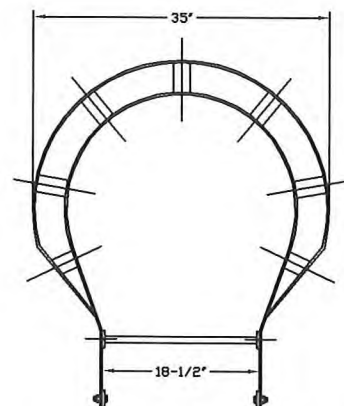
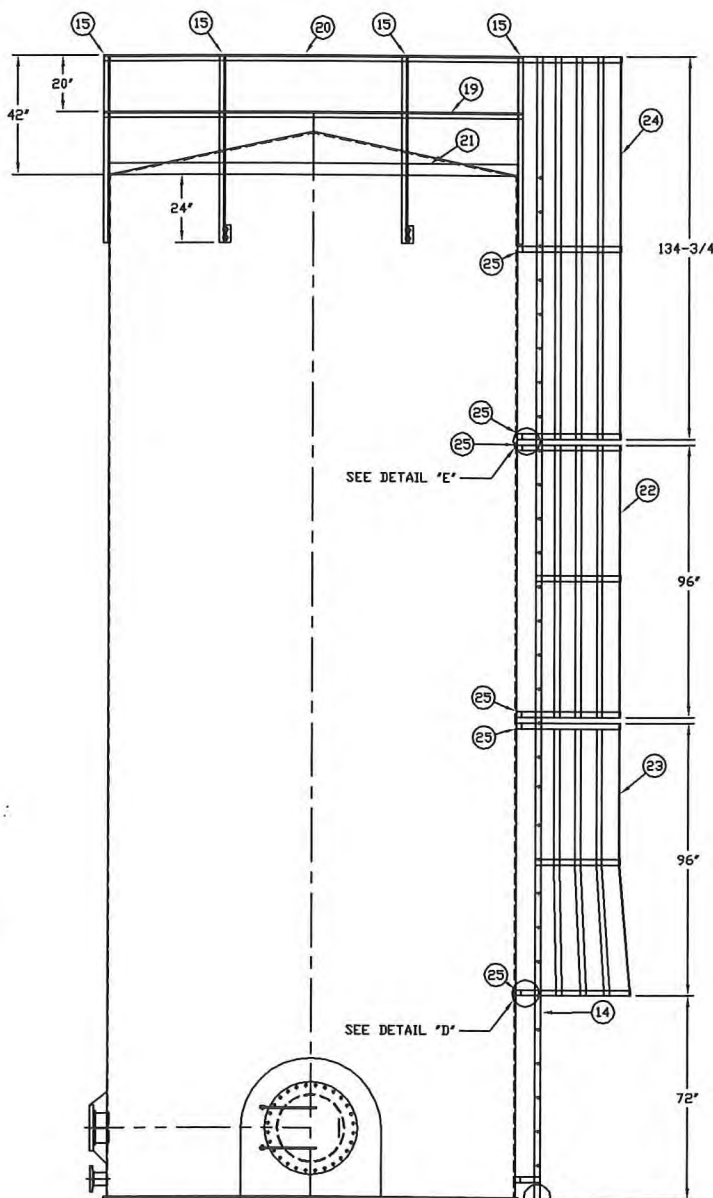
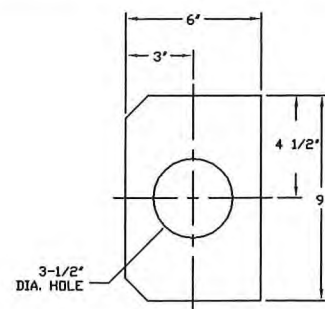
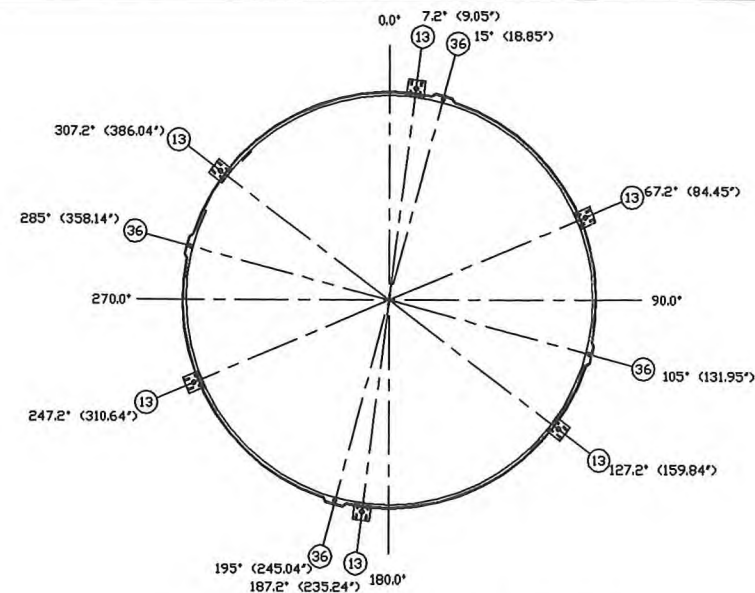
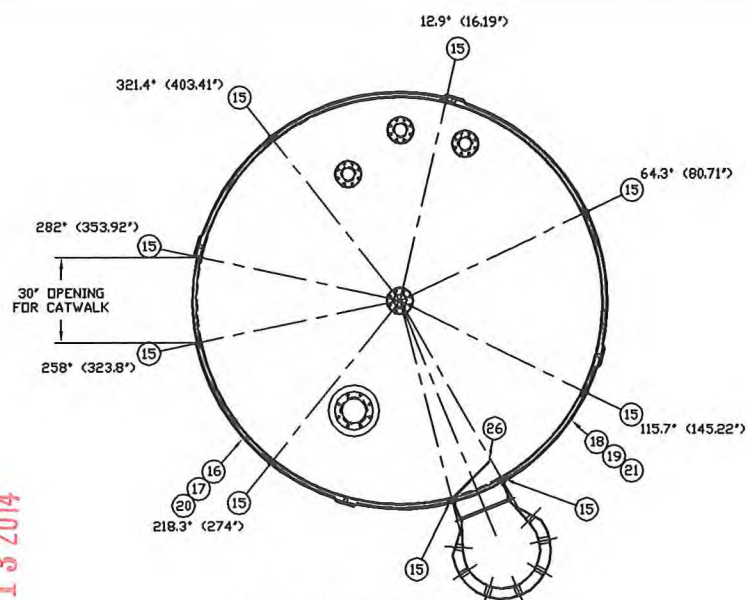
CLAWSON TANK COMPANY

CUSTOMER: SYSTECH ENVIRONMENTAL CORP. DAYTON, OH 45420	DATE: 2004
JOB: SYSTECH ENVIRONMENTAL CORP. DAYTON, OH 45420	JOB #:
SCALE: 3/8" = 12"	APPROVED BY:
DATE: 6-28-11	CHECKED BY:
DESCRIPTION: 25,000 GALLON API-650 VERTICAL C.S.	PRINT #:
	DRAWING NUMBER: 11-05T16

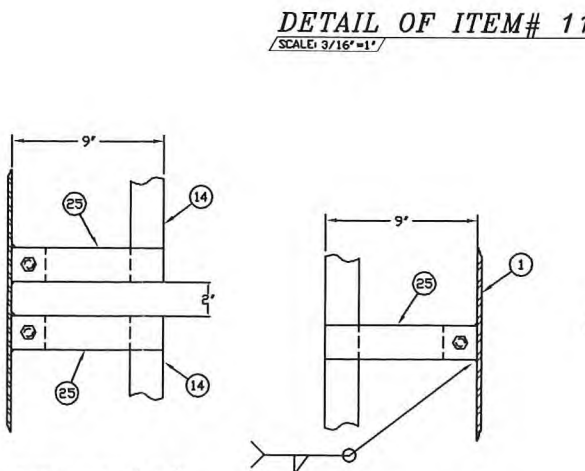
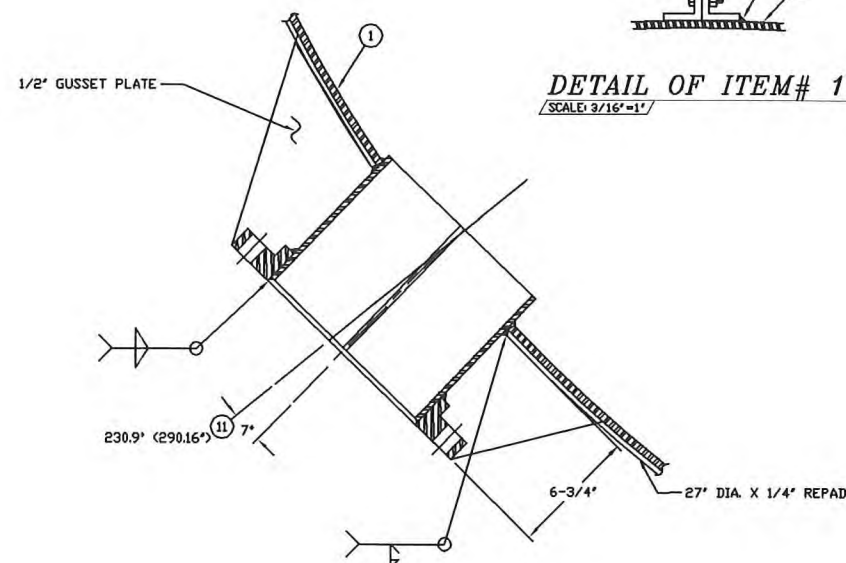
00341

OHIO EPA - DWMW

AUG 13 2014



DETAIL "C"
SCALE: 3/16"=1'



DETAIL "D"
SCALE: 3/16"=1'

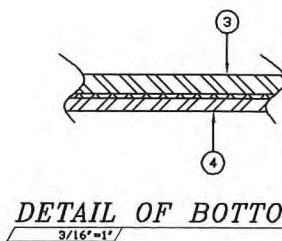


FIG. 4.5(2)

SHEET 2 OF 2

SCHEDULE		
NO.	QTY.	DESCRIPTION
SA-36	3.36	2" X 1/4" FLAT BAR X 20' (CUT 2 PCS @ 402-3/4" LG) - LADDER RAIL
SA-36	2.32	3/4" DIA. ROUND BAR X 20' (CUT 30 PCS @ 18-1/2") - RUNG
SA-36	2.47	2" X 2" X 3/8" ANGLE X 20' (CUT 9 PCS @ 65-5/8") - (POST)
SA-36	0.23	2" X 2" X 3/8" ANGLE X 20' (CUT 9 PCS @ 6")
ZINC PLATED C.S.	18	1/2" DIA. BOLT X 1-1/2" LG
ZINC PLATED C.S.	18	1/2" DIA. NUT
SA-36	16	2" X 2" X 3/8" ANGLE X 20' (ROLLED @ 143-1/4" ID. - LEG OUT) - TOP RAIL
SA-36	17	2" X 2" X 3/8" ANGLE X 20' (ROLLED @ 143-1/4" ID. - LEG OUT) - MID RAIL
SA-36	18	2" X 2" X 3/8" ANGLE X 20' (ROLLED @ 143-1/4" ID. - LEG OUT) - TOP RAIL
SA-36	19	2" X 2" X 3/8" ANGLE X 20' (ROLLED @ 143-1/4" ID. - LEG OUT) - MID RAIL
SA-36	20	5" X 1/4" FLAT BAR X 20' (ROLLED @ 144" O.D.) - KICK PLATE
SA-36	21	5" X 1/4" FLAT BAR X 20' (ROLLED @ 144" O.D.) - KICK PLATE
SA-36	22	96" CAGE ASSEMBLY
SA-36	23	134-3/4" CAGE ASSEMBLY
SA-36	24	2" X 9" X 1/4" PLATE - LADDER CLIP
SA-36	8	2" X 2" X 1/4" PLATE - TANK CLIP
ZINC PLATED C.S.	8	1/2" DIA. BOLT X 1-1/2" LG
ZINC PLATED C.S.	8	1/2" DIA. NUT
SA-105	26	18" SWING GATE ASSEMBLY
SA-53 GB	27	4" 150# R.F.S.D. FLANGE
SA-36	1	4" SCH 80 PIPE X 7' LG PE
SA-36	1	9-1/2" DIA. X 1/4" PLATE (REPAD)
SA-105	28	4" 150# R.F.S.D. FLANGE
SA-53 GB	1	4" SCH 80 PIPE X 7' LG PE
SA-36	1	9-1/2" DIA. X 1/4" PLATE (REPAD)
SA-36	29	API LABEL
SA-36	30	2" X 2" X 3/8" ANGLE 20' LG (ROLLED TO 453" O.D.)
SA-36	31	6" X 9" X 1/4" PLATE (SHELL LIFT LUG)
SA-36	36	1" SCH 40 PIPE X 1-1/2" LG TOE
SA-36	1	1" SCH 40 FEMALE THREADED PIPE CAP

NOTES:

- LADDER, CAGE, HANDRAIL TO BE OF ALL WELD CONSTRUCTION
- EXTERIOR TO RECEIVE A SHOP COAT OF CHEMTHANE 3107 YELLOW PER MANUFACTURER'S SPECIFICATIONS

5	10-12-11	DRAWING NUMBER 11-05117 ADDED	DD
4	9-07-11	CHANGED PAINT FROM SHERWIN WILLIAMS TO CHEMTHANE	LL
3	8-8-11	ADDED DETAIL OF TANK BOTTOM	DR
2	7-25-11	UPDATED HANRAIL, UPDATED SCHEDULE	DR
1	7-22-11	UPDATED DETAIL OF #36, REVISED #13 IN SCHEDULE	LL

CLAWSON
TANK

CLAWSON TANK COMPANY

CUSTOMER: SYSTECH ENVIRONMENTAL CORP.
DAYTON, OH 45420

DATE: 6-28-11

SCALE: 3/8" = 12"

APPROVED BY: [Signature]

DRAWN BY: DAVID ROSS

CHECKED BY: [Signature]

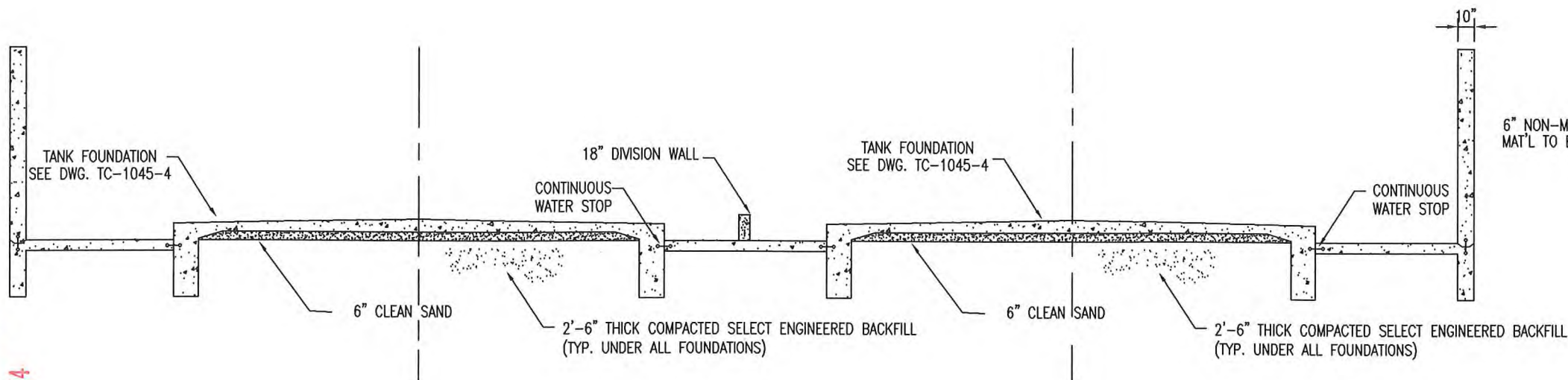
DESCRIPTION: LADDER AND CAGE ASSEMBLY

2004

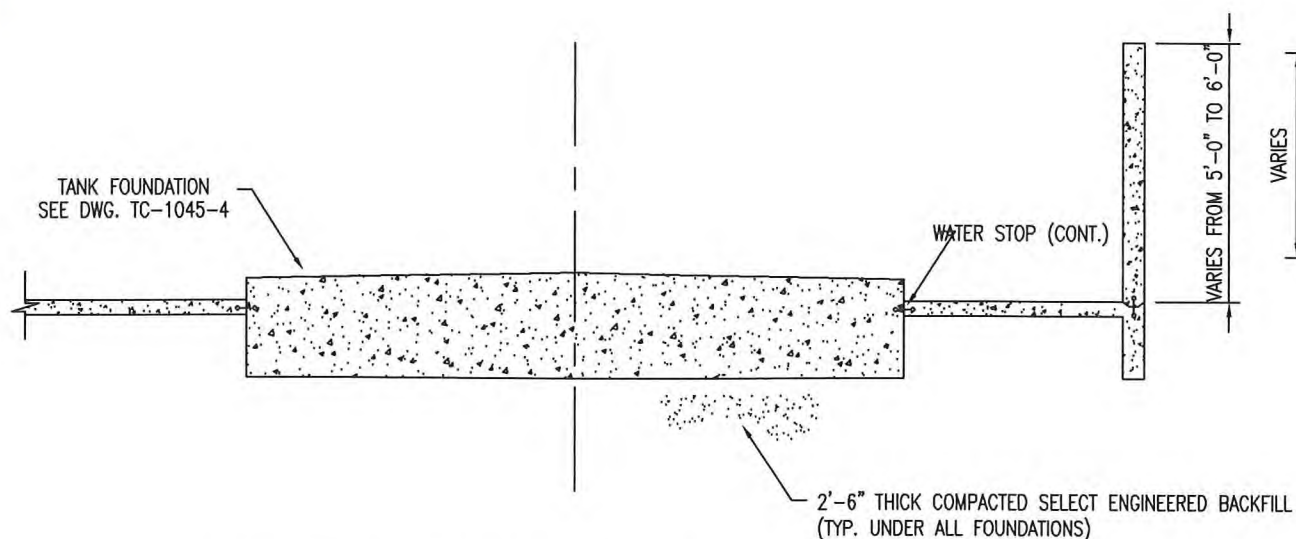
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11-05117

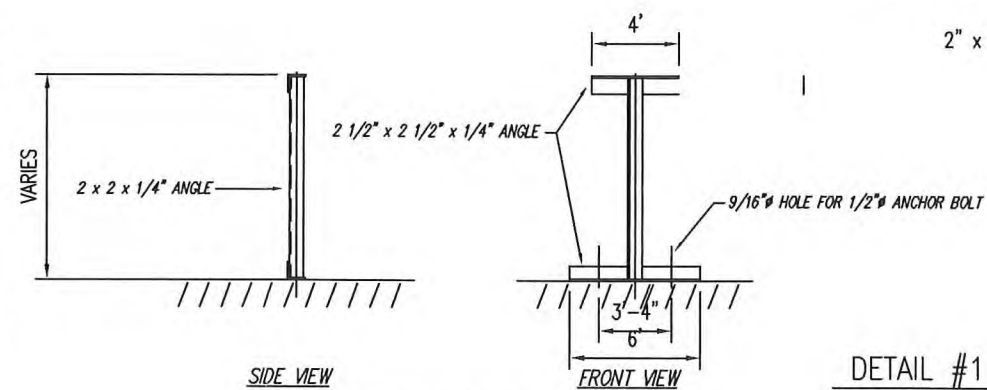
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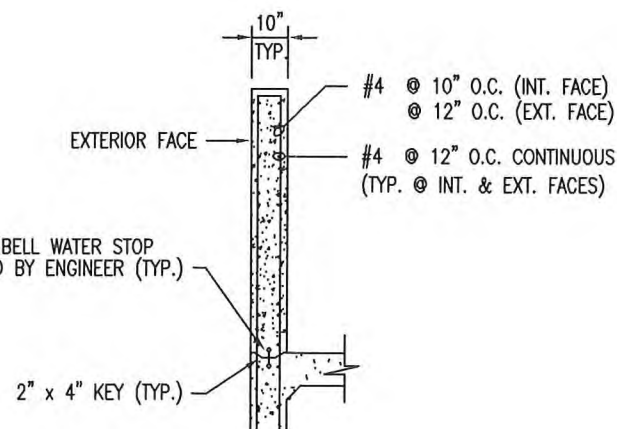
SECTION "A-A" (CONTAINMENT AREA WITH TANK FOUNDATION - LOOKING NORTH)
SCALE: 1/4"=1'-0"



SECTION "B-B" (CONTAINMENT AREA WITH TANK FOUNDATION - LOOKING WEST)
SCALE: 1/4"=1'-0"



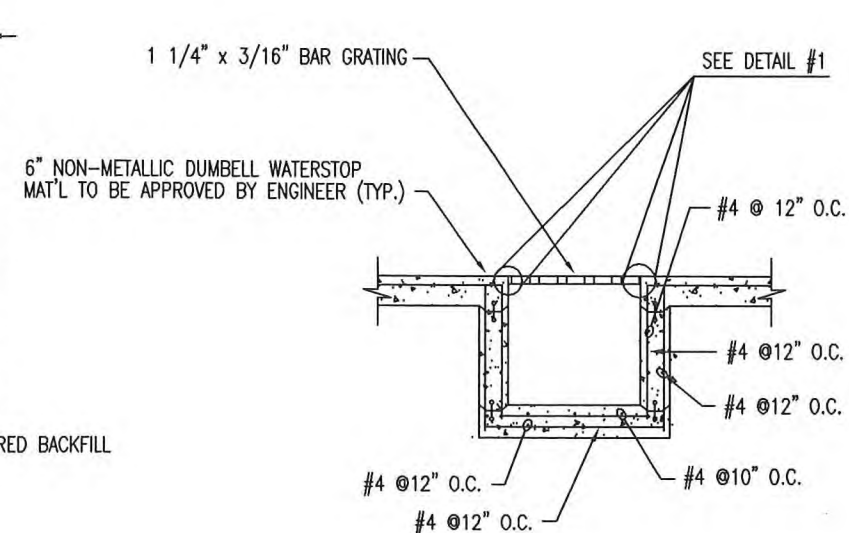
SIDE VIEW
FRONT VIEW
TYPICAL SUPPORT DETAIL



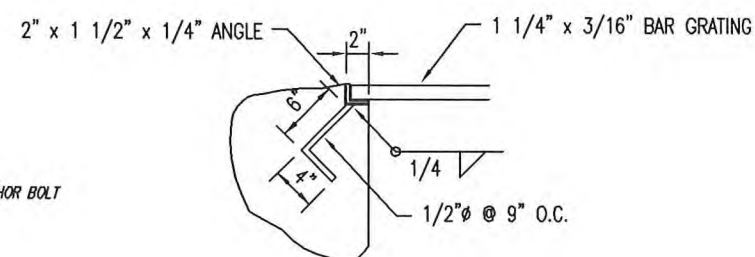
6" NON-METALLIC DUMBELL WATER STOP
MAT'L TO BE APPROVED BY ENGINEER (TYP.)

2" x 4" KEY (TYP.)

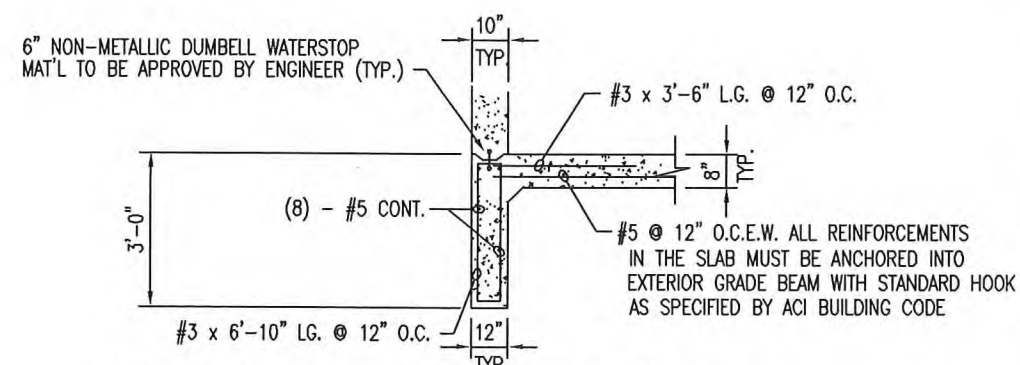
TYPICAL WALL REINFORCEMENT
SCALE: 1/2"=1'-0"



SECTION "C-C" (TYPICAL SUMP DETAIL - LOOKING WEST)
SUMP 2' X 2' X 3' INSIDE DIMENSIONS

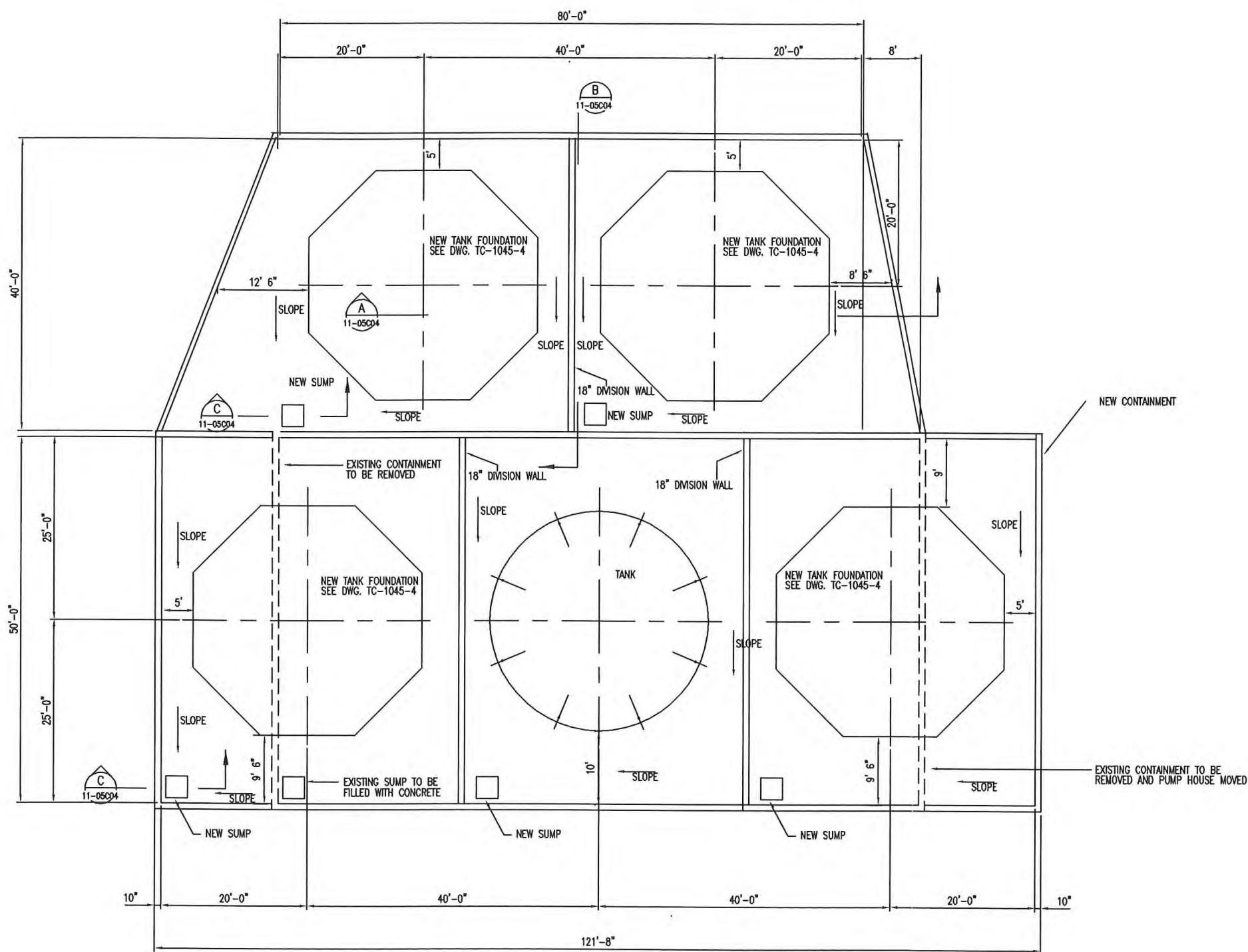


DETAIL #1 (TYPICAL BAR GRATING DETAIL)
SCALE: 1 1/2"=1'-0"



TYPICAL REINFORCEMENT OF 1'-0" x 3'-0" EXTERIOR GRADE BEAM
SCALE: 1/2"=1'-0"

SYMB.	DATE	BY	DESCRIPTION
5	9/14/12	DLD	REVISED LOGO COLORS AND ADDRESS
4	10/98	NW	CHANGED SUMP DETAIL
3	4/98	NW	ADDED DIVISION WALL
2	1/98	NW	ADDED SUPPORT DETAIL
1	6/97	JW	RELEASED FOR PERMIT
0	9/30/96	TSC	RELEASED FOR PERMIT APPLICATION
CHANGES			
DRWN BY:	T. CABRAL	DATE	9-10-96
CHKD. BY:		DATE	
PAULDING CO-PROCESSING FACILITY PROPOSED BURN TANK ADDITIONS FOUNDATION DETAILS FIG. 4.6B			
ENVIRONMENT AND ENERGY SYSTECH ENVIRONMENTAL CORPORATION			
3085 WOODMAN DR. DAYTON, OHIO 937/643-1240			
SCALE	AS NOTED	SHEET	OF
DWG. NO.	11-05C04		
REV. NO.	5		



GENERAL NOTES:

- ALL CONCRETE WORK SHALL CONFORM WITH A.C.I. BUILDING CODE, STD. 318-77.
- CONCRETE SHALL DEVELOP A MINIMUM COMPRESSIVE STRENGTH IN 28 DAYS OF 3000 PSI.
- REINFORCING STEEL SHALL BE NEW AMERICAN BILLET A.S.T.M. A615 GRADE 60. EXCEPT FOR TIES WHICH MAY BE GRADE 40.
- SPICE REINFORCING BAR. IF NECESSARY. AS FOLLOWS: #4 BAR, 14" MIN; #5 BAR, 17" MIN.
- THE MINIMUM CONCRETE COVER SHALL BE PROVIDED AS FOLLOWS, UNLESS OTHERWISE NOTED: CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH, 3" EXPOSE TO EARTH OR WEATHER, POURED IN FORMS, 2" NOT EXPOSED TO WEATHER OR CONTACT WITH GROUND 1 1/2"
- CHAMFER EXPOSED CONCRETE EDGES 3/4".
- ANY DISTURBED SUBGRADE MUST BE COMPACTED TO 100% MAXIMUM DRY DENSITY PER STD. PROCTOR PROCEDURE.
- TANK SUPPORT CONCRETE PAD SURFACE TO BE LEVEL AND TROWELED.
- MAXIMUM ALLOWABLE SOIL BEARING CAPACITY: 2000 PSF.



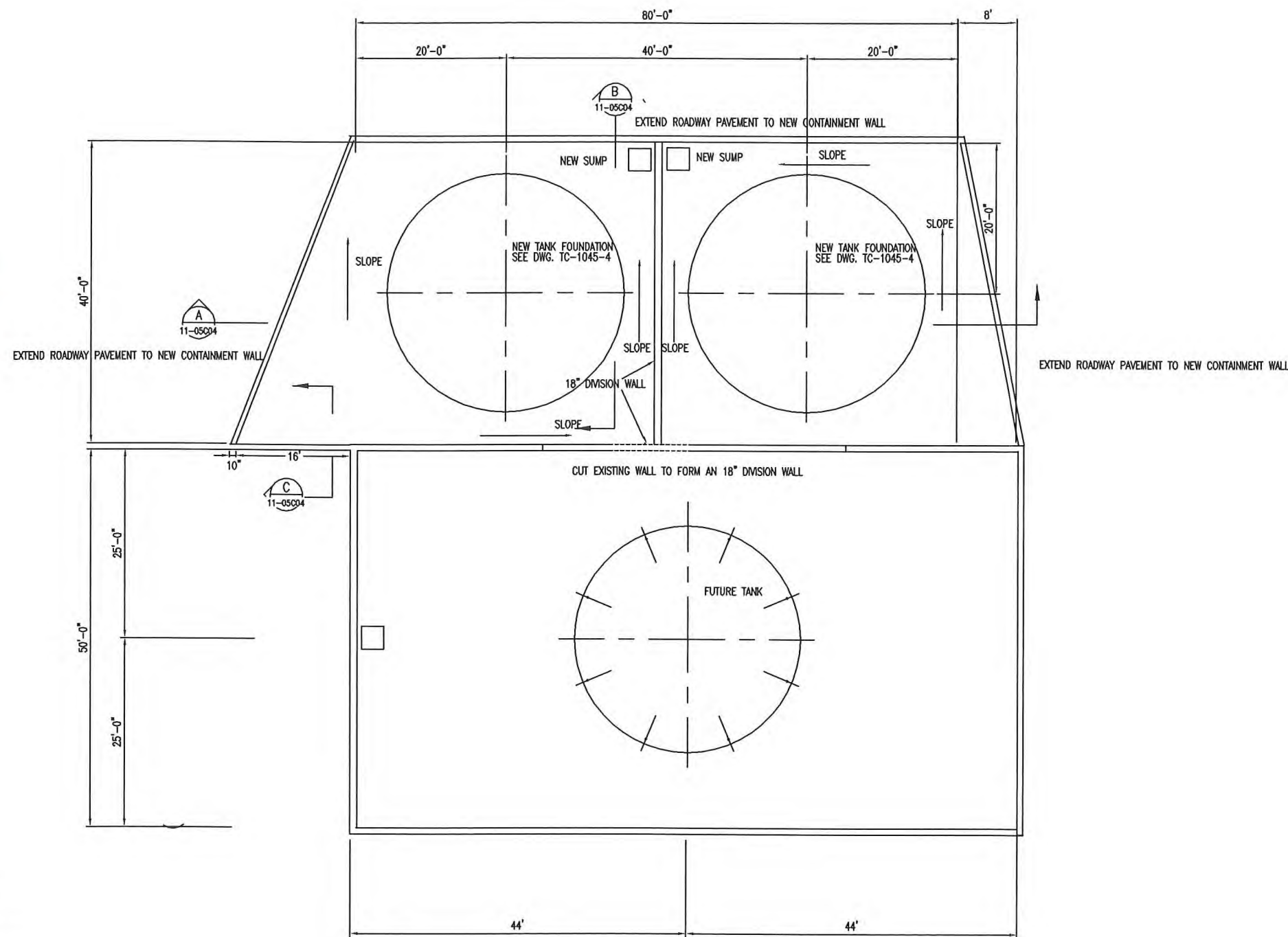
PLAN - BURN TANK GENERAL ARRANGEMENT

SCALE: 1/4"=1'-0"

5	9/19/12	DLD	REVISED ADDRESS
4	4/10/98	NW	ADDED DIVISION WALLS
3	1/8/98	NW	ADDED DIMENSIONS AND SLOPES
2	5/8/97	NW	REVISED PER FACILITY COMMENTS
1	9/30/96	TSC	RELEASED FOR PERMIT APPLICATION
SYMB	DATE	BY	DESCRIPTION
CHANGES			
DRWN BY:	T. CABRAL	DATE	9-10-96
CHKD. BY:		DATE	
PAULDING CO-PROCESSING FACILITY PROPOSED BURN TANK ADDITIONS FOUNDATION PLAN FIG. 4.6A			
ENVIRONMENT AND ENERGY SYSTECH ENVIRONMENTAL CORPORATION			
3085 WOODMAN DR. DAYTON, OHIO 45420 937/643/1240			
SCALE	AS NOTED	SHEET	OF
DWG. NO.	11-05C03	REV. NO.	5

00344

OHIO DEPT. OF TRANSPORTATION
AUG 13 2014



GENERAL NOTES:

1. ALL CONCRETE WORK SHALL CONFORM WITH A.C.I. BUILDING CODE, STD. 318-77.
2. CONCRETE SHALL DEVELOP A MINIMUM COMPRESSIVE STRENGTH IN 28 DAYS OF 3000 PSI.
3. REINFORCING STEEL SHALL BE NEW A.S.T.M. A615 GRADE 60.
EXCEPT FOR TIES WHICH MAY BE GRADE 40.
4. SPICE REINFORCING BAR. IF NECESSARY. AS FOLLOWS: #4 BAR, 12" MIN; #5 BAR, 18" MIN.
5. THE MINIMUM CONCRETE COVER SHALL BE PROVIDED AS FOLLOWS, UNLESS OTHERWISE NOTED:
CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH, 3"
EXPOSE TO EARTH OR WEATHER, POURED IN FORMS, 2"
NOT EXPOSED TO WEATHER OR CONTACT WITH GROUND 1 1/2"
6. CHAMFER EXPOSED CONCRETE EDGES 3/4".
7. ANY DISTURBED SUB GRADE MUST BE COMPACTED TO 100% MAXIMUM DRY DENSITY PER STD. PROCTOR PROCEDURE.
8. TANK SUPPORT CONCRETE PAD SURFACE TO BE SLOPED AND TROWELED.
9. 1" EXPANSION JOINT WILL BE PLACED AGAINST THE EXTERIOR OF THE NEW CONTAINMENT BEFORE PLACING THE ROADWAY PAVEMENT



PLAN - BURN TANK GENERAL ARRANGEMENT

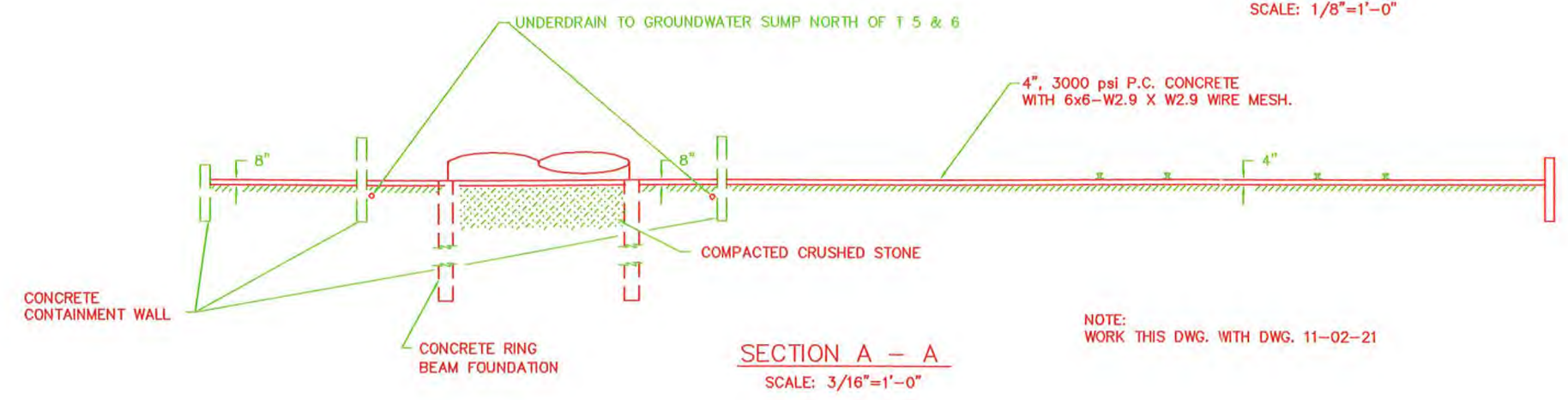
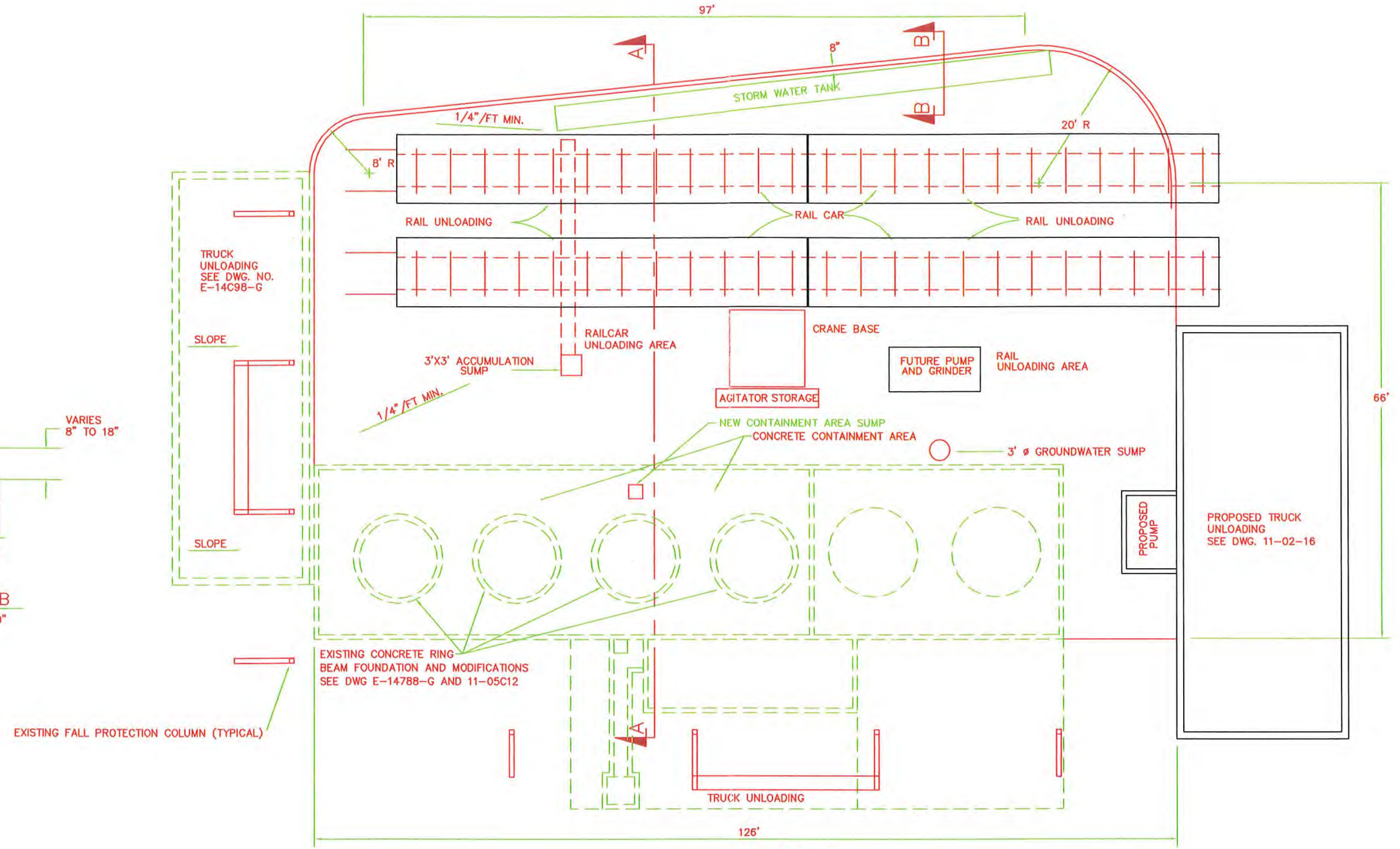
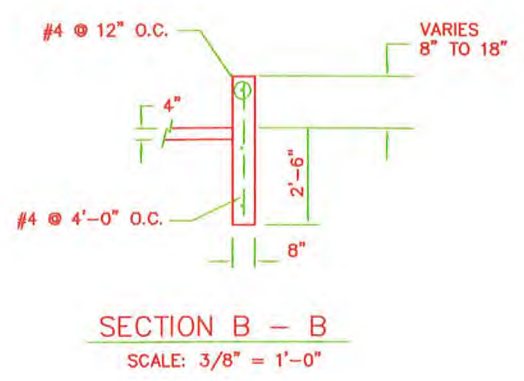
SCALE: 1/4"=1'-0"

6	7/12/12	OLD	REVISED DRAWING NAME, ADDRESS, FIGURE NUMBER AND LOGO
5	10/9/98	N W	CHANGED TANK FOUNDATIONS SHAPE TO ROUND
4	10/5/98	N W	MOVED SUMP LOCATIONS, CHANGED SLOPES
3	1/10/98	N W	ADDED DIVISION WALL
2	1/30/98	N W	ADDED SLOPES
1	1/8/98	N W	ADDED DIMENSIONS
SYMB.	DATE	BY	DESCRIPTION
CHANGES			
DRWN BY:	N WALLIS	DATE	6-25-97
CHKD. BY:		DATE	
PAULDING CO-PROCESSING FACILITY BURN TANK 8 & 9 ADDITIONS INTERMEDIATE FOUNDATION PLAN FIG. 4.6C			
ENVIRONMENT AND ENERGY SYSTECH ENVIRONMENTAL CORPORATION			
3085 WOODMAN DR. DAYTON, OHIO 937/643-1240			
SCALE	AS NOTED	SHEET	OF
DWG. NO.	11-05C05	REV. NO.	6

00345

OF 11/11/11

AUG 13 2014



NOTE:
WORK THIS DWG. WITH DWG. 11-02-21

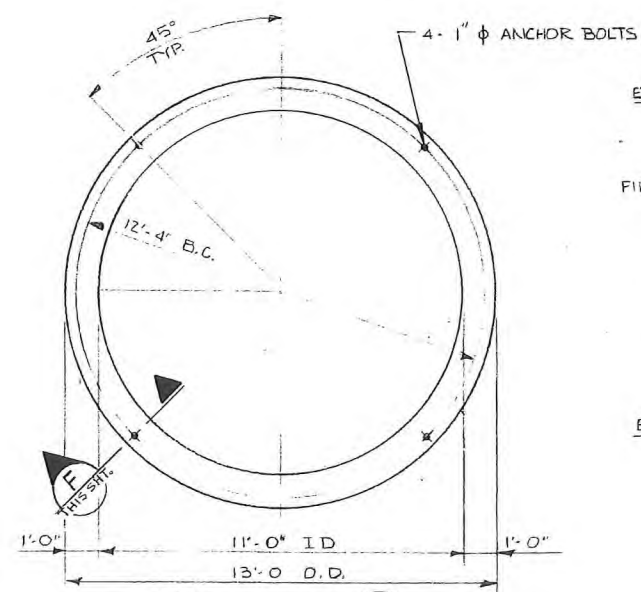
6	8/29/12	DLD	COMBINED WITH 11-02-20A, ADDED STORMWATER TANK, CRANE RAILS, MOVED AGITATOR STORAGE
5	3/16/04	BH	NEW CONTAINMENT SUMP & UNDERDRAIN, ORIG. TANK FOUNDATION
4	1/4/01	NW	MODIFIED SIZE OF TANKS 1-4
3	10/12/99	NW	MOVED CRANE BASE
2	6/25/99	NW	ADDED RAIL CAR AGITATOR, RE-ORIENTED EXISTING RAIL UNLOAD PUMPS
1	8/26/98	BJA	ADDED NEW RAIL & TRUCK UNLOADING AREAS. REVISED TITLE BLOCK.
SYMB. DATE BY DESCRIPTION			
CHANGES			
DRWN BY:	KAB	DATE	1/25/88
CHKD. BY:	DAH	DATE	1/25/88
PAULDING WASTE MANAGEMENT PLAN AND SECTIONS, CONCRETE LIQUID WASTE FUELS FIG. 4-8			
ENVIRONMENT AND ENERGY SYSTECH CORPORATION 3085 WOODMAN DRIVE DAYTON, OHIO 45420 937-643-1240			
SCALE AS SHOWN	SHEET 1 OF 1	DWG. NO. 11-02-20	6 REV. NO.

SYSTECH®

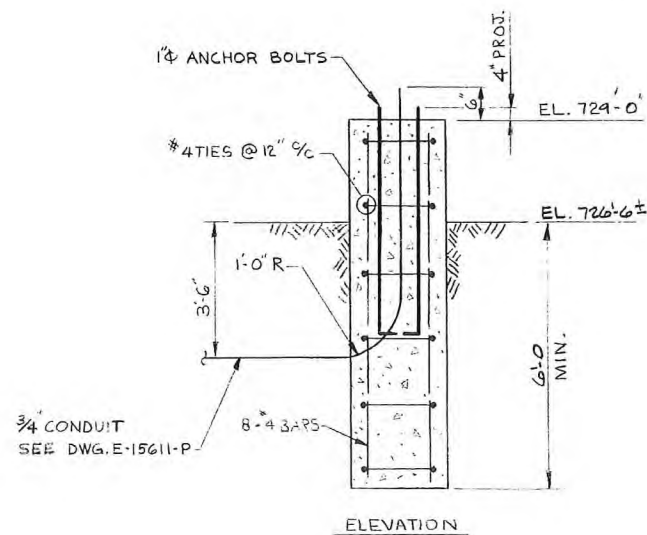
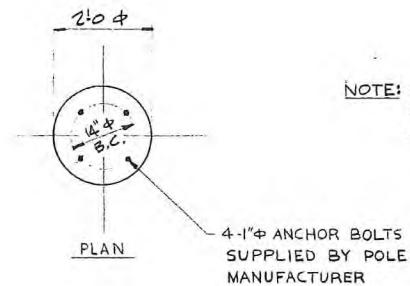
00346

OHIO EPA - DMWM
AUG 13 2014

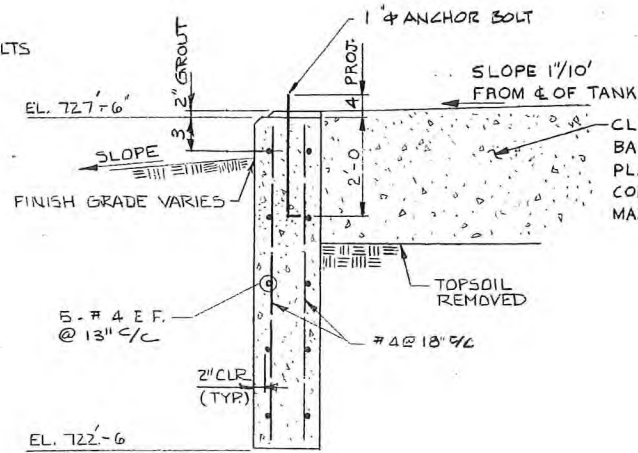
BILL OF MATERIAL				
MARK	REQ'D	DESCRIPTION	REMARKS	FURN. BY



DETAIL 1
TANK FOUNDATION
SCALE: 3/8"=1'-0"
(4 REQ'D)

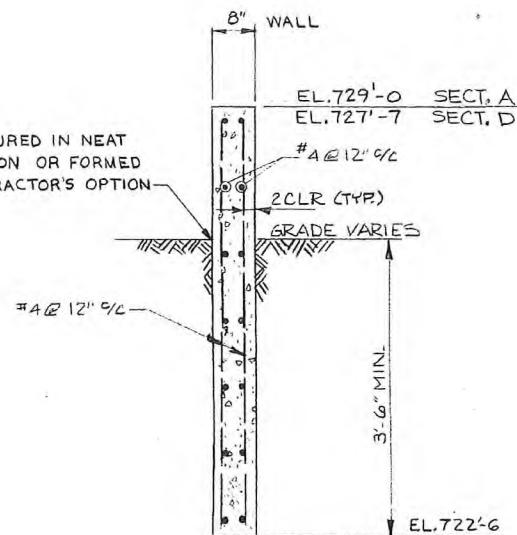


DETAIL 5
LIGHT POLE FDN.
(TWO REQ'D)

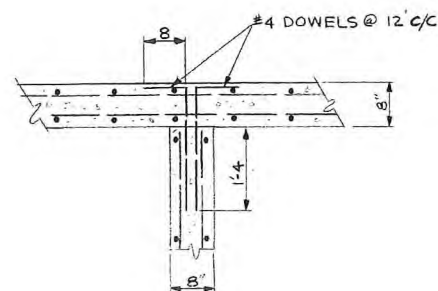


SECTION F
SCALE: 3/4"=1'-0" THIS SHT.

NOTE: WALL POURED IN NEAT
EXCAVATION OR FORMED
AT CONTRACTOR'S OPTION

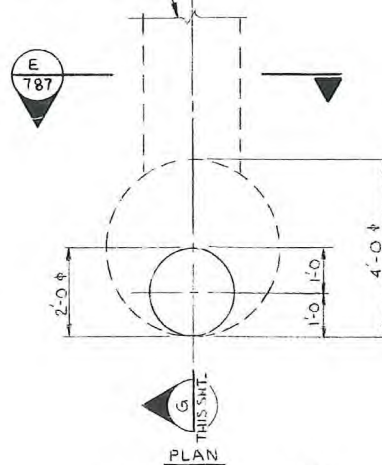


SECTION A
SCALE: 3/4"=1'-0"



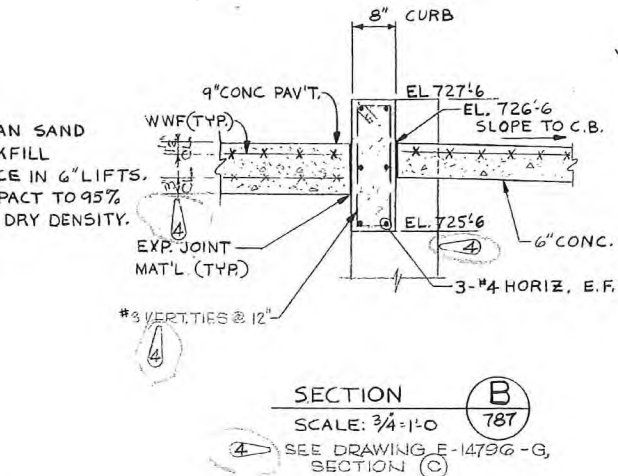
DETAIL 6
WALL INTERSECTION
(4 PLACES)

SEE DWG. E-14785-G
FOR CONT. OF PIPE DUCT

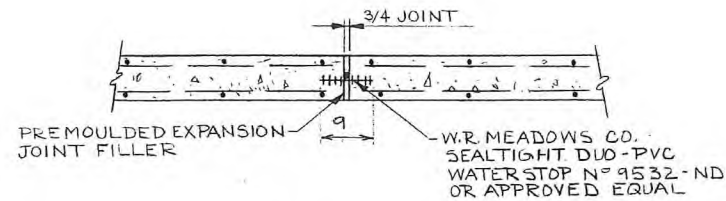


DETAIL 7
PIPE MANHOLE
SCALE: 1/2"=1'-0"

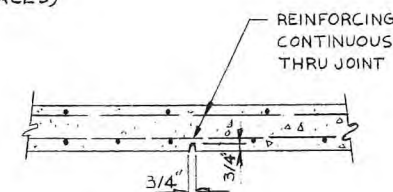
BLAZON ENTERPRISES, INC.
ENGINEERING-CONSTRUCTION-ELECTRONIC & MACHINE PRODUCTS
4756 W. BANCROFT ST. • TOLEDO, OHIO 43615 • (419) 537-6567



SECTION B
SCALE: 3/4"=1'-0"
SEE DRAWING E-14786-G,
SECTION C

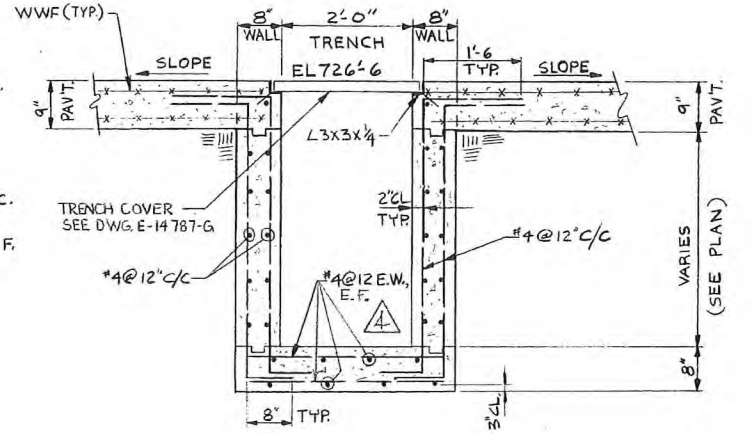


DETAIL 2
DIKE WALL
EXPANSION JOINT
SCALE: 3/4"=1'-0"
(4 PLACES)

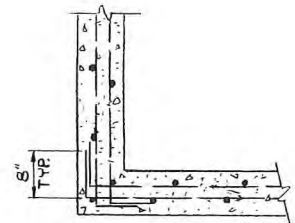


DETAIL 3
DIKE WALL
CONTRACTION JOINT
SCALE: 3/4"=1'-0"
NOTE: SPACE @ 18" C/C MAX.

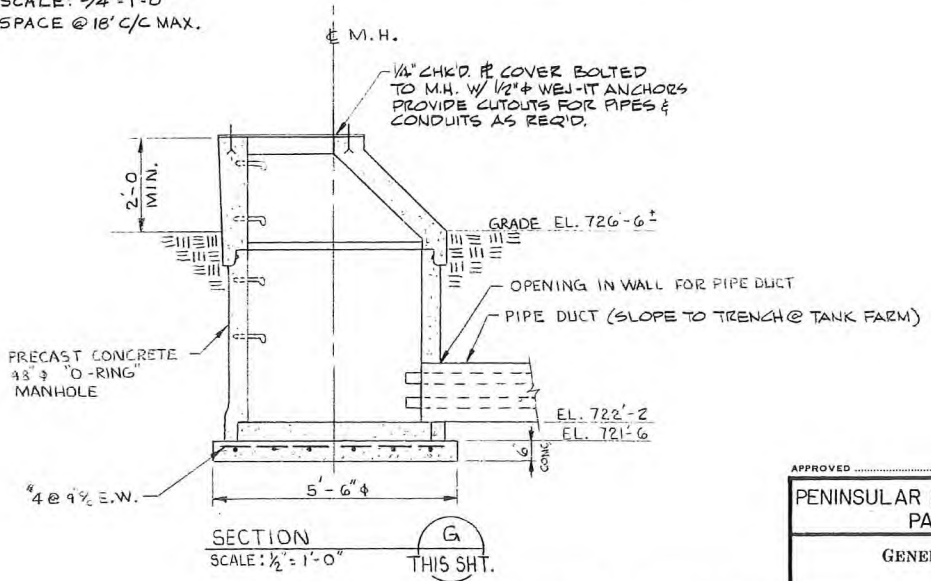
SECTION C
SCALE: 3/4"=1'-0"



SECTION C
SCALE: 3/4"=1'-0"



DETAIL 4
DIKE WALL CORNER
SCALE: 3/4"=1'-0"
(6 PLACES)



SECTION G
SCALE: 1/2"=1'-0" THIS SHT.

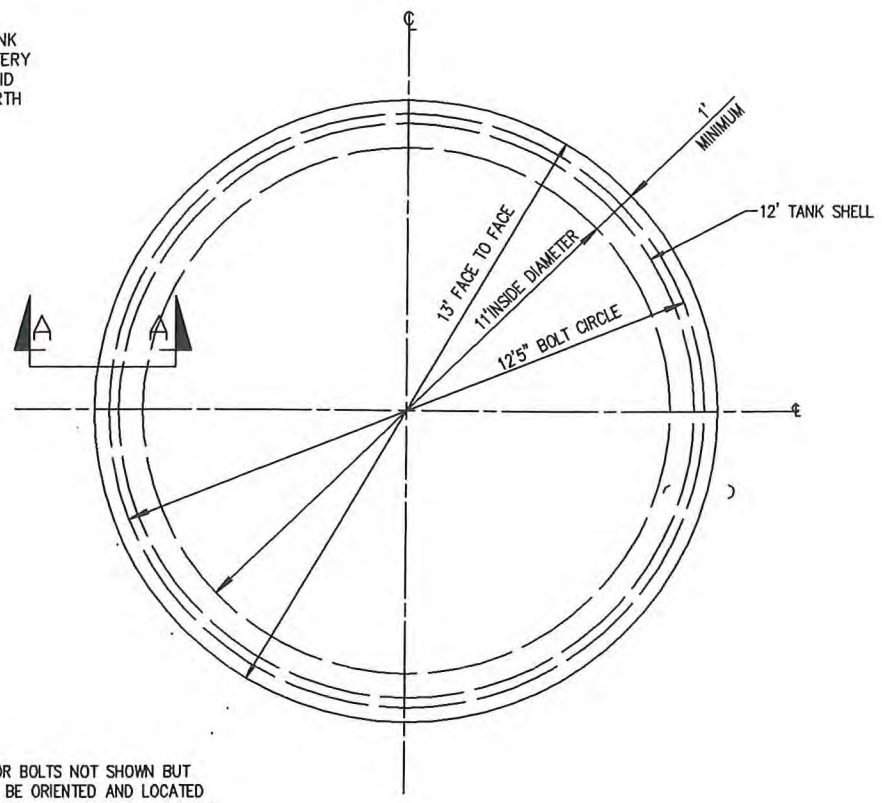
APPROVED _____ CHIEF ENGINEER	
PENINSULAR PORTLAND CEMENT DIV. PAULDING, OHIO	
GENERAL PORTLAND INC. DALLAS, TEXAS FIG. 4.9	
WASTE FUEL UTILIZATION PROJECT FOUNDATION DETAILS	
REVISION #1 11-21-79 RAISED PIPE DUCT EL. @ M.H.; ADDED SLOPE TO PIPE DUCT	REVISION #2 10-15-79 CHANGED TANK FDN TO 4
REVISION #3 10-15-79 CHANGED TANK FDN TO 4	REVISION #4 11-21-79 RAISED PIPE DUCT EL. @ M.H.; ADDED SLOPE TO PIPE DUCT
DRAWN BY: T.C. DATE: 10-12-79	DRAWING NO. E-14788-G
CHECKED BY: GEL DATE: 10-15-79	SCALE: NOTED
CORRECT: _____	C.O. _____

24300

OHIO DEPT. OF HIGHWAY

AUG 13 2014

TANK
BATTERY
GRID
NORTH



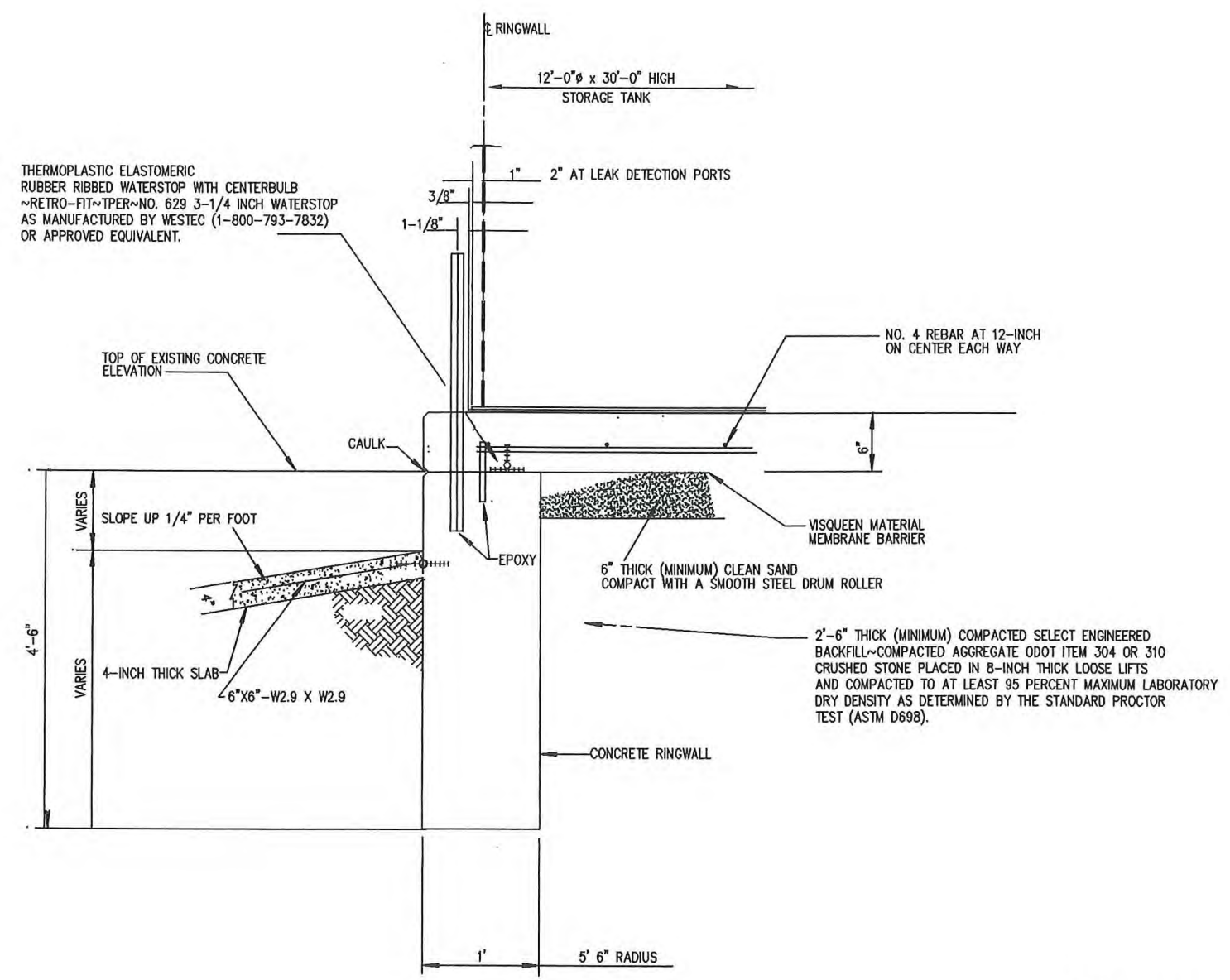
NOTE:
ANCHOR BOLTS NOT SHOWN BUT
SHALL BE ORIENTED AND LOCATED
BY OTHERS - SEE TYPICAL ANCHOR
BOLT DETAIL NOTE 4.

PLAN
SCALE: 1/2" = 1'-0"

CONCRETE SPECIFICATIONS

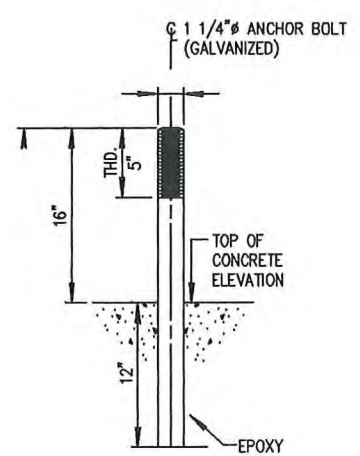
1. CONCRETE MATERIAL AND PLACEMENT SHALL BE IN ACCORDANCE WITH ACI-318.
2. CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF FIVE THOUSAND (5,000) POUNDS PER SQUARE INCH IN STANDARD SIX (6) INCH BY TWELVE (12) INCH CYLINDERS AT TWENTY-EIGHT (28) DAYS.
3. CEMENT SHALL CONFORM TO ASTM C150 TYPE I.
4. NOT LESS THAN FIVE AND ONE-HALF (5-1/2) SACKS OF CEMENT SHALL BE USED PER CUBIC YARD OF CONCRETE REGARDLESS OF THE STRENGTH OBTAINED. NOT OVER SIX AND ONE-HALF (6-1/2) GALLONS OF WATER PER SACK OF CEMENT SHALL BE USED AND THE CONCRETE MIX SHALL HAVE A MAXIMUM SLUMP OF FOUR (4) INCHES. 6% AIR.
5. THE BONDING AGENT SHALL BE WELD-CRETE OR APPROVED EQUAL.
6. THE AGGREGATE USED IN THE CONCRETE SHALL BE CLEAN, WELL-GRADED AGGREGATE WITH A MAXIMUM PARTICLE SIZE OF THREE-QUARTERS (3/4) INCH AND SHALL CONFORM TO ASTM C33.
7. THE WATER USED IN THE CONCRETE MIX SHALL BE POTABLE WATER.
8. NO ADDITIVES AND/OR RETARDANTS SHALL BE ADDED TO CONCRETE MIX UNLESS PRIOR WRITTEN APPROVAL IS GIVEN BY THE ENGINEER.
9. THE CONTRACTOR SHALL USE THE NECESSARY CONVENTIONAL MEANS TO PROTECT THE PLACED CONCRETE FROM ANY DAMAGING ENVIRONMENTAL ELEMENTS DURING THE CONCRETE'S CURING TIME.
10. REINFORCING STEEL SHALL BE DEFORMED REINFORCING BAR WITH A MINIMUM YIELD STRENGTH OF SIXTY THOUSAND (60,000) POUNDS PER SQUARE INCH, SHALL CONFORM TO ASTM 615, GRADE 60, AND SHALL BE EPOXY COATED.
11. SHOULD THE CONTRACTOR ELECT TO USE READY-MIX CONCRETE, THIS CONCRETE MIX SHALL CONFORM TO ASTM C94.
12. EPOXY SHALL BE SIKA ANCHOR-FIX -2 OR APPROVED EQUAL.
13. CURING AGANT SHALL BE APPLIED AT 1 GALLON PER 200 SQ. FT.

TENSION REBAR LAP SPLICES SHALL BE IN ACCORDANCE WITH ACI CODE PROVISIONS CLASS "B"	
BAR SIZE	SPLICE LAP
NO. 4	11 1/2"



NOTE: THE TOP OF THE CONCRETE SHALL BE SMOOTH AND LEVEL $\pm 1/16"$ OVER THE SURFACE AREA. THE CONCRETE STRENGTH SHALL BE AT LEAST 5000 POUNDS PER SQUARE INCH AFTER 28 DAYS. REINFORCEMENT SPLICES MUST BE STAGGERED AND SHALL BE LAPPED TO DEVELOP FULL STRENGTH IN THE BOND.

DETAIL "A"
SCALE: 1" = 1'-0"



TYPICAL
ANCHOR BOLT
DETAIL
SCALE: N.T.S.
(6 REQUIRED)

- NOTES:
1. BOLTS AND NUTS SHALL CONFORM TO ASTM A307.
 2. NUTS SHALL BE AMERICAN STANDARD HEAVY HEXAGONAL.
 3. THREADS SHALL BE UNC. - 2A.
 4. ANCHOR BOLTS SHALL BE EQUALLY SPACED AROUND THE PERIMETER OF THE TANK.

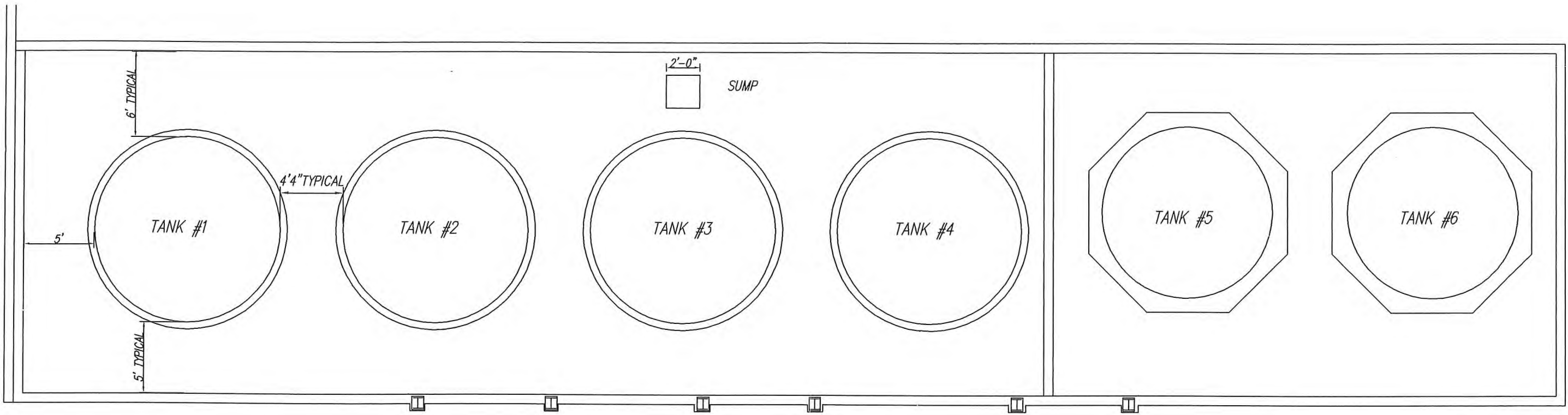
Unless Otherwise Specified all units are in feet and inches (12"-5").			
Tolerances are: feet / inches			
Feet	±3 inches	±.1	
Feet-Inch	±1/2 inch	±.03	
Fraction	±1/4 inch	±1.0°	

2	07-12-12	DLD	REVISED DRAWING NAME, FIGURE NUMBER AND LOGO
1	07-01-11	DLD	CORRECTED TITLE FROM 30,000 GAL TO 25,000 GAL
SYMB	DATE	BY	DESCRIPTION
CHANGES			
DRWN BY:	NW	DATE	6/10/11
CHKD. BY:		DATE	
PAULDING SUPPLEMENTAL FUELS 25,000 GALLON TANKS 1, 2, 3, AND 4 FOUNDATION PLAN AND DETAIL FIG. 4.9A			
ENVIRONMENT AND ENERGY SYSTECH ENVIRONMENTAL CORPORATION 3085 WOODMAN DRIVE DAYTON, OHIO 45420 937-643-1240			
SCALE	AS SHOWN	SHEET	1 OF 1
DWG. NO.	11-05C12	REV. NO.	2



00348

OK FOR EDDA TMM/MM
AUG 13 2014.



- NOTES:
- 1. FLOOR SLOPES 1/4" PER FOOT TO SUMP
 - 2. CONTAINMENT WALLS, TANKS 5-6, AND DIVISION WALL ALL EXISTING
 - 3. INTERIOR OF CONTAINMENT AREA WILL BE COATED WITH SOLVENT RESISTANT COATING

00349

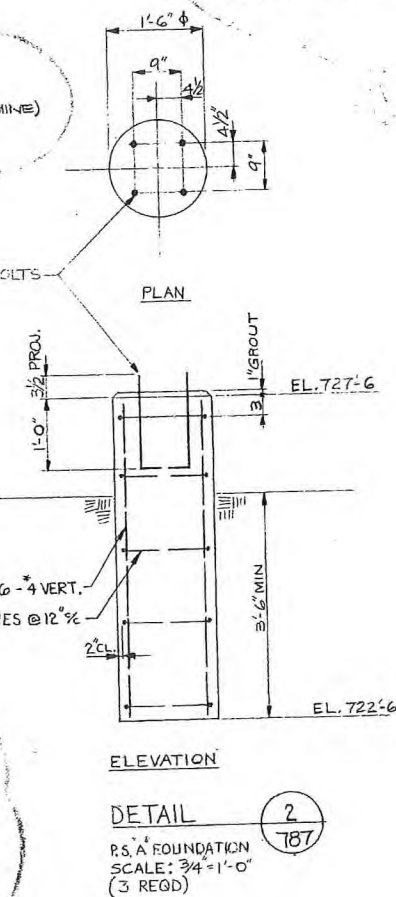
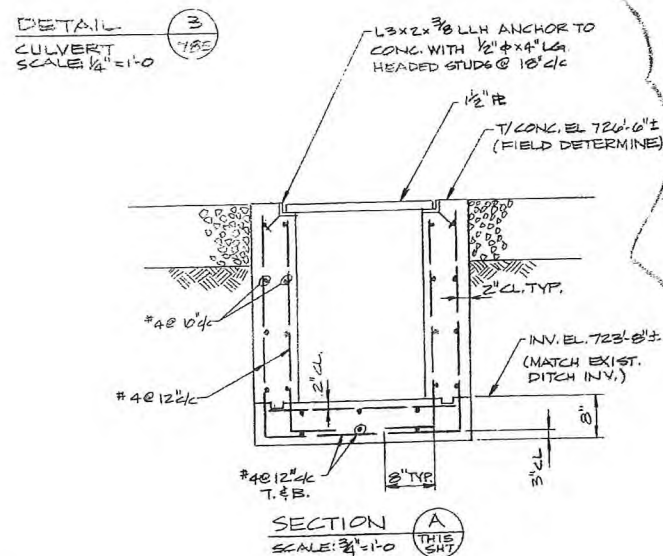
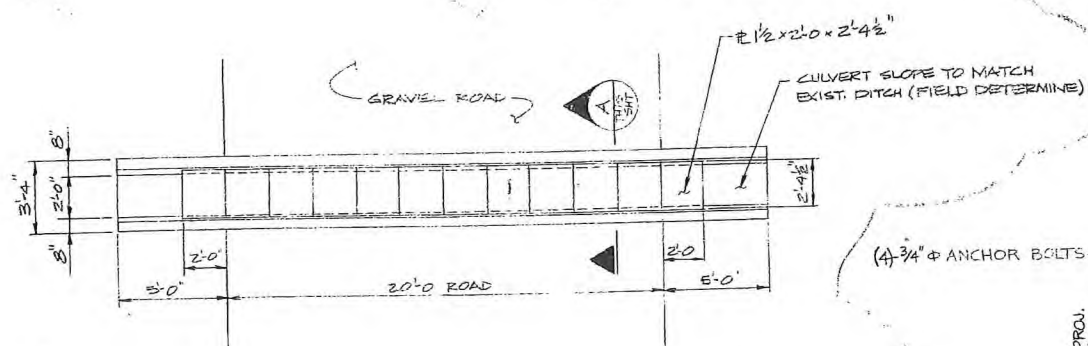
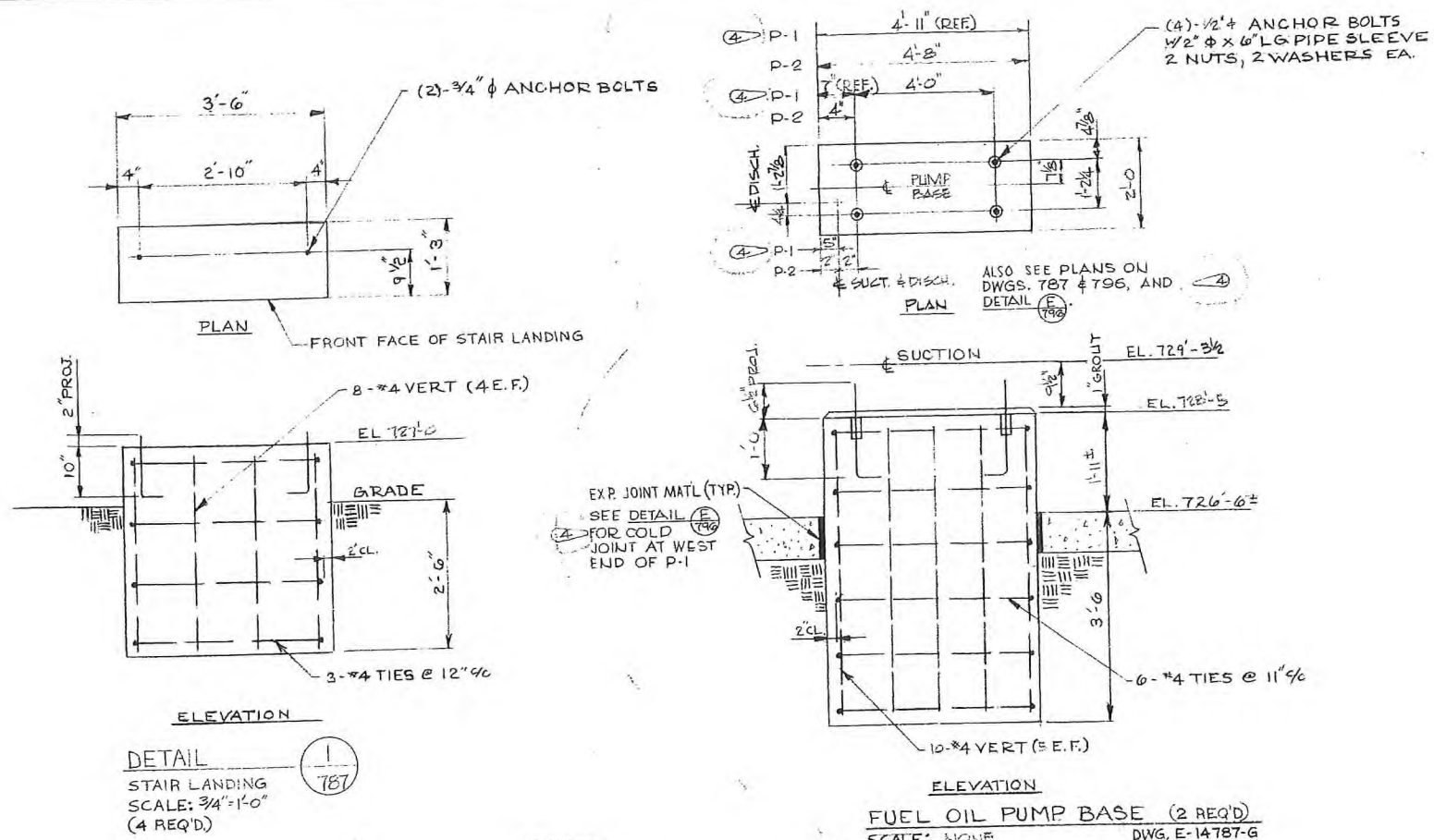
2 12/29/04 B.H.		CHANGED SUMP SIZE & LOCATION	
1 8/17/01 H. W.		ADDED NOTES	
SYMB.	DATE	BY	DESCRIPTION
CHANGES			
DRWN BY: H. W.	DATE 4/30/01	CHKD. BY:	DATE
PAULDING CO-PROCESSING FACILITY SMALL TANK FARM FIG. 4.10			
ENVIRONMENT AND ENERGY Systech Environmental Corporation 3085 WOODMAN DRIVE DAYTON, OHIO 45420 937-643-1240			
SCALE 9/32"=1'-0"	SHEET OF	DWG. NO. 11-05P30	REV. NO. 2



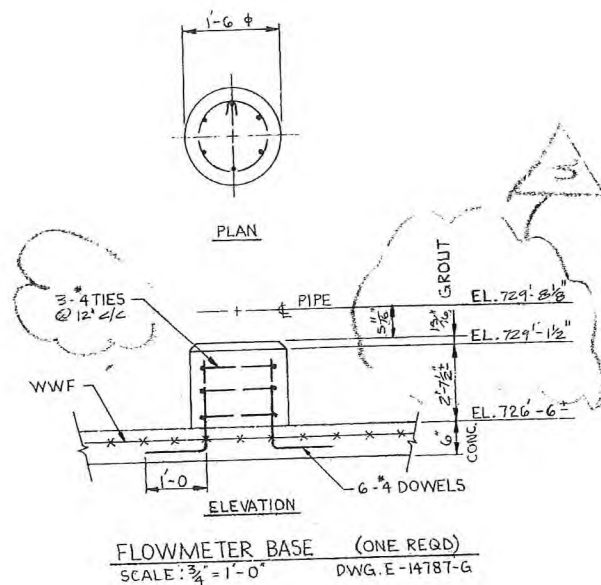
AUG 13 2014

BILL OF MATERIAL

MARK	REQ'D	DESCRIPTION	REMARKS	FURN. BY
------	-------	-------------	---------	----------



HOLD FOR CERTIFIED PUMP DUGS.



APPROVED _____ CHIEF ENGINEER

PENINSULAR PORTLAND CEMENT DIV.
PAULDING, OHIOGENERAL PORTLAND CEMENT COMPANY
DALLAS, TEXASWASTE FUEL UTILIZATION PROJECT
FOUNDATION DETAILS FIG. 4.11DRAWN BY: ESB DATE: 10-12-79
TRACED BY: GEL
CHECKED BY: GEL
SCALE: NOTED
CORRECT: YES
DRAWING NO. E-14789-G

BLAZON ENTERPRISES, INC.

ENGINEERING - CONSTRUCTION - ELECTRONIC & MACHINE PRODUCTS
4756 W. BANCROFT ST. • TOLEDO, OHIO 43615 • (419) 537-6567REVISION #3: PW 12-31-79
REMOVED UNLOADING
PUMP & STRAINER BASES
REV'D FLOWMETER ELEV
ADDED CULVERT DETAILREVISION #4: LHM 8-7-80
INCREASED FUEL OIL PUMP BASE P-1 4'-0" DIMENSION
TO 4'-11" TO 7'-0" TO BE ADDED NOTE REGARDING
COLD JOINT BETWEEN P-1 PUMP BASE AND CURB.
ADDED NOTE REFERRING TO PUMP BASE P-1 PLANS
ON OTHER DRAWINGS.REVISION #2: GEL 11-17-79
CHGD ELEV. FUEL
OIL PUMP & STRAINERREVISION #1: GEL 11-7-79
REVISED PUMP BASES
ADDED HOLD RAISED
STAIR LANDING

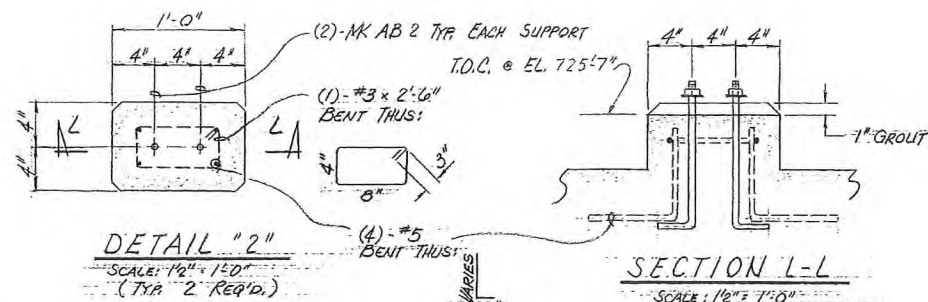
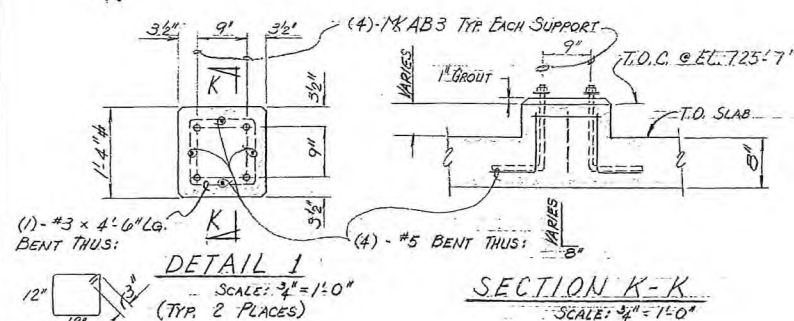
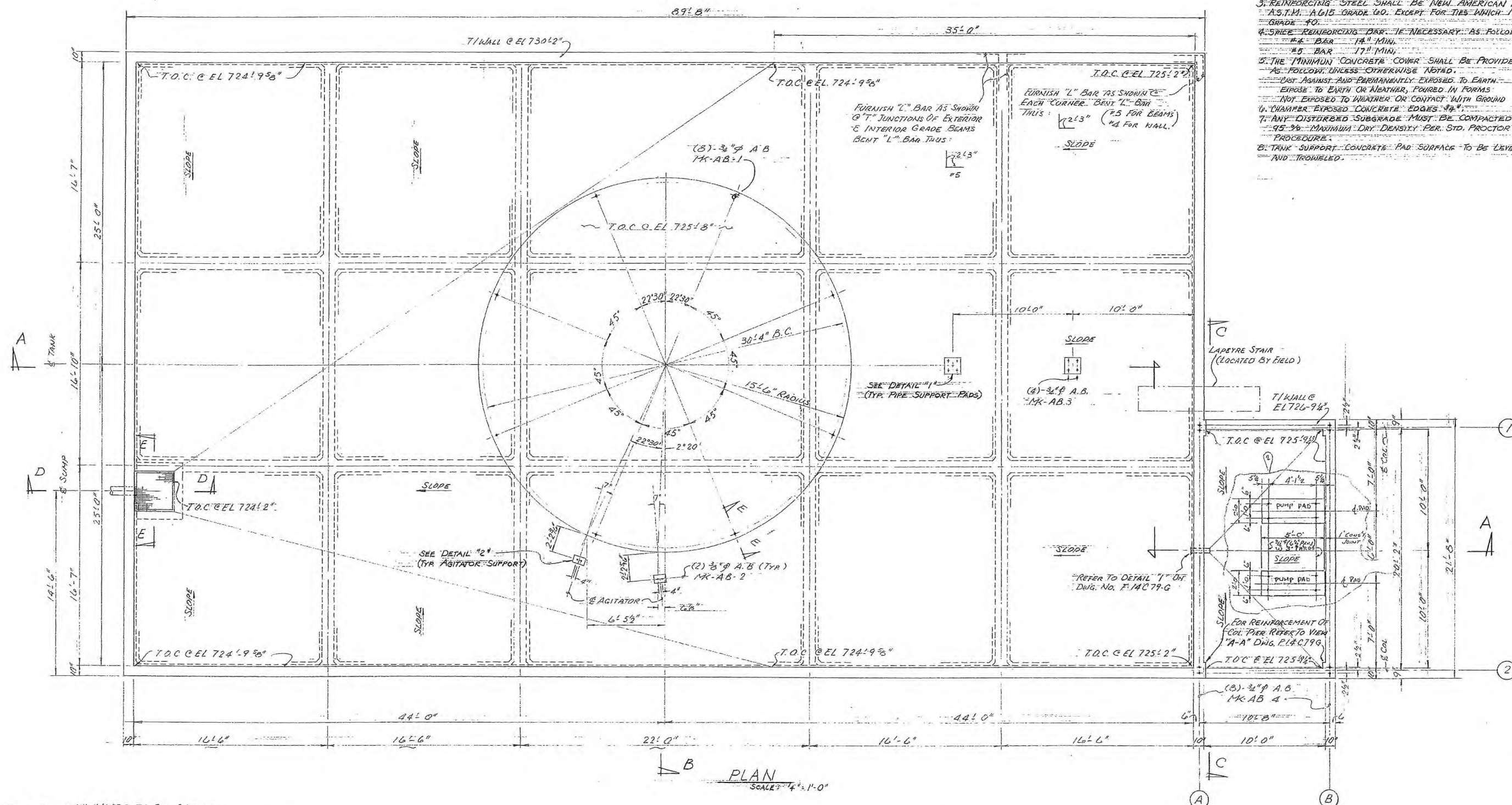
AUG 13 2014

BILL OF MATERIAL

MARK	REQ'D	DESCRIPTION	REMARKS	FURN. BY
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GENERAL NOTES:

1. ALL CONCRETE WORK SHALL CONFORM WITH A.C.I. BUILDING CODE STD. 318-77.
2. CONCRETE SHALL DEVELOP A MINIMUM COMPRESSIVE STRENGTH IN 28 DAYS OF 3000 P.S.I.
3. REINFORCING STEEL SHALL BE NEW AMERICAN BILLET A.S.T.M. A615 GRADE 60, EXCEPT FOR TIES WHICH MAY BE GRADE 40.
4. SPICE REINFORCING BAR IF NECESSARY AS FOLLOWS:
#4 BAR 14" MIN.
#5 BAR 17" MIN.
5. THE MINIMUM CONCRETE COVER SHALL BE PROVIDED AS FOLLOWS UNLESS OTHERWISE NOTED:
- 3" AGAINST AND PERMANENTLY EXPOSED TO EARTH
- 2" EXPOSED TO EARTH OR WEATHER, POURED IN FORMS
- 1 1/2" NOT EXPOSED TO WEATHER OR CONTACT WITH GROUND
- 1" IN CHAMFER EXPOSED CONCRETE EDGES
6. ANY DISTURBED SUBGRADE MUST BE COMPACTED TO 95% MAXIMUM DRY DENSITY PER STD. PROCTOR PROCEDURE.
7. TANK SUPPORT CONCRETE PAD SURFACE TO BE LEVEL AND TROWELED.



NOTE: - FOR SECTION A-A THROUGH SECTION E-E
REFER TO DRAWING F-14C78-G
- FOR SECTION F-F REFER TO DRAWING F-14C79-G

WORK THIS DRAWING WITH DRAWING NO F-14C78-G & F-14C79-G.

APPROVED: 3-13-86 CHIEF ENGINEER

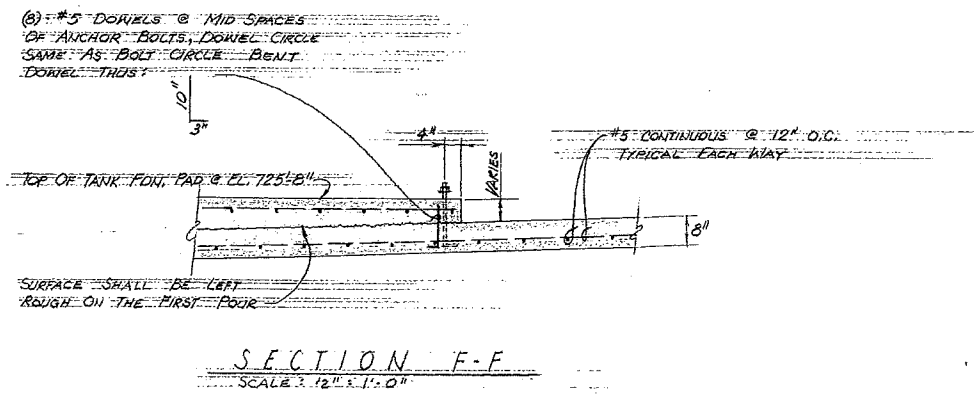
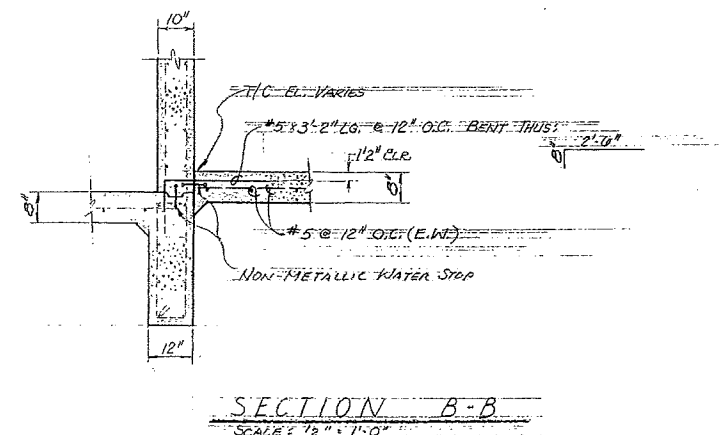
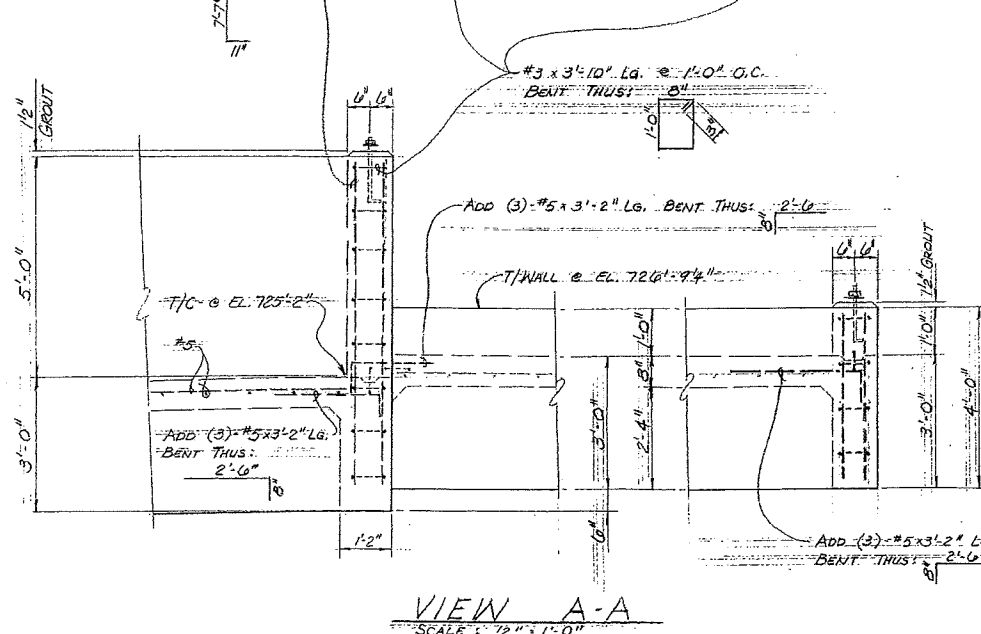
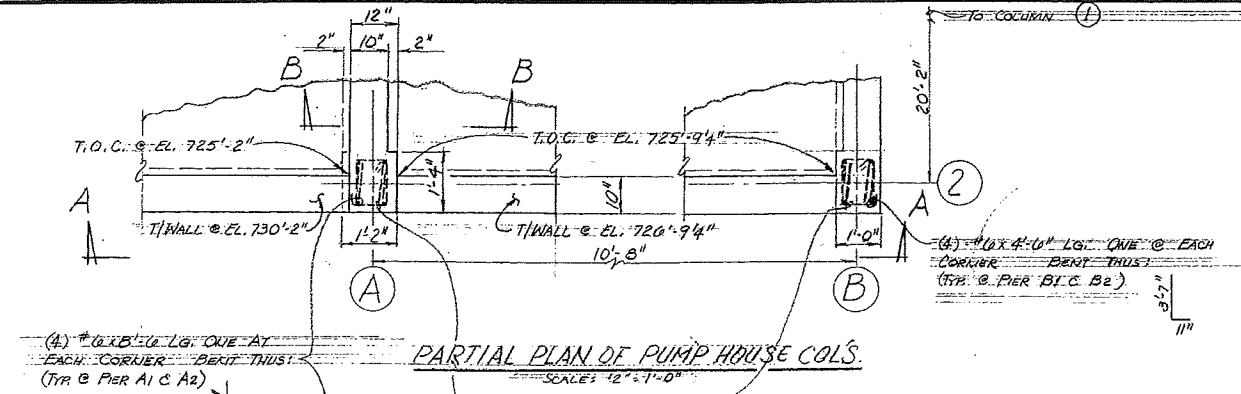
PENINSULAR DIVISION
RAULDING PLANTGENERAL PORTLAND INC.
DALLAS, TEXAS FIG. 4.12PLAN & SECTIONS
FOUNDATION
SUPPLEMENTAL FUEL

DRAWN BY: J.E. & J.D. DATE: 3-11-86
TRACED BY: JRS
CHECKED BY: JRS
CORRECT: JRS, C.O. 144

00351

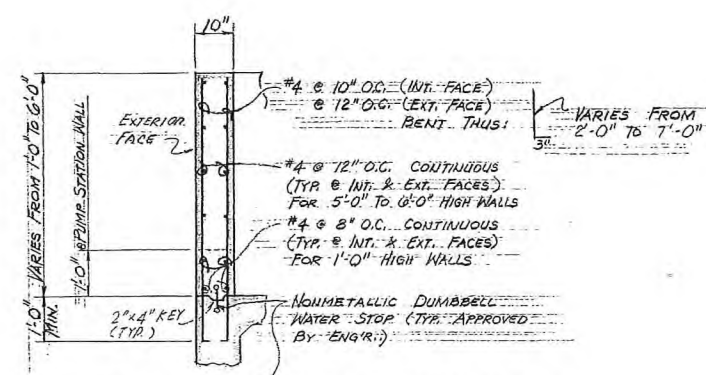
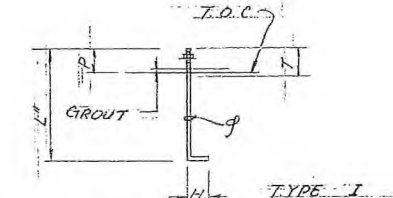
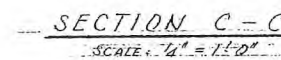
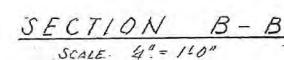
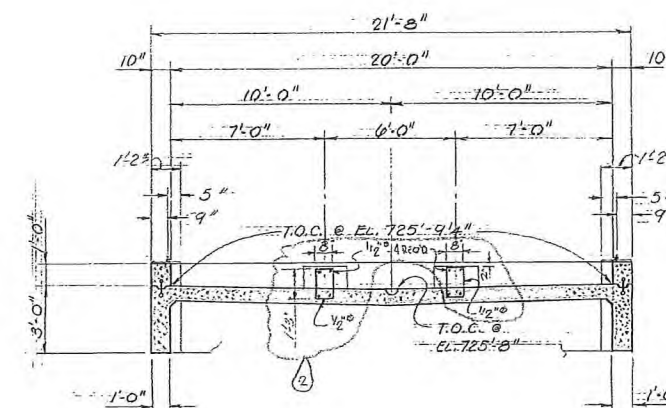
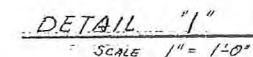
OHIO F-14C79-G
WM
AUG 13 2014

BILL OF MATERIAL				
MARK	REQ'D	DESCRIPTION	REMARKS	FURN. BY

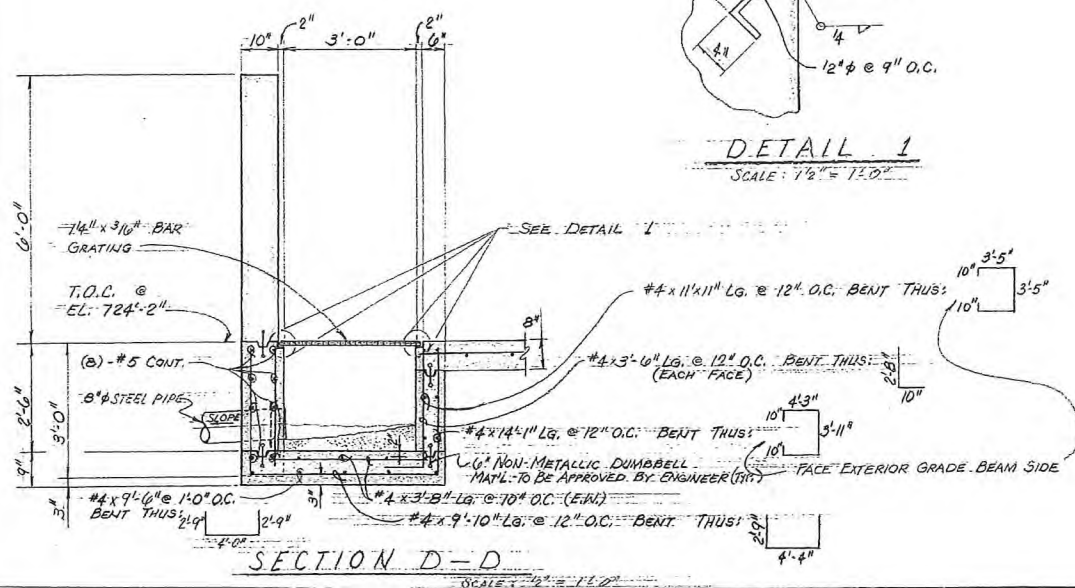
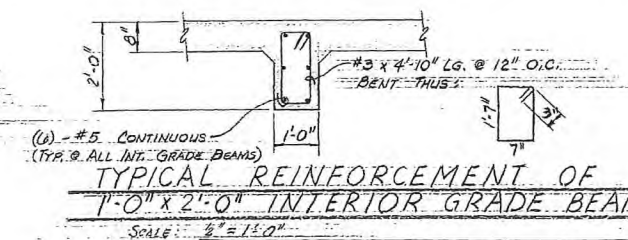
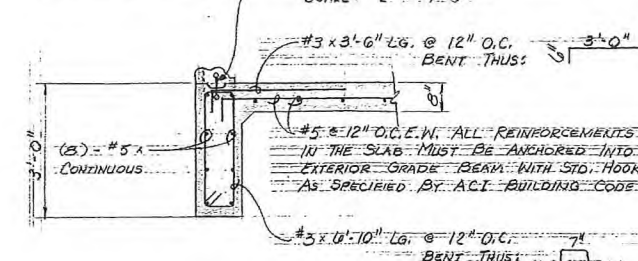
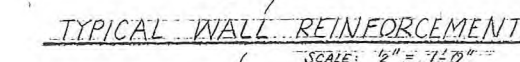


WORK THIS DRAWING WITH DRAWING NO'S. F-14C77-G & F-14C78-G

APPROVED: <u>3-12-86</u> CHIEF ENGINEER	
PENINSULAR DIVISION PAULDING PLANT	
GENERAL PORTLAND INC. DALLAS, TEXAS FIG. 4.13	
PLAN, VIEW & SECTIONS FOUNDATION SUPPLEMENTAL FUEL	
DRAWN BY: <u>DRS</u> DATE: <u>3-11-86</u>	DRAWING NO. <u>F-14C79-G</u>
TRACED BY: <u>DRS</u>	
CHECKED BY: <u>DRS</u> SCALE: <u>AS SHOWN</u>	
CORRECT: <u>DRS</u> C.O. <u>146</u>	



<u>ANCHOR BOLT SCHEDULE</u>									
MARK	Ø DIA	REQ'D	TYPE	L LENGTH	P. PROJ.	T THREAD	GROUT	H HOOR	REMARKS
AB-1	3/4"	3	I	14 1/2"	2"	2"	-	4"	FOR TANK
AB-2	3/8"	4	I	11 1/2"	3"	3"	1"	3"	FOR AGITATORS
AB-3	3/4"	3	I	11 1/2"	3"	3"	1"	3	FOR PIPE SUPPORTS
AB-4	3/4"	3	I	17 1/2"	4	3 1/2"	1 1/2"	3"	FOR BLOC COL BASE



25

APPROVED [Signature] 3-13-86 CHIEF ENGINEER

PENINSULAR DIVISION
PAULDING PLANT

GENERAL PORTLAND INC.
DALLAS, TEXAS

SECTIONS
FOUNDATION
SUPPLEMENTAL FUEL

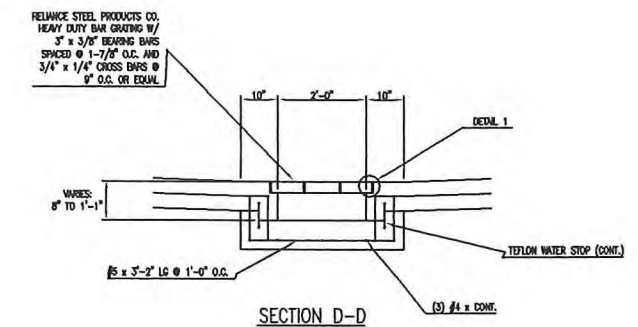
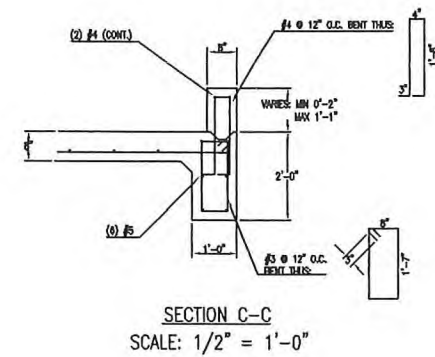
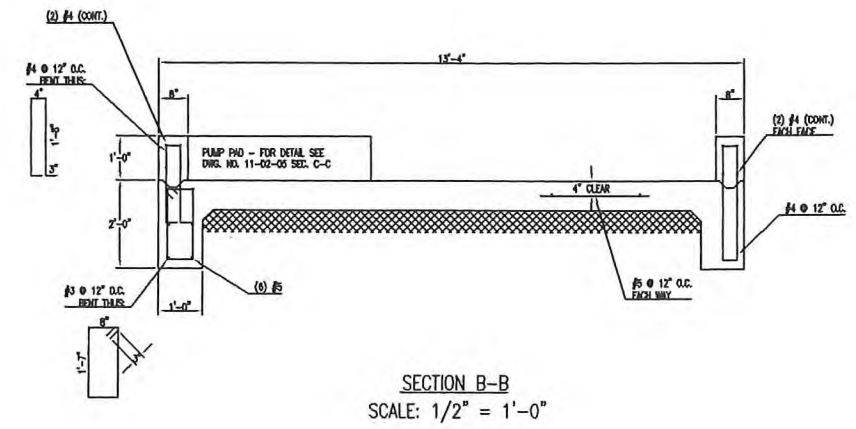
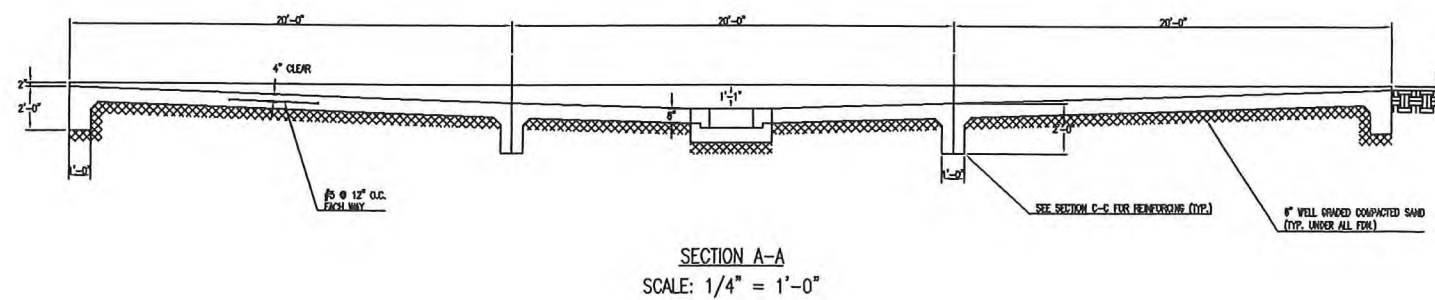
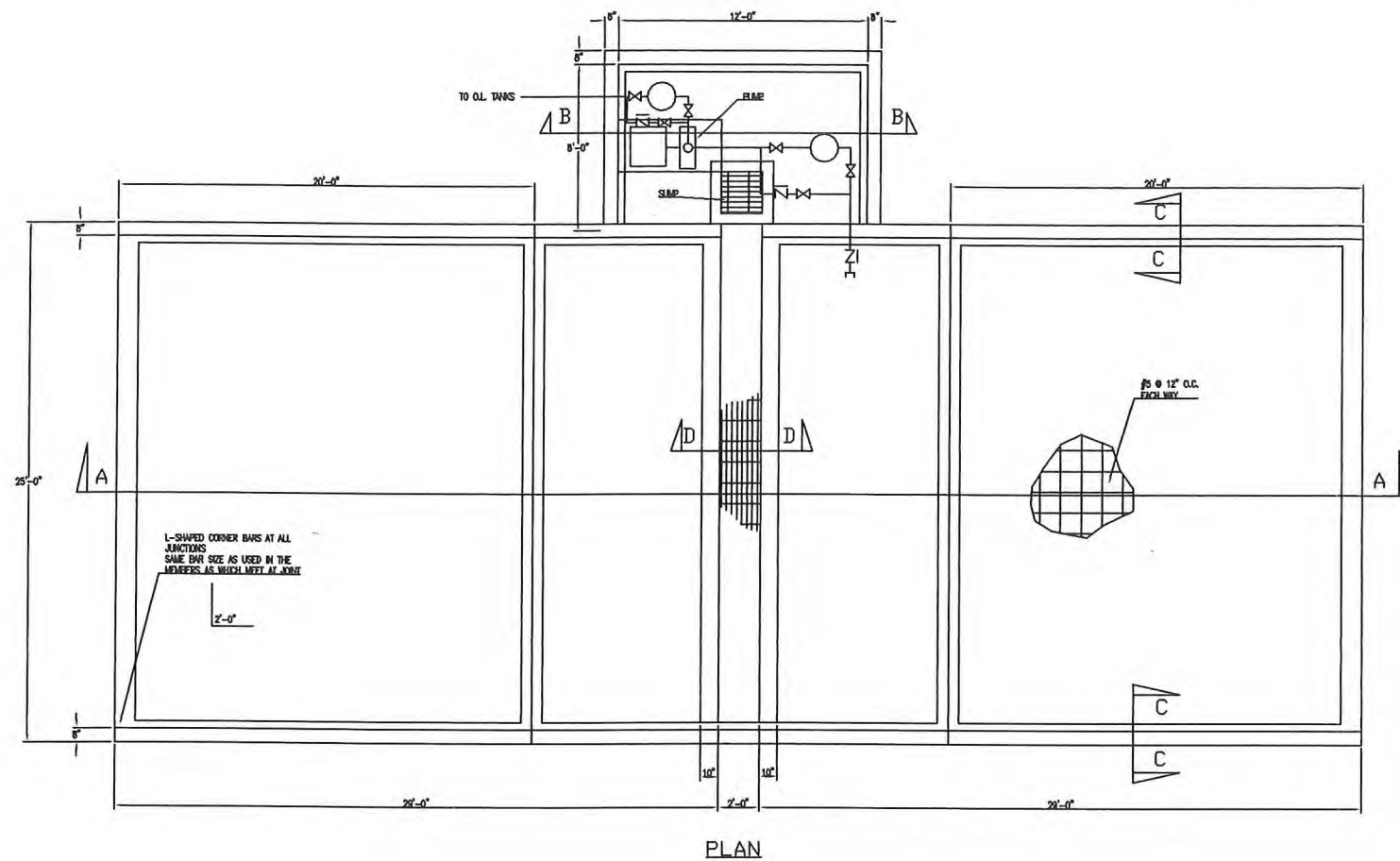
FIG. 4.14

FIG. 4.14

DRAWN BY: <u>Y. L. & D.</u>	DATE: <u>3/12/86</u>	DRAWING NO. <u>F-14C78-G</u>
TRACED BY: <u>"</u>	<u>"</u>	
CHECKED BY: <u>CDS</u>	<u>3-13-86</u>	
SCALE: <u>AS SHOWN</u>		
CORRECT: <u>CDS</u>	C.O. <u>14/c</u>	

DRAWING NO.
F-74C78-G

OHIO EPA - DMWM
AUG 13 2014



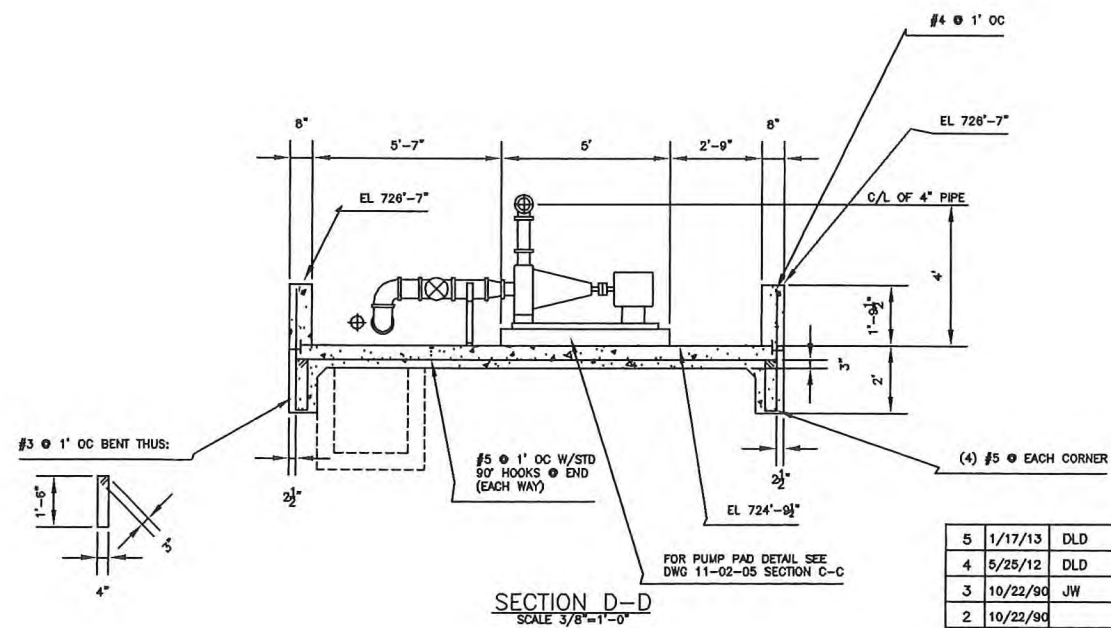
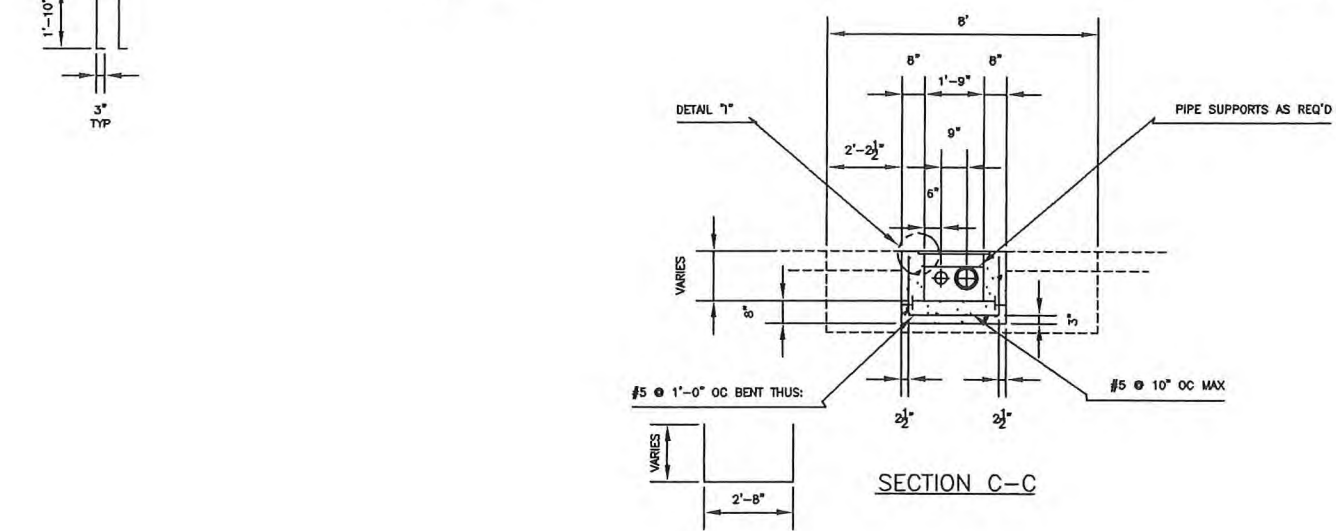
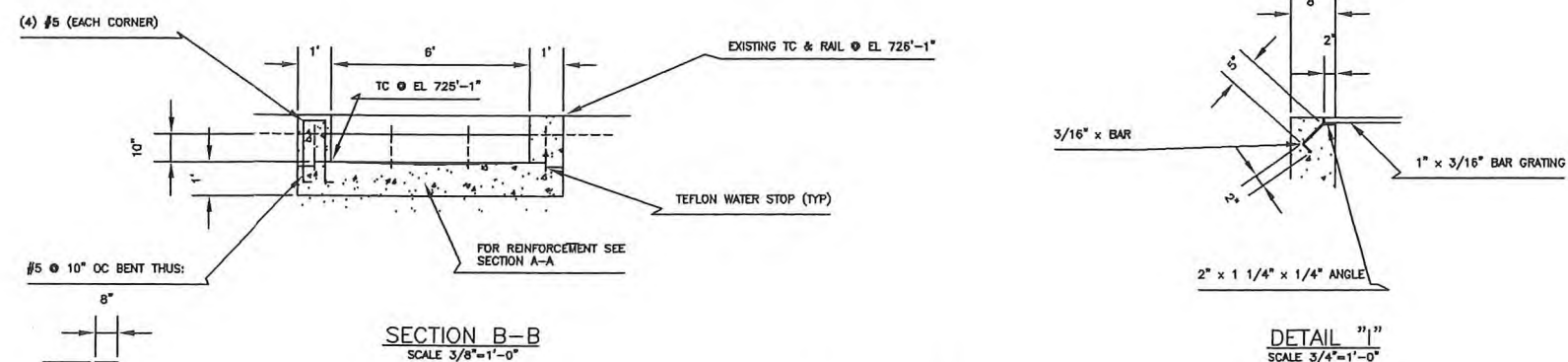
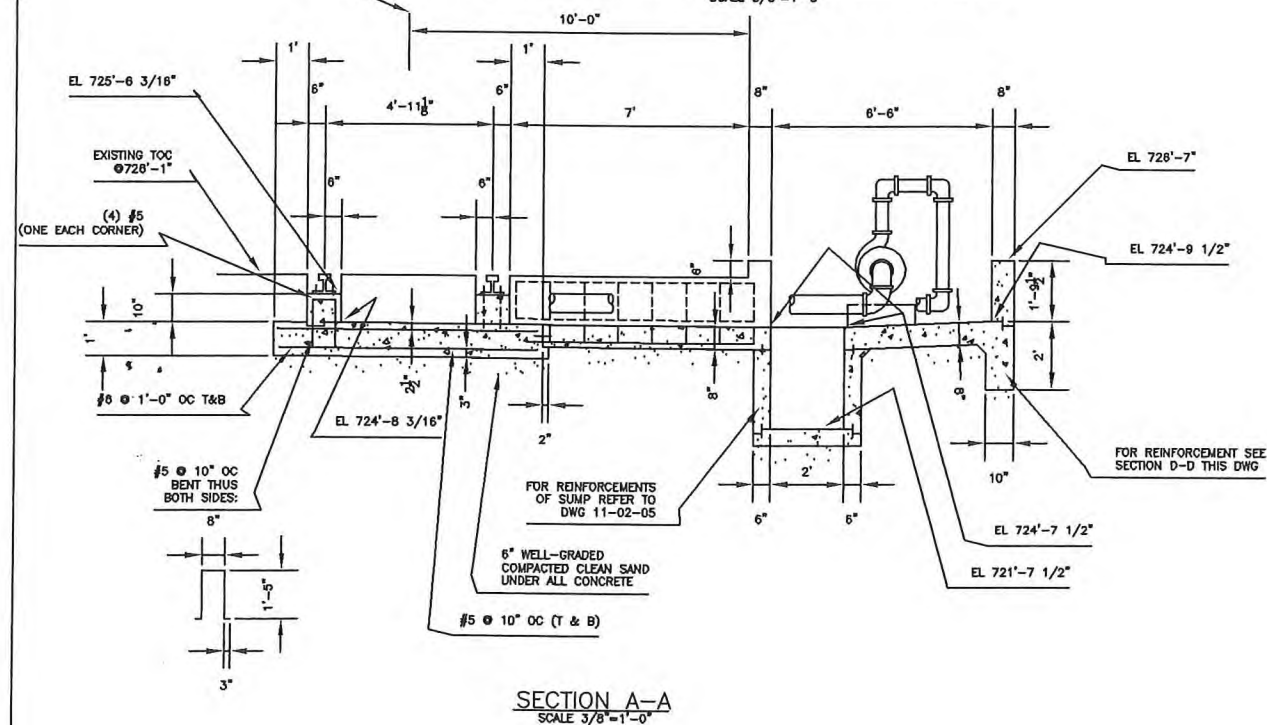
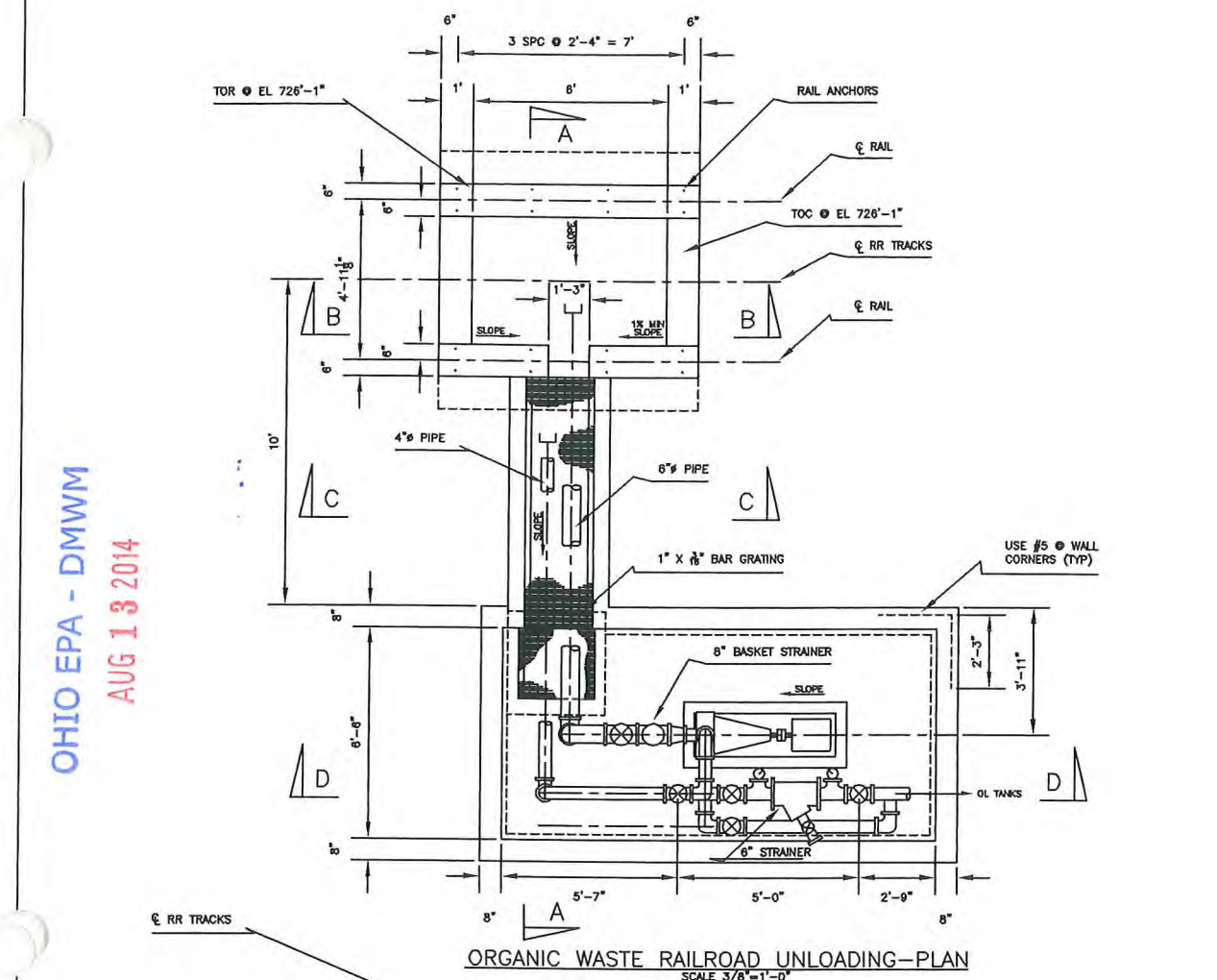
FOR SUMP DETAIL SEE DWG. NO. 11-02-05

5	1/17/2013	OLD	ADDED DETAILS FROM REVISION 1
4	5/24/2012	OLD	REVISED DRAWING NAME, ADDRESS, FIGURE NUMBER AND LOGO
3	2/1/2000	NEW	TRANSFERRED TO CAD/ GENERAL REVISION
2			
1			
SYMB.	DATE	BY	DESCRIPTION
CHANGES			
DRWN BY: Benham Group		DATE	CHKD. BY:
			DATE
PAULDING SUPPLEMENTAL FUEL FACILITY			FIGURE NO. 4.15
UNCONSTRUCTED TRUCK UNLOAD			
PLAN, SECTIONS, & DETAILS			FOUNDATION & PAVING
ENVIRONMENT AND ENERGY			
Systech Environmental Corporation			
3085 WOODMAN DR DAYTON, OHIO 45420 937/643-1240			
SCALE		SHEET	DWG. NO.
1/4"=1'-0"		1 OF 1	11-02-16
			REV. NO. 4

00354

SYSTECH

OHIO EPA - DMWM
AUG 13 2014



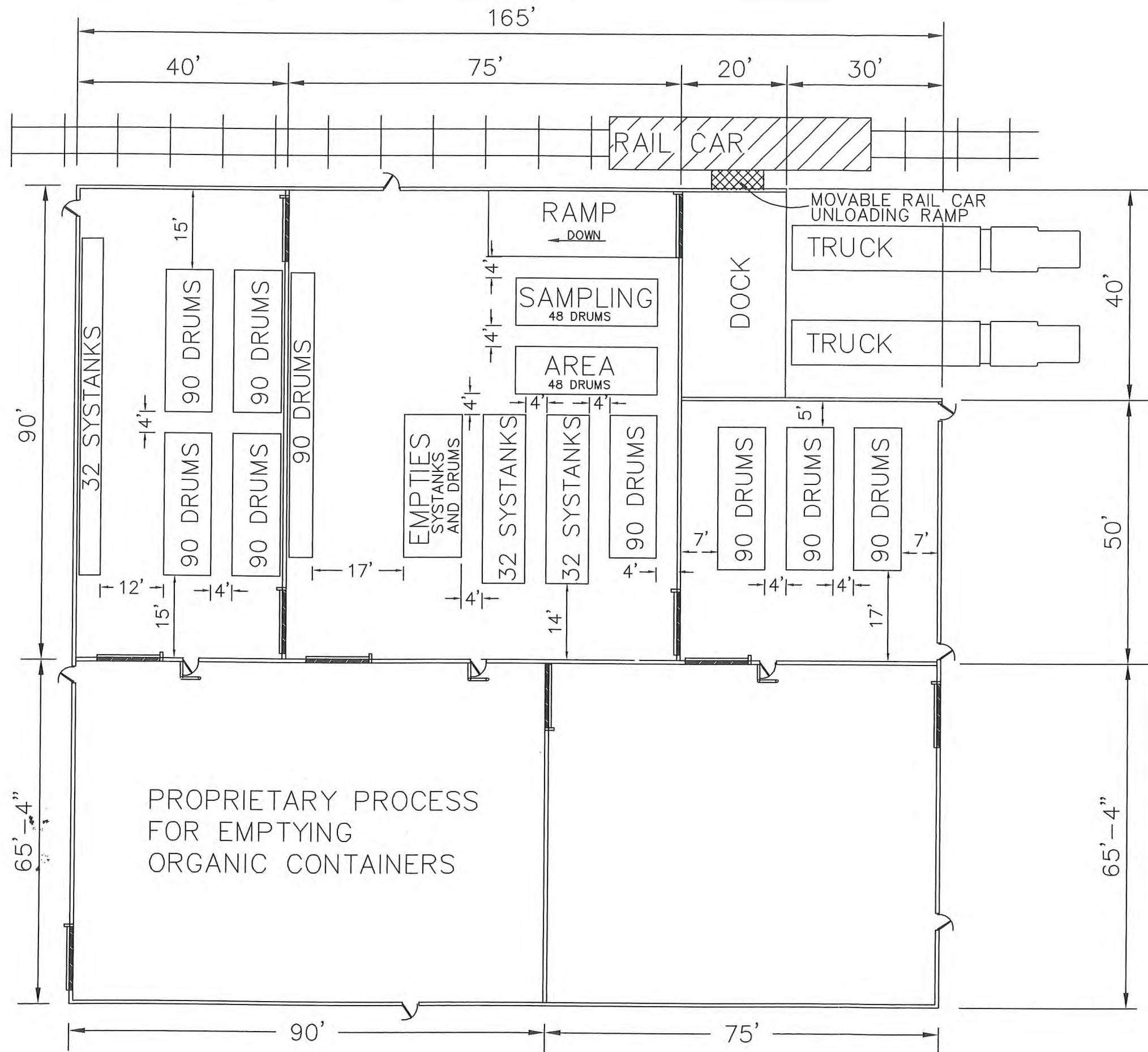
NOTES
FOR LOCATION OF THIS UNLOADING REFER TO DRAWING NO. 11-02-02

3	1/17/13	DLD	ADDED DETAILS FROM REV 2
4	5/25/12	DLD	REVISE ADDRESS, LOGO AND FIGURE NUMBER
3	10/22/90	JW	TRANSFERED TO CAD
2	10/22/90		MODIFIED NOTES
1	8/29/88	T.B.G.	CHNG PIPE RT FROM "AOL TANKS" TO "OL TANKS"/ NUMEROUS CHANGES
SYMB DATE		BY	DESCRIPTION
CHANGES			
DRWN BY: BENHAM GROUP		DATE 11/11/88	CHKD. BY: _____
			DATE _____
PAULDING WASTE MANAGEMENT FIGURE NO. 4.16 PLAN & SECTIONS RAILROAD UNLOADING, ORGANIC WASTE			
ENVIRONMENT AND ENERGY			
SYSTECH ENVIRONMENTAL CORPORATION			
3085 WOODMAN DR		DAYTON, OHIO 45420	937/643-1240
SCALE 3/8" = 1'-0"	SHEET 1 OF 1	DWG. NO. 11-02-17	REV. NO. 5

5555



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AUG 13 2014



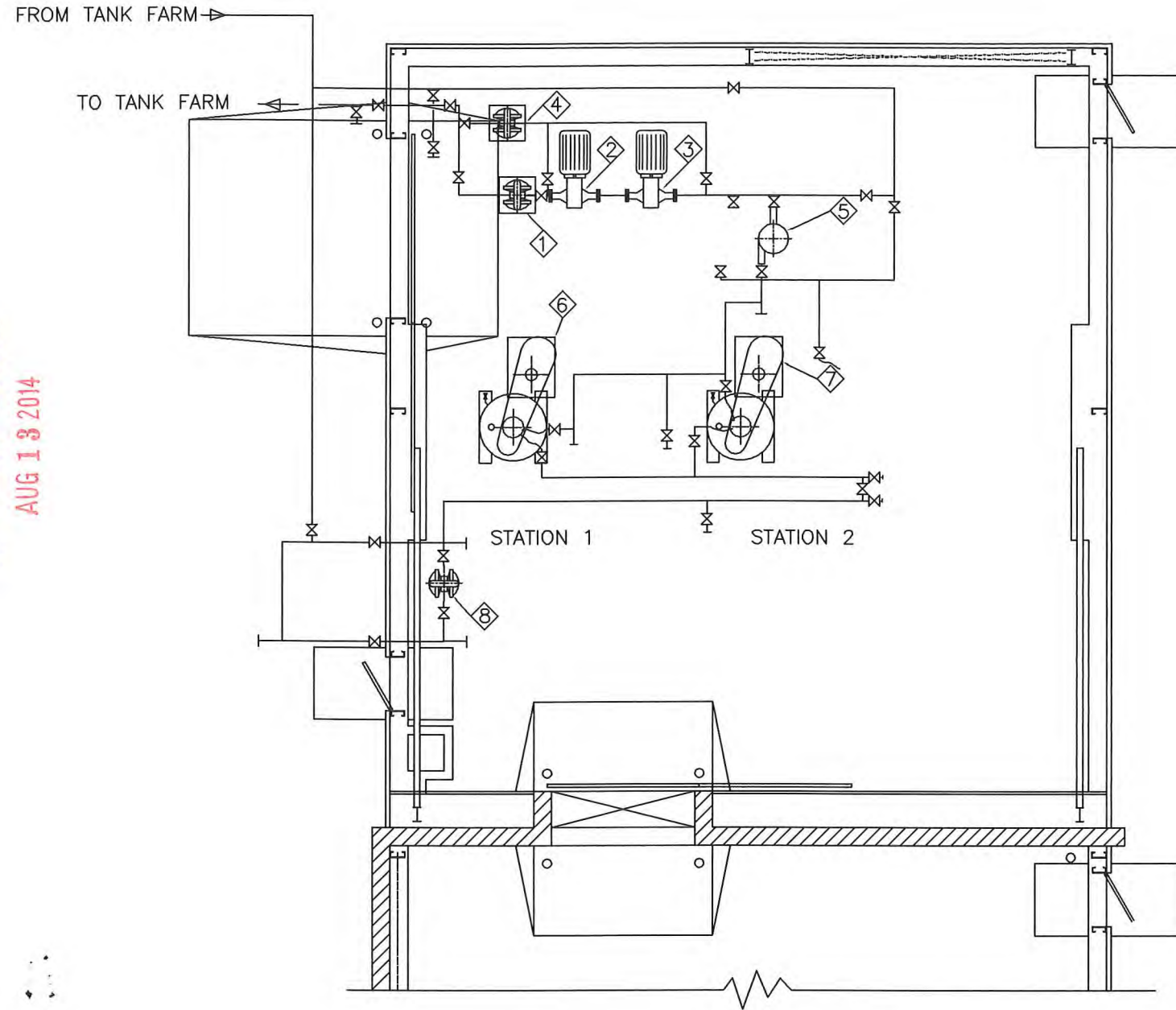
00357

3	5/25/12	DLD	REVISED ADDRESS, LOGO AND CORP NAME
2	12/9/02	NW	REMOVED PROPRIETARY NOTE.
1	9/22/88	BJA	ADDED PROPRIETARY NOTE. REMOVED 270 DRUMS, 64 SYSTANKS.
SYMB.	DATE	BY	DESCRIPTION
CHANGES			
DRWN BY:	RAC	DATE 8/27/88	CHKD. BY: DAH
PAULDING WASTE MANAGEMENT FIGURE NO. 4.18		DATE 8/29/88	
GENERAL ARRANGEMENT			
ORGANIC STORAGE			
ENVIRONMENT AND ENERGY			
SYSTECH ENVIRONMENTAL CORPORATION			
3085 WOODMAN DR. DAYTON, OHIO 45420		937/643-1240	
SCALE	SHEET 1 OF 1	DWG. NO.	REV. NO.
NTS		11-02-23	3



OHIO EPA - DMWM

AUG 13 2014



FLOOR PLAN

SCALE 1/4"=1'-0"

PROCESS EQUIPMENT SCHEDULE		
ITEM	DESCRIPTION	REMARKS
1	DIAPHRAGM PUMP	FLOOR MOUNTED
2	GRINDER	FLOOR MOUNTED
3	GRINDER	FLOOR MOUNTED
4	DIAPHRAGM PUMP	FLOOR MOUNTED
5	KNOCK OUT BOX	FLOOR MOUNTED
6	MIXER	FLOOR MOUNTED
7	MIXER	FLOOR MOUNTED
8	DIAPHRAGM PUMP	FLOOR MOUNTED

5	5/25/13	DLD	CORRECTED PIPING, ORIENTATION OF PUMPS, LOGO AND ADDED FIGURE NUMBER
4	5/25/12	DLD	REMOVED KNOCKOUT BOX, ADDED PUMP AND FIGURE NO AND REVISED LOGO
3	2/12/03	NW	REVISED FOR PERMIT
2	12/10/02	NW	REVISED PER FACILITY COMMENTS
1	7/12/88	TCR	DELETED SHAR LIGHT DETAIL
SYMB	DATE	BY	DESCRIPTION
CHANGES			
DRWN BY: LSE		DATE 5/13/88	CHKD. BY: DATE
PAULDING SUPPLEMENTAL FUELS FIG 4.19			
CONTAINER HANDLING FACILITY			
PROCESS EQUIPMENT			
ENVIRONMENT AND ENERGY			
SYSTECH ENVIRONMENTAL CORPORATION			
3085 WOODMAN DRIVE DAYTON, OHIO 45420 937-643-1240			
SCALE	SHEET	OF	DWG. NO. 11-01-M05 REV. NO. 5
AS NOTED			

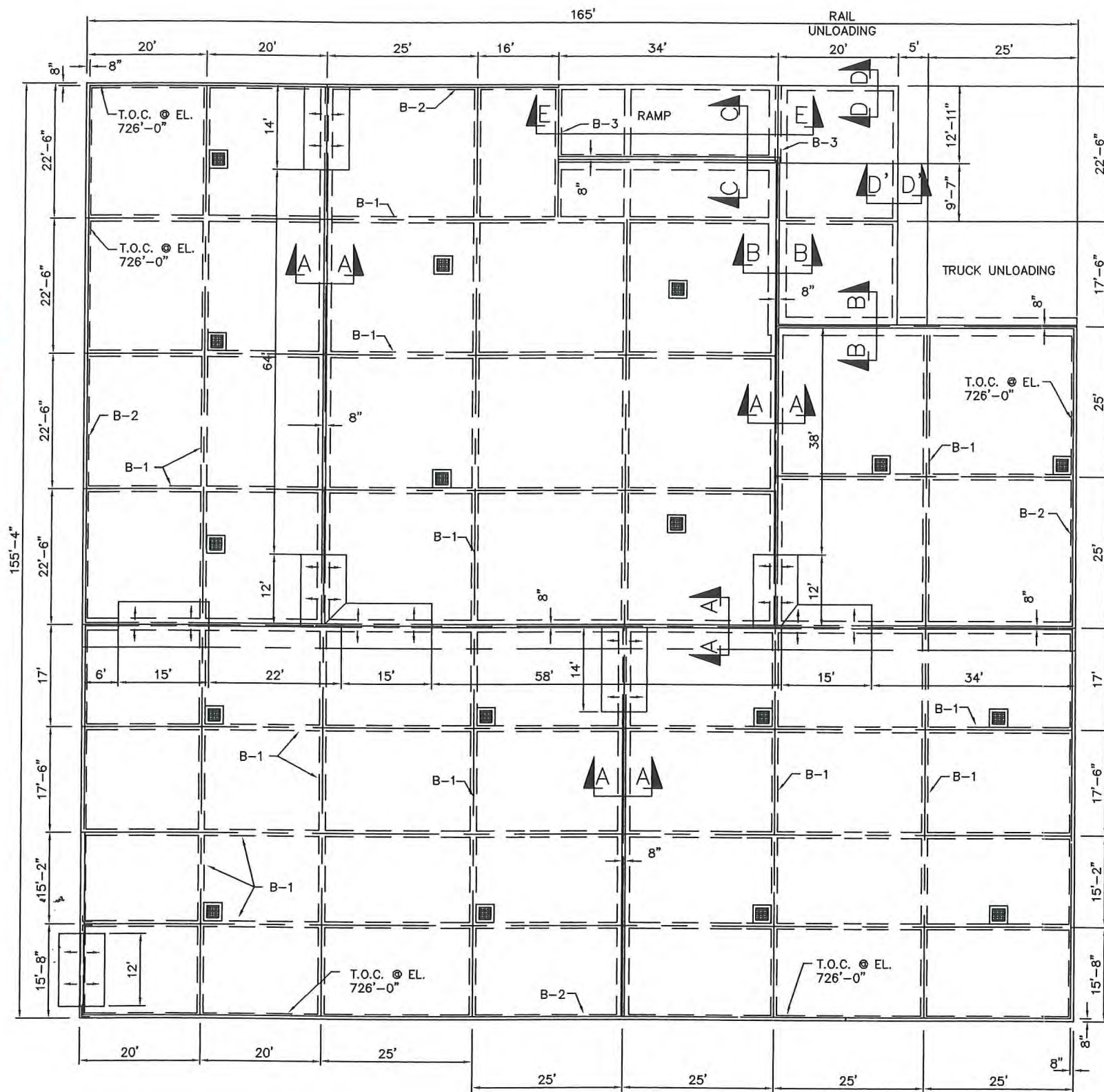
PROJECT NO.
HEAPY ENGINEERING
MECHANICAL ELECTRICAL CONSULTANTS
DAYTON-COLUMBUS, OHIO

Unless Otherwise Specified all units
are in feet and inches (12"-5").
Tolerances are: feet / inches
Feet .03 inches .x .01
Ft.-Inch 1/2 inch .x .03
Fraction 1/4 inch Angles 1/2°

00358

SYSTECH®

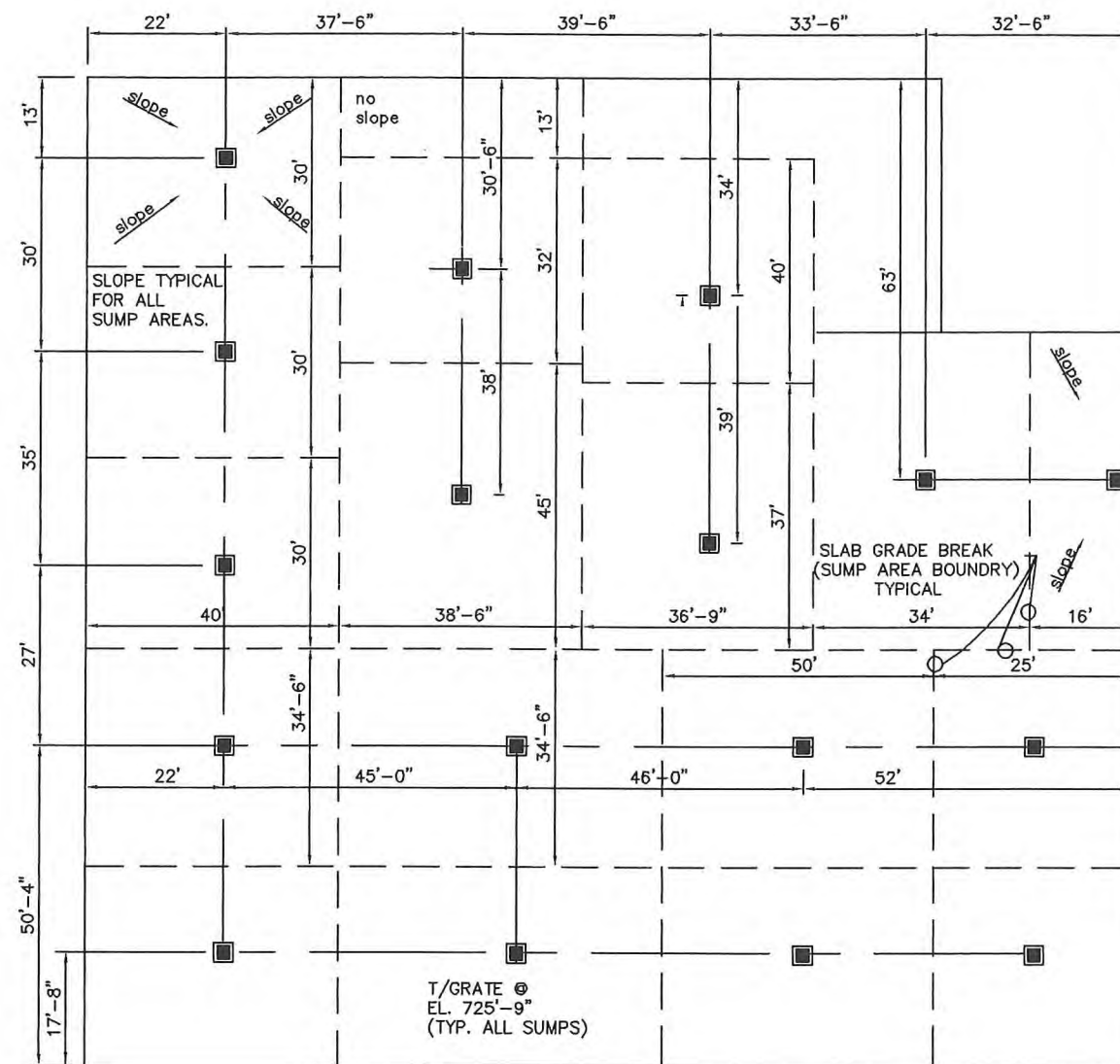
AUG 13 2014



PLAN

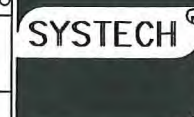
3/32" = 1'-0"

NOTE:
BUILDING FOUNDATIONS ARE TO BE IN ADDITION TO
CONTAINMENT CONCRETE SHOWN.

SUMP LOCATIONS
NTS

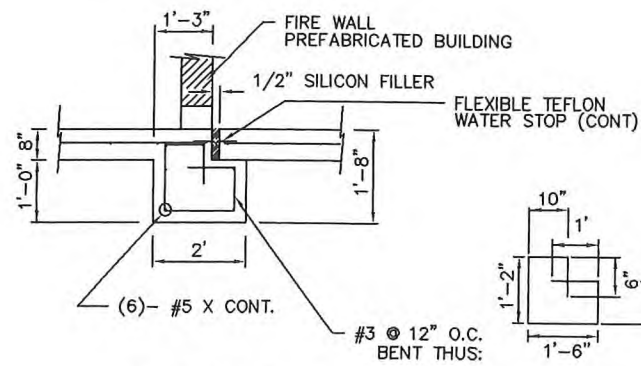
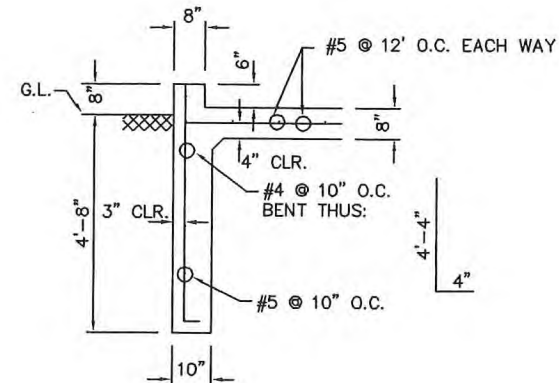
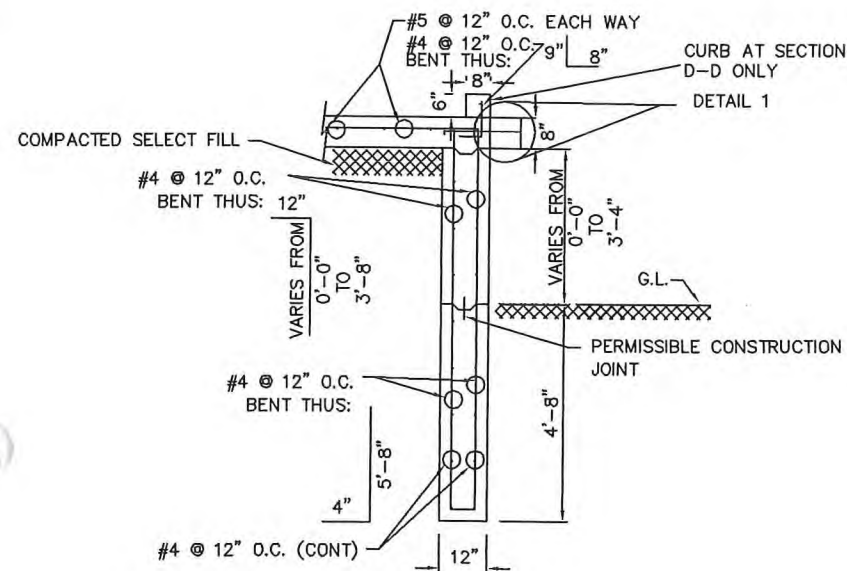
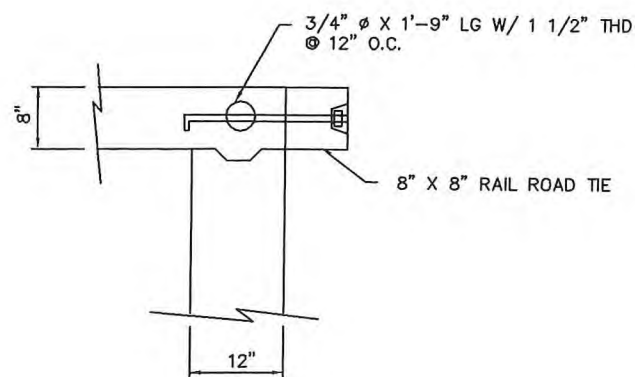
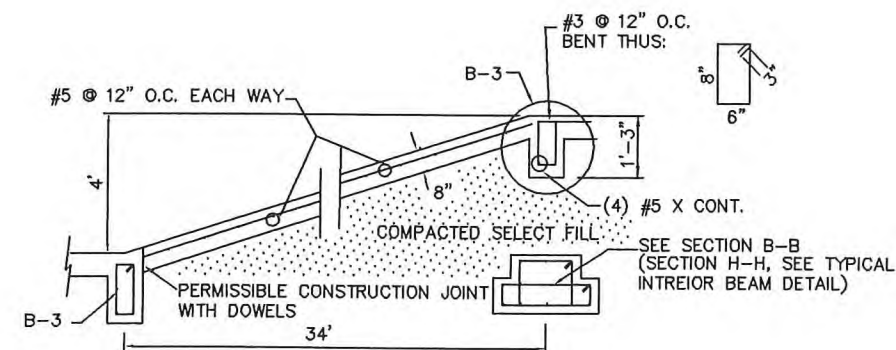
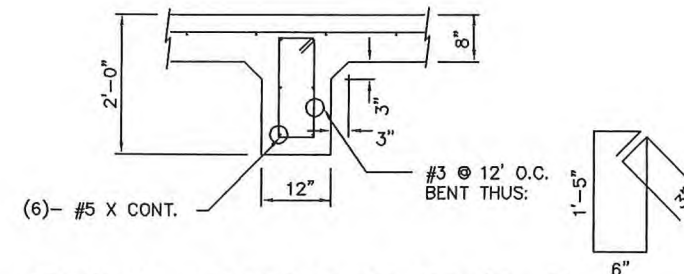
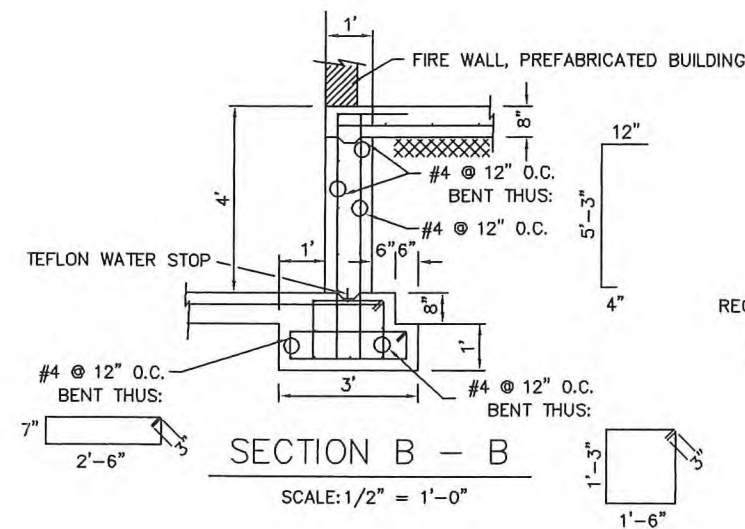
APPROVALS:
ENGINEERING _____
OPERATIONS _____
SAFETY _____
CONFIDENTIAL INFORMATION
This drawing and design are confidential
and are the property of SYSTECH Corp.
This drawing may not be copied, in
whole or in part, or released to others
without the written consent of SYSTECH.

2	1/26/98	NW	MODIFIED PER FACILITY COMMENTS
1	8/29/88	BJA	REMOVED AOL TANKS, CHANGED WALLS, REVISED TITLE BLOCK
SYMB.	DATE	BY	DESCRIPTION
CHANGES			
DRWN BY:	KAB	DATE	1/13/88
CHKD. BY:	HLS	DATE	1/13/88
PAULDING WASTE MANAGEMENT PLAN CONCRETE LAYOUT ORGANIC AREA FIG. 4.20			
ENVIRONMENT AND ENERGY SYSTECH CORPORATION 3085 Woodman Dr. Dayton, Ohio 45420 937/643-1240			
SCALE	SHEET 1 OF 1	DWG. NO.	11-02-12
AS SHOWN		REV. NO.	2

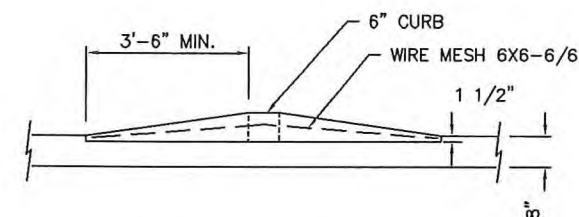


00359

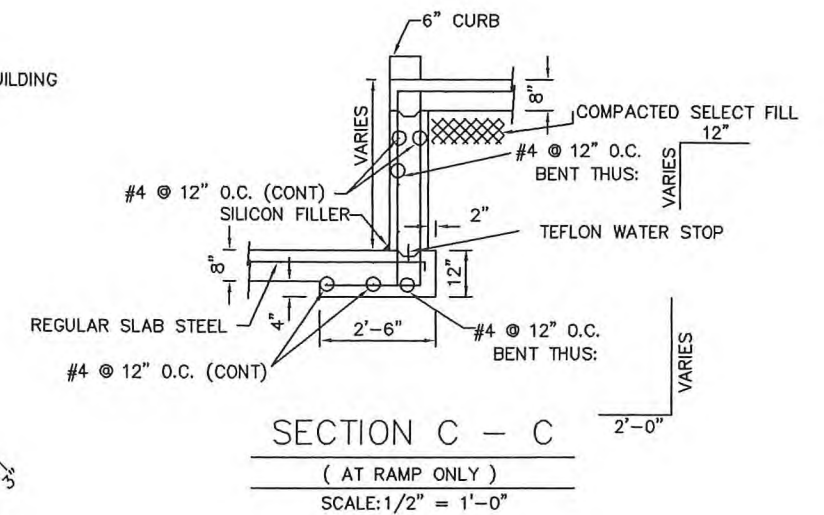
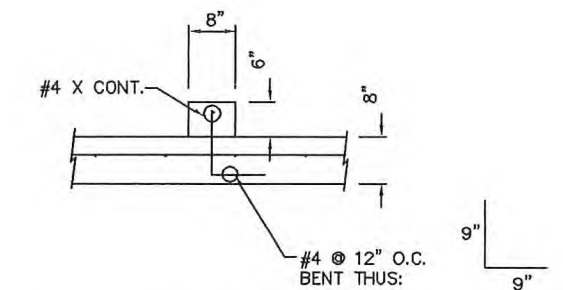
AUG 13 2014

SECTION A - A
SCALE: 1/2" = 1'-0"TYPICAL EXTERIOR GRADE
BEAM WITH CURB (B-2)EXCEPT @ A.O.L. AREA
& DOCK - RAMP AREA
SCALE: 1/2" = 1'-0"SECTION D' - D'
SECTION D - D
(AT RAMP AND DOCK)
SCALE: 1/2" = 1'-0"DETAIL 1
AT UNLOAD SIDE
SCALE: 1" = 1'-0"SECTION E-E & BEAM B-3 DETAIL
N.T.S.

TYPICAL INTERIOR BEAM (B-1)

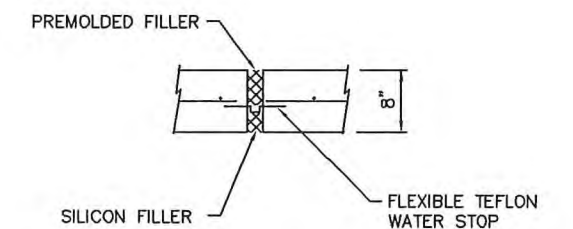
EXCEPT @ FIRE WALL
& EXPANSION JOINT
SCALE: 3/4" = 1'-0"TYPICAL RAMP SECTION
SCALE: 1/2" = 1'-0"

NOTE:

GRADE BEAM AND FOUNDATION DESIGN
COMPATIBLE WITH BUILDING FOUNDATION
DESIGN AT TIME OF SELECTION OF
PREFABRICATED BUILDING.SECTION C - C
(AT RAMP ONLY)
SCALE: 1/2" = 1'-0"

8" INTERIOR CURB (TYP.)

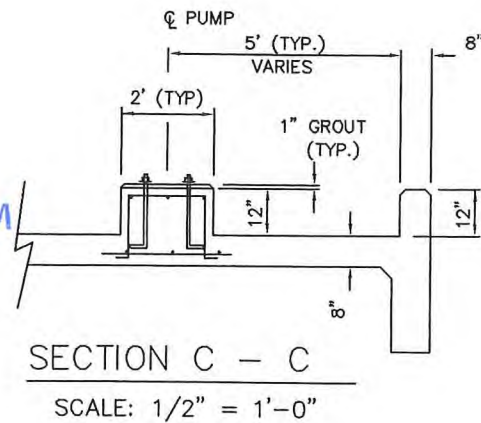
SCALE: 3/4" = 1'-0"

EXPANSION JOINT @ 8" CURB
(PLAN VIEW)
SCALE: 1" = 1'-0"

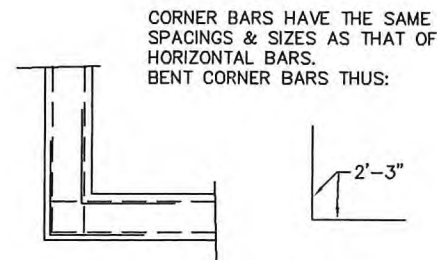
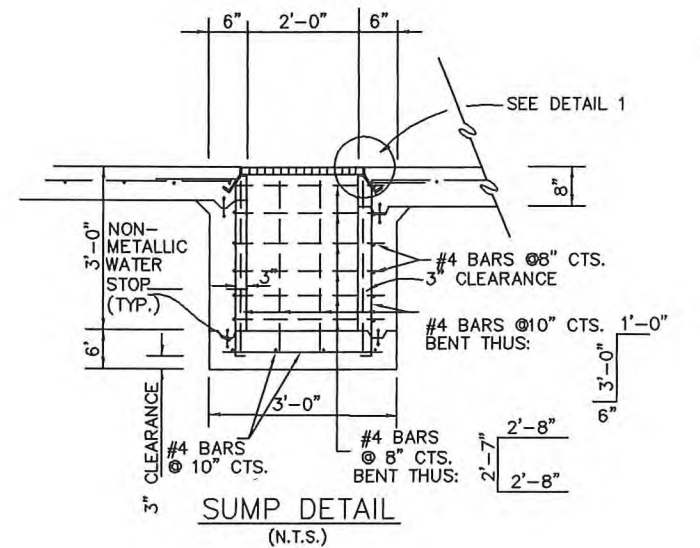
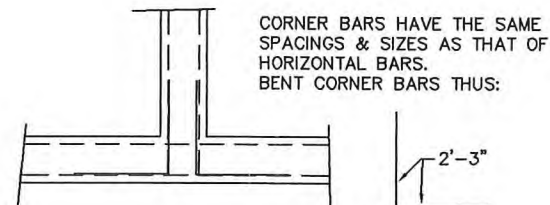
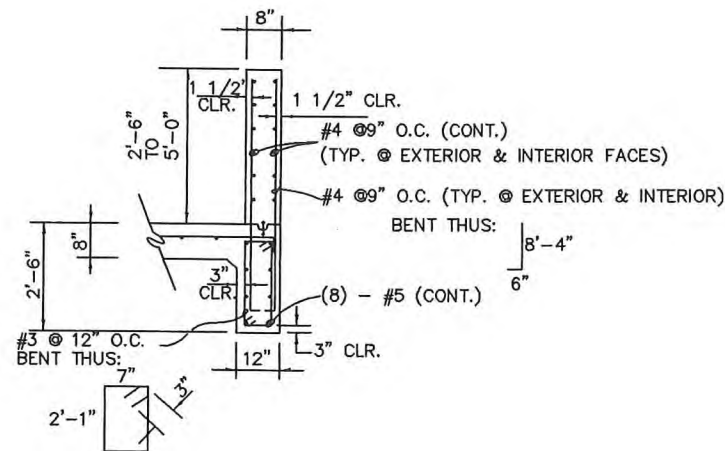
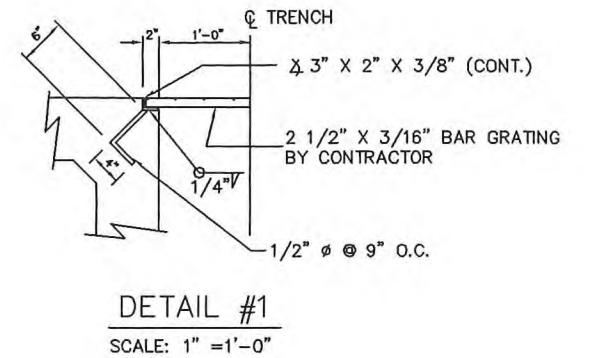
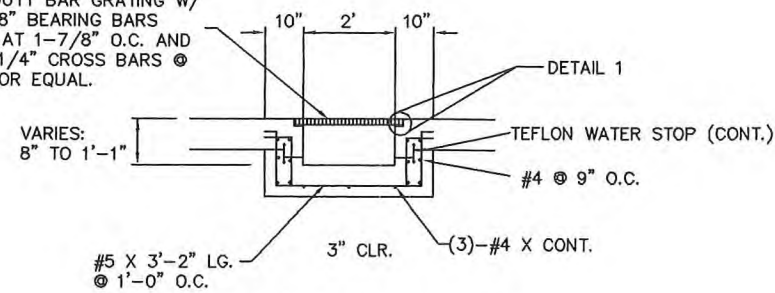
00360

3	5/25/12	DLD	REVISE ADDRESS AND LOGO
2	1/97	BS	REMOVED INORGANIC REF.
1	8/26/88	BJA	OLD DWG #11-02-19
SYMB.	DATE	BY	DESCRIPTION
CHANGES			
DRWN BY:	KAB	DATE	1/13/88
CHKD. BY:	HLS	DATE	1/13/88
PAULDING WASTE MANAGEMENT FIG 4.22 SECTIONS AND DETAILS CONTAINER STORAGE ORGANIC STORAGE AREAS			
ENVIRONMENT AND ENERGY SYSTECH ENVIRONMENTAL CORPORATION 3085 WOODMAN DR. DAYTON, OHIO 45420 937/643-1240			
SCALE	AS SHOWN	SHEET	1 OF 1
DWG. NO.	11-06C02	3	REV. NO.

OHIO EPA - DMWM
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RELIANCE STEEL PRODUCTS CO.
HEAVY DUTY BAR GRATING W/
3" X 3/8" BEARING BARS
SPACED AT 1-7/8" O.C. AND
3/4" X 1/4" CROSS BARS @
9" O.C. OR EQUAL.



WORK THIS DWG. WITH DWG. 11-02-04,
11-02-07, 11-02-12, 11-02-19.

SECTIONS A-A, B-B, C-C, D-D, ARE
FROM DWG. 11-02-04.

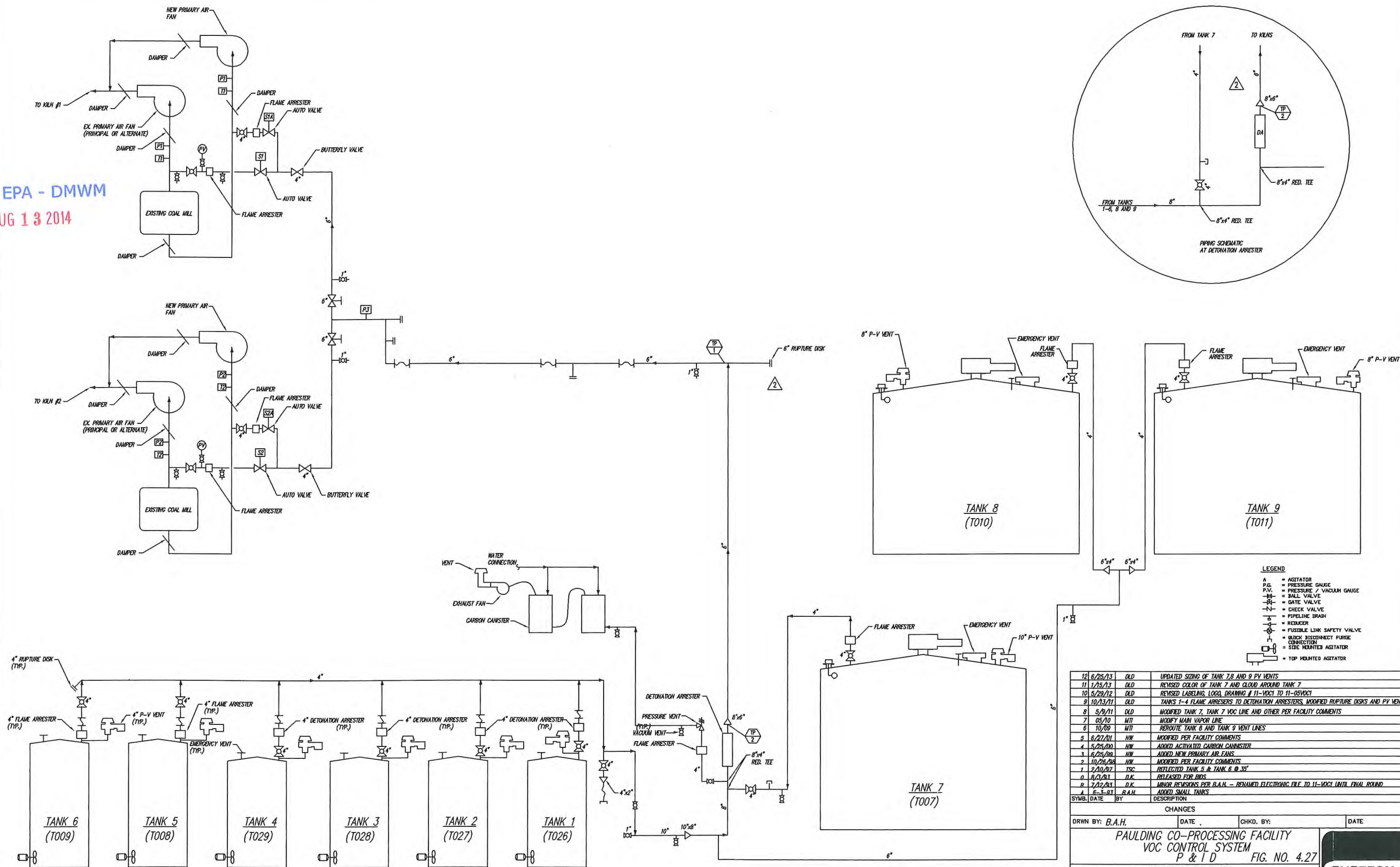
3	5/30/12	DLD	REVISED TITLE BLOCK.
2	10/22/88	TC	REMOVED SECTION A-A & B-B. SYSTECH DWG# 11-06C05
1	8/25/88	BJA	ADDED "SECTIONS" NOTE. REVISED TITLE BLOCK.
SYMB.	DATE	BY	DESCRIPTION
CHANGES			
DRWN BY:	KAB	DATE	1/13/88
CHKD. BY:	HLS	DATE	1/13/88
PAULDING WASTE MANAGEMENT FIGURE 4.23 SECTIONS, TANK CONTAINMENT INORGANIC LIQUIDS			
ENVIRONMENT AND ENERGY SYSTECH CORPORATION 3085 WOODMAN DR. DAYTON, OHIO 45420 937/643-1240			
SCALE	AS NOTED	SHEET 1 OF 1	DWG. NO. 11-02-05
			2 REV. NO.



SYSTECH

OHIO EPA - DMWM

AUG 13 2014

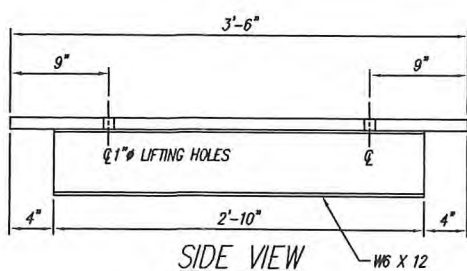
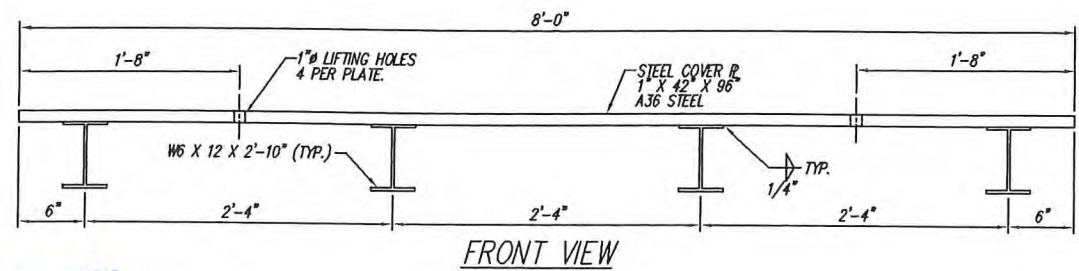


SYMB.	DATE	BY	DESCRIPTION
12	6/25/13	DLD	UPDATED SIZING OF TANK 7, 8 AND 9 PV VENTS
11	1/15/13	DLD	REVISED COLOR OF TANK 7 AND CLOUD AROUND TANK 7
10	5/29/12	DLD	REVISED LABELING, LOGS, DRAWING # 11-VOC1 TO 11-05VOC1
9	10/13/11	DLD	TANKS 1-4 FLAME ARRESTERS TO DETONATION ARRESTERS, MODIFIED RUPTURE DISKS AND PV VENTS
8	5/9/11	DLD	MODIFIED TANK 7, TANK 7 VOC LINE AND OTHER PER FACILITY COMMENTS
7	05/10	MTI	MODIFY MAIN VAPOR LINE
6	10/09	MTI	REROUTE TANK 8 AND TANK 9 VENT LINES
5	6/27/01	NW	MODIFIED PER FACILITY COMMENTS
4	5/25/00	NW	ADDED ACTIVATED CARBON CANNISTER
3	6/25/99	NW	ADDED NEW PRIMARY AIR FANS
2	10/26/98	NW	MODIFIED PER FACILITY COMMENTS
1	2/10/97	TSC	REFLECTED TANK 5 & TANK 6 @ 35'
0	8/13/91	D.K.	RELEASED FOR BIDS
R	7/12/93	D.K.	MINOR REVISIONS PER B.A.H. - REMAINED ELECTRONIC FILE TO 11-VOC1 UNTIL FINAL ROUND
A	6-8-91	B.A.H.	ADDED SMALL TANKS

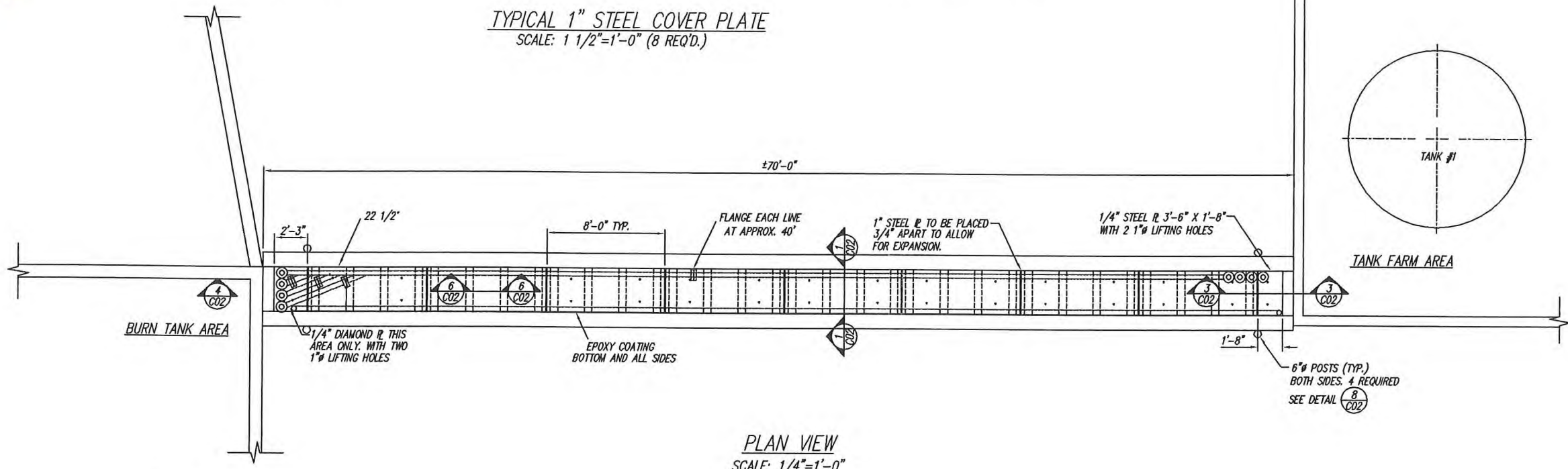
CHANGES			
DRWN BY:	DATE:	CHKD. BY:	DATE:
PAULDING CO-PROCESSING FACILITY VOC CONTROL SYSTEM P & I D FIG. NO. 4.27			
Systech Environmental Corporation 3085 WOODMAN DR. DAYTON, OHIO 45420-1159 937/643-1240			
SCALE NONE	SHEET OF	DWG. NO. 11-05VOC1	REV. NO. 12

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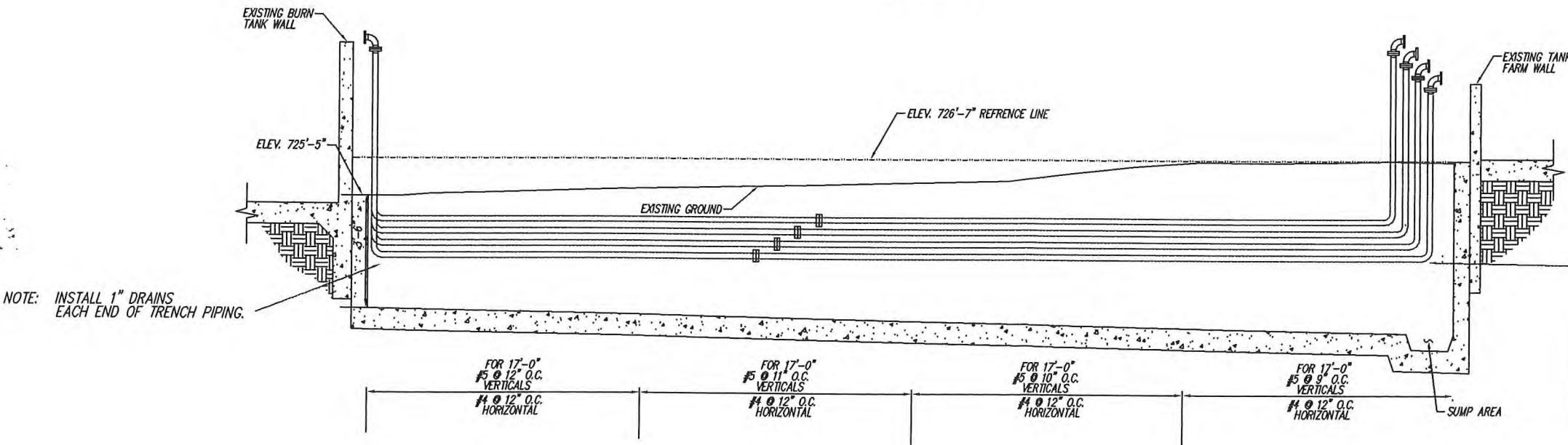
OHIO EPA - DMWM
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TYPICAL 1" STEEL COVER PLATE
SCALE: 1 1/2" = 1'-0" (8 REQ'D.)



PLAN VIEW
SCALE: 1/4" = 1'-0"



ELEVATION SECTION
VERTICAL SCALE: 1/2" = 1'-0"
HORIZONTAL SCALE: 1/4" = 1'-0"
NOTE: TOP OF TRENCH TO MATCH TOP OF GRADE.

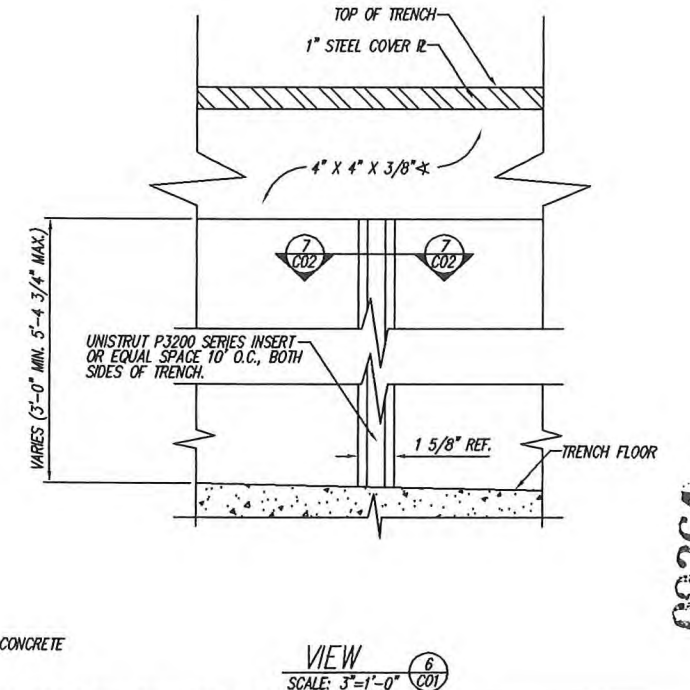
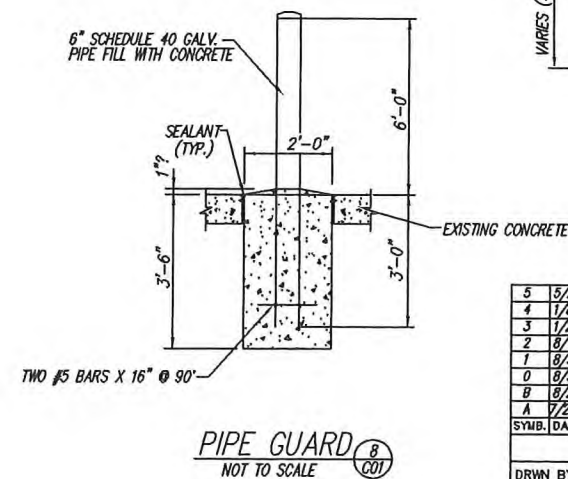
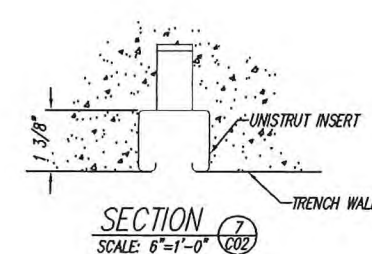
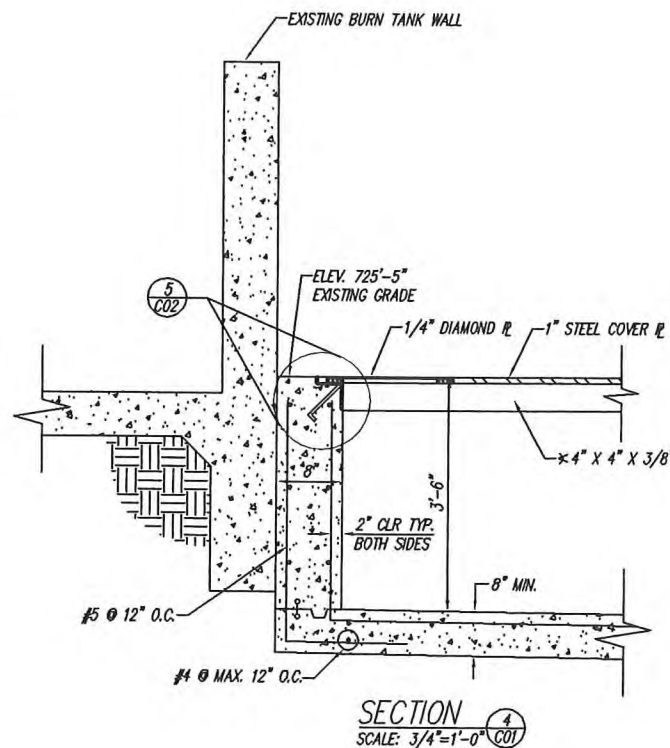
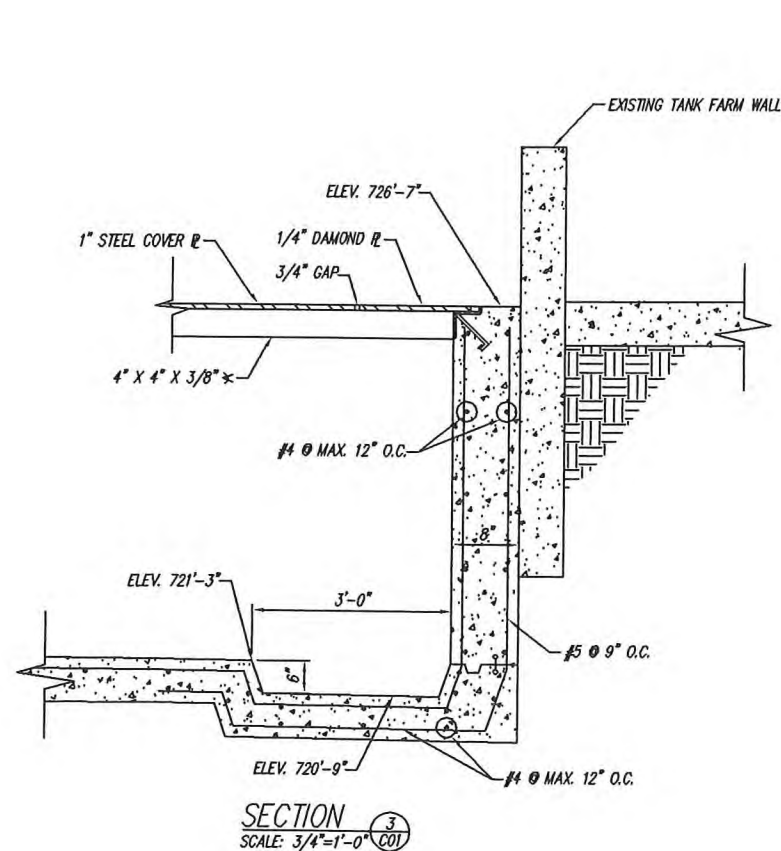
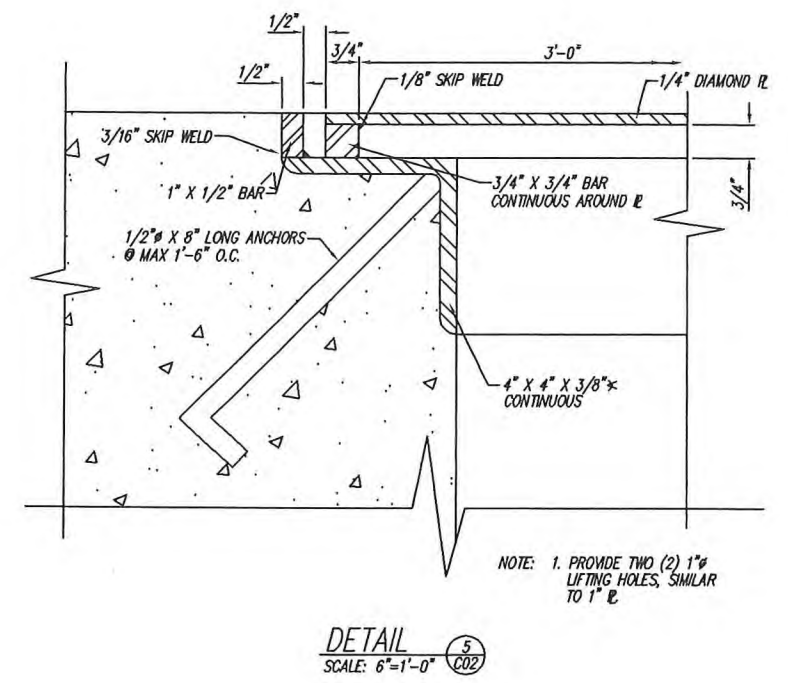
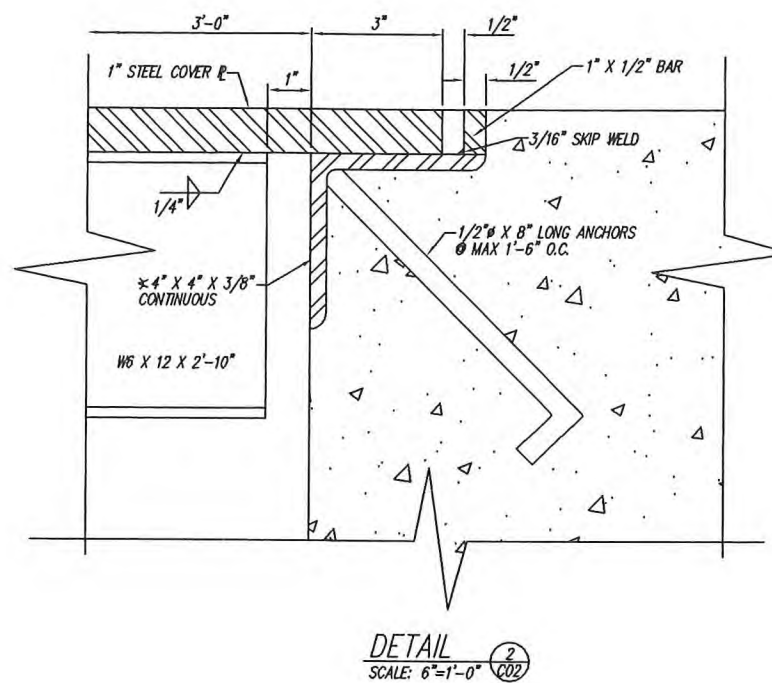
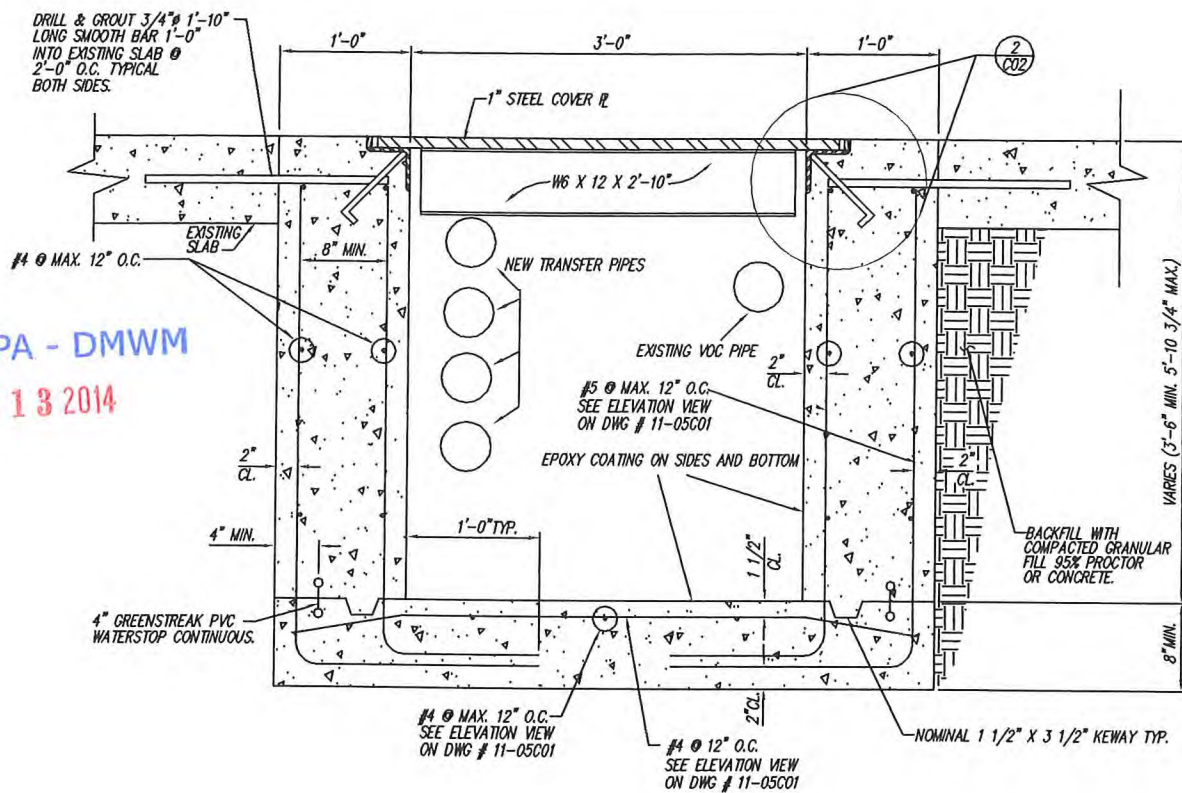
NOTE: INSTALL 1" DRAINS EACH END OF TRENCH PIPING.

5	6/29/12	DLD	ADDED FIG #, REVISED ADDRESS AND LOGO
4	1/8/99	NW	ADDED NEW BURN TANK PIPING
3	1/28/98	NW	ADDED NEW BURN TANK CONTAINMENT, NOTE ON COATING
2	8/11/93	D.K.	REVISED PER BH COMMENTS
1	8/5/93	D.K.	REVISED PER COMMENTS BY T.C. & B.S.
0	8/3/93	D.K.	RELEASED FOR BIDS
B	8/2/93	D.K.	REVISED PER KINTECH CHANGES
A	7/23/93	D.K.	REVISED PER B.H. COMMENTS
SYMB. DATE BY DESCRIPTION			
CHANGES			
DRWN BY: D. KENDRICK		DATE: 7/23/93	CHKD. BY:
			DATE:
FIGURE NO. 4.28 PAULDING CO-PROCESSING FACILITY TRENCH PLAN AND ELEVATION			
ENVIRONMENT AND ENERGY Systech Environmental Corporation			
3085 WOODMAN DR. DAYTON, OHIO 45420 937/643-1240			
SCALE AS NOTED	SHEET OF	DWG. NO. 11-05C01	REV. NO. 5

00363



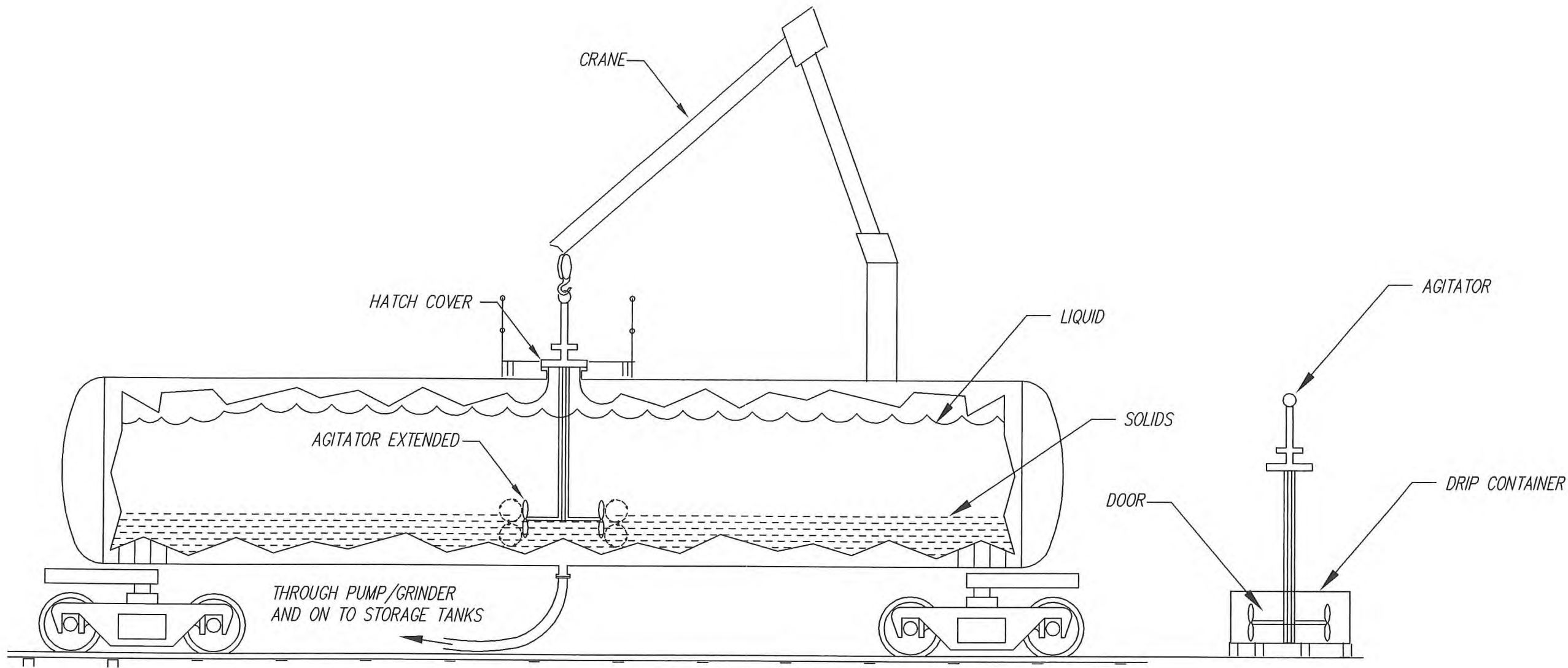
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SYMB.	DATE	BY	DESCRIPTION
5	5/29/12	DLD	REVISED FIG #, ADDRESS AND LOGO
4	1/8/99	NW	MOVED TRANSFER LINES
3	1/28/98	NW	ADDED COATING NOTE AND TRANSFER LINES
2	8/11/93	D.K.	REVISED PER BH COMMENTS
1	8/5/93	D.K.	REVISED PER T.C. & B.S. COMMENTS
0	8/5/93	D.K.	RELEASED FOR REVIEW
B	8/2/93	D.K.	REVISED PER KNTech CHANGES
A	7/28/93	D.K.	RELEASED FOR REVIEW
CHANGES			
DRWN BY:	D. KENDRICK	DATE:	7/26/93
CHKD. BY:		DATE:	
PAULDING CO-PROCESSING FACILITY VOC TRENCH DESIGN DETAILSHEET FIG NO. 4.28A			
System Environmental Corporation 3085 WOODMAN DR. DAYTON, OHIO 45420 937/643-1240			
SCALE:	AS NOTED	SHEET OF:	DWG. NO. 11-05C02
			REV. NO. 5

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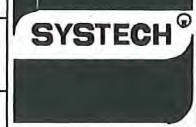
OHIO EPA - DMWM
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2	5/30/12	DLD	REVISED ADDRESS AND LOGO
1	10/1/03	NW	CHANGED AGITATOR STORAGE
SYMB.	DATE	BY	DESCRIPTION
CHANGES			
DRWN BY:	NW	DATE	10/12/99
CHKD. BY:		DATE	
FIGURE NUMBER 4.30			
PAULDING RAILCAR AGITATION			
ENVIRONMENT AND ENERGY			
SYSTECH ENVIRONMENTAL CORPORATION			
3085 Woodman Drive Dayton, Ohio 45420 937-643-1240			
SCALE	NONE	SHEET OF	DWG. NO. 11-02M01
		REV. NO.	2

Unless Otherwise Specified all units are in feet and inches (12-5').
Tolerances are: feet inches
Feet .03 inches .01
FT-Inch .01/2 inch .03
Fraction .01/4 inch .01.0'



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SECTION V PROCEDURES TO PREVENT HAZARDS

This section presents information in response to the following requirements:

Security Provisions	40 CFR §270.14(b)(4) OAC 3745-54-14
Inspection Schedules	40 CFR §270.14(b)(5) OAC 3745-54-15
Preparedness and Prevention	40 CFR §270.14(b)(6) OAC 3745-54-30
Prevention Equipment and Procedures	40 CFR §270.14(b)(8) OAC 3745-50-44(A)(8)
Ignition/Reaction Precautions	40 CFR §270.14(b)(9) OAC 3745-50-44(A)(9)

5.1 Facility Security Provisions

This section is prepared in compliance with the requirements of 40 CFR §270.14(b)(4) and OAC 3745-50-44(A)(4) and contains a description of the security procedures and equipment required by 40 CFR §264.14 and OAC 3745-54-14.

The waste management facility is located in a rural and generally unpopulated area of the county where there is a low probability of unknowing or unauthorized entry. Security is provided by fencing, gates, personnel surveillance, warning signs, and a surveillance camera. The location of these features is illustrated in Figure 5.1.

5.1.1 24-Hour Surveillance

The entrance gate to the facility is monitored during routine business hours, and cement plant personnel are on duty 24 hours a day. Only those persons specifically involved with the activities of the waste management facility are authorized to be in the area. Since only a small number of personnel are authorized, unauthorized persons are readily identified and confronted.

A television camera and monitor provide continuous surveillance aid in

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identifying unauthorized entry or emergency conditions. The location of the camera is indicated in Figure 5.1. The pictures from the television camera are displayed on monitors in the cement plant control room, which is manned 24 hours a day.

Surveillance of the entire waste management area from any location is relatively easy due to the small area that it occupies. Ample lighting is provided throughout the site. Cement plant personnel check the waste management area during each of their shifts at night and on weekends.

5.1.2 Barriers and Means to Control Entry

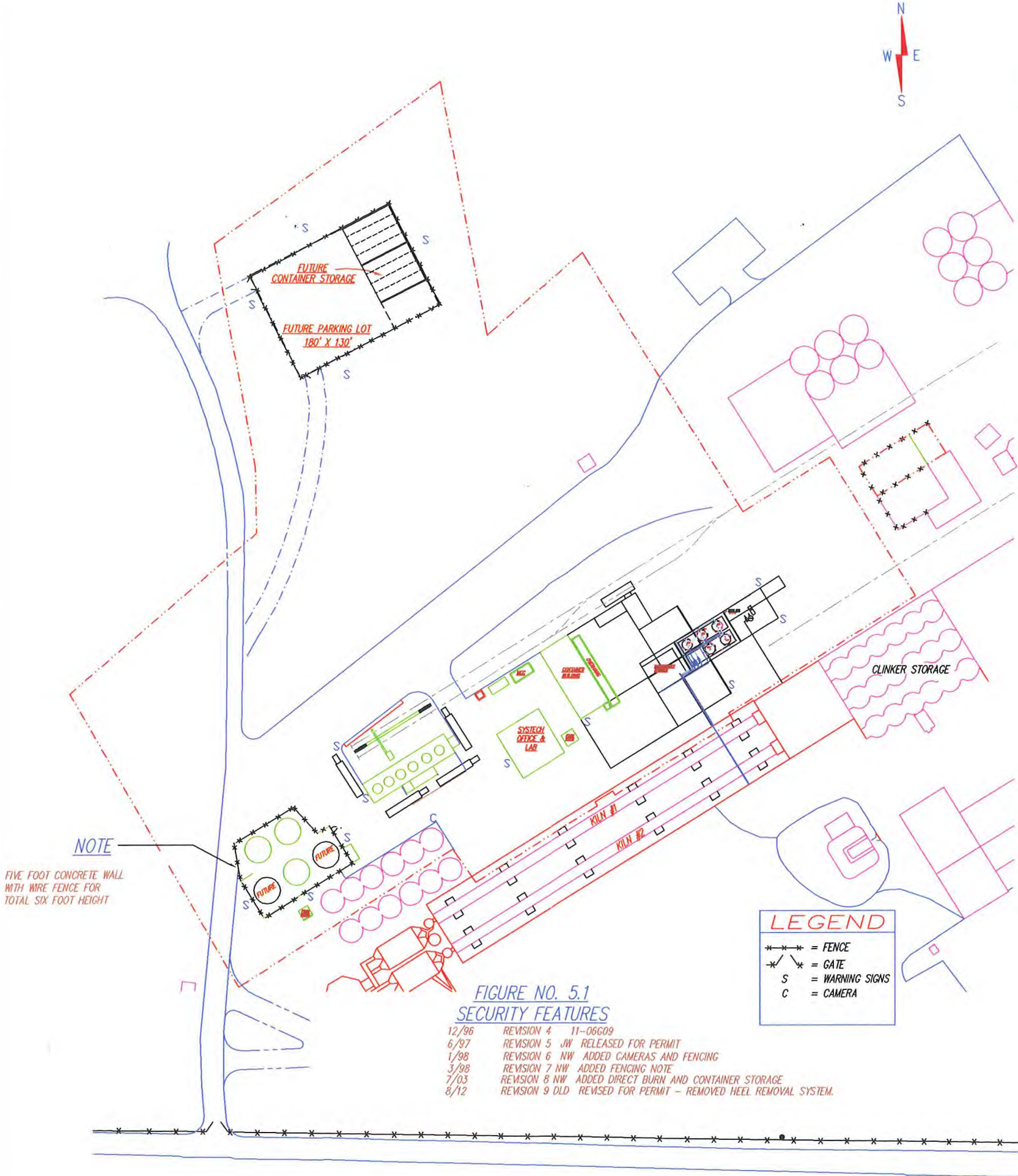
The boundary of the cement plant property is secured on three sides with a six-ft high, chain-link fence topped with barbed wire. A deep ditch runs along the fourth side of the plant's property. There is a gate which controls access to the active portion of the waste management facility. Visitors and contractors entering the waste management facility must check in at the cement plant office and sign a visitor logbook before receiving authorization to enter the active waste management area. The contact person is responsible for informing visitors or contractors of special precautions or safety procedures in the waste management area.

In the event that intruders are observed on the television monitor or by any of the plant personnel, they would be asked to identify themselves and explain the purpose of their presence. Systech would use its discretion in dealing with intruders; options would range from promptly escorting unauthorized persons from the property to calling the police and filing charges for trespassing.

5.1.3 Warning Signs

Figure 5.1 illustrates the location of the warning signs posted around the active portion of the facility to prevent unknowing entry by unauthorized personnel. These signs say, "DANGER--UNAUTHORIZED PERSONS KEEP OUT," and, "DANGER--NO SMOKING, OPEN FLAMES OR LIGHTS." They are legible from a distance of twenty-five feet and are visible from all angles of approach.

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5.2 Inspection Schedules

5.2.1 General Inspection Requirements

Systech has developed and follows a written schedule for the routine inspection of monitoring equipment, safety and emergency equipment, security devices, operating and structural equipment, containers, and tanks. Where applicable, each of these systems is checked for malfunction, deterioration, operating errors, and discharges. These inspections are designed to ensure that there will be no incidents or discharges which would threaten human health or harm the environment.

A copy of this written schedule, which is kept at the facility, is presented at the end of this section as 5.6 Appendix 1. The items listed in the appendix are considered important because of their role in preventing, detecting, or responding to environmental or human health hazards. Noted by each item are the types of problems to be looked for during the inspection.

The frequency of the various inspections depends on the rate of possible deterioration in each system and the probability of an incident if the deterioration or operator error goes undetected between inspections. However, areas which are potentially subject to spills are inspected daily, when in use. Systech will remedy any problems turned up during an inspection promptly and effectively.

5.2.1.1 Remedial Action

If inspections reveal that non-emergency maintenance is needed, it will be completed as quickly as possible to preclude damage and reduce the need for emergency repairs. If a hazard is imminent or has already occurred during the course of an inspection or at any time between inspections, remedial action will be taken immediately. Systech personnel will notify the appropriate authorities and initiate remedial actions.

In the event of an emergency involving the release of hazardous constituents to the environment, efforts will be directed towards containing the hazard, removing it, and, subsequently, decontaminating the affected area. Details of response to emergency situations are set forth in Section VI, Contingency Plan.

5.2.1.2 Inspection Requirements

An inspection log is maintained as a part of the operating record at the facility for each calendar year; it includes sections for daily, monthly, and annual inspections. The Facility Manager ensures that records of inspections are entered in the inspection log; these records are maintained at the facility for three years from the date of inspection.

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The records include the following information:

The date and time of the inspection,

The name of the inspector,

A notation of the observations made, and

The nature of any repairs or other remedial actions.

5.2.2 Container Inspection Requirements

Incoming shipments of containers are inspected upon receipt for signs of damage, corrosion, or leaks. Containers and the container storage areas are listed on the daily inspection log sheet.

The Facility Manager will ensure that the waste management area, where containers are stored, is thoroughly inspected each week. The inspectors look for leaking containers and for possible deterioration of the drums and containers or of the containment system. They also check for the tightness of lids, leaks in flanges, high liquid level/overflow, leaks in plug seals, and evidence of corrosion.

If a container is found to be leaking, the waste will be transferred to a container which is in good condition or to a storage tank. Any spilled waste will be handled in accordance with the Contingency Plan (see Section 6.4.2.2.3).

5.2.3 Tank Inspection Requirements

Systech personnel conduct daily inspections of all the tank systems and subcomponents, including above ground piping and the vaulted lines below grade. Daily inspections include the tanks' overfill control and level indicators to ensure that they are functioning properly. Data is gathered on a daily basis from all equipment monitoring the tanks. This is done in order to determine that the tanks are operated according to their design and to provide a means of documenting waste inventories.

~~The weekly inspection includes~~ the aboveground portions of the tanks are inspected to detect corrosion or erosion and leaking of fixtures and seams. Specifically, the exterior of the tanks are inspected for corrosion, discoloration, cracks, buckles, bulges, malfunction of seals, damaged ladders, and corroded pipes. At the same time the area immediately surrounding the tank is inspected to detect obvious signs of leakage, such as wet spots or discoloration.

Each month the nozzles are closely examined for deterioration or deformation.

Annually Systech tests each metal tank by using a non-destructive, ultrasonic, thickness gauge. This test checks the thickness of each tank's walls to ensure sufficient shell strength. Readings are recorded on and compiled to develop a corrosion history.

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Also annually, protective coatings on all tanks are inspected for rust spots, blisters, or other signs of deterioration.

Section 6.~~4.22.3~~ details the procedures which personnel will use to respond to tank spills or leakage. Section 4.2.1 covers procedures and schedules for any necessary repairs to a tank.

5.2.4 Inspection Logsheets

5.6 Appendix 1 contains copies of the inspection logsheets. These sheets are designed for accurate, practical, regular inspections of all necessary equipment. They ensure that equipment is operating as it should and that all repairs are handled quickly and thoroughly.

5.2.5 Definitions of Inspection Frequency Terms

Below are the frequency terms as defined by Systech. Not all may be used for log-sheet inspections. However, other regulatory or permit recordkeeping requirements would use the same definitions.

Daily –

Defined as a 24-hour calendar day; midnight to midnight. Daily inspections are performed once each calendar day.

Weekly –

Defined as a calendar week; Sunday through Saturday. Weekly inspections are performed once each calendar week.

Monthly –

Defined as a calendar month, starting on the 1st day and ending on the last day of the same month. Monthly inspections are performed once each calendar month.

Quarterly –

Defined as a three month period. Quarterly inspections would be done 4-times a year. Four (4) quarters are included in a calendar year (January through March), (April through June), (July through September) and (October through December).

Semi-Annual or Semi-Annually –

Defined as a six(6) month period. Semi-annual inspections are performed twice a year, one during (January through June), another during (July through December).

Annual or Annually –

Defined as a twelve (12) month calendar year. Annual inspections would be performed once between January 1 and December 31.

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5.3 Preparedness and Prevention

Systech is constantly striving to minimize the risk of fires or spills. Should an unavoidable incident occur, personnel have been trained and equipped to contain emergencies and minimize any associated risks through immediate and effective response.

In order to comply with the requirements of this section, Systech has:

- designed and equipped the facility for maximum safety,
- developed standard operating procedures,
- prepared emergency response plans, and
- made arrangements with local response teams.

Systech does not request a waiver for any of the preparedness and prevention requirements of this section. The sections on Process Information, the Contingency Plan, and Procedures to Prevent Hazards contain detailed discussions of the following requirements.

5.3.1 Design and Operation of Facility

Systech Corporation has nearly thirty-five years of progressive experience in the critical evaluation, design and operation of a wide variety of waste management systems and facilities. This diverse knowledge and cumulative experience and expertise is incorporated into the designs and operational procedures of this facility.

- Section IV, Process Information, provides descriptions and engineering drawings of system and facility design information. This section also provides information on the operational procedures and equipment which complement the design features to minimize the risk of a spill, fire or other incident. Section VI, Contingency Plan, provides descriptions of emergency response procedures which rapidly mitigate the effects of an emergency situation. Section VII, Personnel Training, describes the training program which has been developed to provide our employees with the knowledge and expertise to avoid or minimize the impact of hazardous situations.

5.3.2 Required Emergency Equipment

Certain types of equipment are required in order to be able to respond effectively to emergency situations:

- Internal alarms and communications devices to alert and inform facility personnel and the emergency coordinator,
- External communications equipment to summon outside assistance,
- Adequate fire fighting equipment, and
- Adequate spill clean-up equipment.

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A detailed inventory list of the currently available emergency communication and response equipment is provided in the Section VI, Contingency Plan. A plan view map of the location of these equipment items is also provided in Section VI Figure 6.3.

5.3.2.1 Internal Communications And Alarm Systems/(a)

Facility personnel will alert others to the existence of a possible emergency situation by voice contact, electric alarm systems, intercom telephones, or radios. The alarms are clearly audible throughout the active process areas of the facility. The telephone intercoms and alarm activation switches are located near all unloading and processing areas. The location and additional details about telephones, emergency sirens, and activation switches are presented in the Contingency Plan.

5.3.2.2 Telephone for Summoning Emergency Assistance/(b)

The internal telephone system also accesses outside telephone networks and can be used to summon emergency response support teams. These telephones are located adjacent to any location where an emergency might arise. Emergency contact phone numbers and external support agreements are presented in the Contingency Plan.

5.3.2.3 Portable Fire and Spill Control Equipment/(c)

The Contingency Plan also presents the current List of Emergency Equipment and the Emergency Equipment Location Map for all emergency fire response and spill control equipment.

5.3.2.4 Water and Foam Fire Control Systems/(d)

The locations of all fire response and control equipment, including automatic sprinklers and foam systems, are illustrated in the Contingency Plan.

Fire protection for the facility will be provided by a dedicated and integrated foam-water system. Water for the foam system and yard hydrants will be supplied by a certified fire pump set in a +1,000,000-gallon pond. The sprinkler system will use a 6% concentrate AFFF/ARC (Aqueous Film-Forming Foam, Alcohol-Resistant Concentrate) foam concentrate. The design, fabrication and installation of all systems and components will comply with the Ohio Basic Building Code, appropriate NFPA Standards, and the requirements of Factory Mutual Engineering. Maintenance and annual testing will be performed by Systech in accordance with the recommendations of Factory Mutual.

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5.3.3 Testing and Maintenance of Equipment/40 CFR §264.33 & OAC 3745-54-33

All emergency communications equipment, alarm systems, fire protection equipment, and spill control equipment are listed on the inspection schedule. This includes references to the appropriate testing and maintenance activities which are necessary to assure proper operation in case of an emergency.

5.3.4 Access To Communications Or Alarm System/40 CFR §264.34 & OAC 3745-54-34

The Contingency Plan illustrates the number and location of all the emergency communication and alarm activation switches. They are located so that they are available to personnel wherever wastes are handled or processed.

5.3.5 Required Aisle Space/40 CFR §264.35 & OAC 3745-54-35

Systech will at all times maintain adequate aisle space to allow the unobstructed movement of personnel, fire response equipment, spill control equipment, and decontamination equipment to all areas of the facility. A minimum of four feet of aisle space will be provided at all times in any area requiring easy access.

5.3.6 Arrangements With Local Authorities/40 CFR §264.37 & OAC 3745-54-37

The Contingency Plan describes in detail the arrangements which have been made with local authorities and emergency response teams. These groups have been contacted and informed of facility operations and have been provided with a copy of the Contingency Plan.

5.4 Prevention Equipment and Procedures/40 CFR §270.14(b)(8) & OAC 3745-50-44(A)(8)

This section is presented in compliance with 40 CFR §270.14(b)(8) and OAC 3745-50-44(A)(8) and provides a description of procedures, structures, or equipment used at the facility to:

- (i) Prevent hazards in unloading operations,
- (ii) Prevent run-off from hazardous waste handling areas,
- (iii) Prevent contamination of water supplies,
- (iv) Mitigate effects of equipment failure and power outages, and
- (v) Prevent undue exposure of personnel to hazardous waste.

5.4.1 (i) Prevent hazards in unloading operations

There are numerous design features, pieces of specialized equipment, and standard operating procedures which minimize the risk of fires, spills, and personnel

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exposure during unloading operations.

Section IV, Process Information, presents the details of all major design features which minimize hazards in unloading operations. These features include, but are not limited to, such items as:

- concrete secondary containment sloped to sumps for unloading areas,
- level indicators, pressure gauges and overfill protection systems
- on all tank systems,
- positive displacement pumps for off-loading organic wastes,
- electrical grounding systems,
- properly designed unloading docks and ramps for forklift trucks.

Special equipment such as forklift trucks, explosion-proof pumps, hose fittings, check valves, and other pieces of equipment are carefully specified and maintained so that they provide the greatest degree of protection from fires, leaks and spills.

Special transporter unloading requirements and procedures have been developed to provide the highest degree of protection from the possibility of fires or material spills. Transporters must rigidly adhere to the procedures outlined below. The full text of these procedures is presented in 5.6 Appendix 2.

The transport driver must follow all D.O.T. requirements. In addition the transport driver:

- is responsible for the safe unloading of wastes from his vehicle;
- must comply with all plant safety rules and operating procedures;
- must electrically ground his vehicle;
- must stay with his vehicle during the entire unloading sequence.

Similar control procedures apply to the unloading of railcars. Only railcars with specifically designed unloading valves and connections are approved for use at Systech facilities. Rail tankers are positioned over the unloading platform, electrically grounded, sampled, connected, unloaded and disconnected by specially trained Systech personnel. Systech personnel remain with the railcar, monitoring the progress of the entire off-loading operation.

5.4.2 (ii) Prevent run-off from hazardous waste handling areas

Section IV, Process Information, presents details of the features designed to contain and control any precipitation which falls on the facility so that it will not run off

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onto unprotected ground. Virtually the entire waste management area is paved and sloped so that precipitation is contained and routed to drains and sumps. These collection systems are either pumped or gravity-drained to the process water tanks or reservoirs, as appropriate.

As described above, all vehicle unloading, secondary containment areas and pumping stations are also sloped and drained to sumps. The output from these sumps can be directed to appropriate waste storage tank systems or to process water tanks, as required, for proper management of the collected liquids.

5.4.3 (iii) Prevent contamination of water supplies

The design features described above and detailed in Section IV have a primary objective of minimizing any potential risk to groundwater supplies. The leak detection and containment systems ensure that any leaks, spills or contaminated precipitation will be detected and controlled. These systems also ensure that such precipitation will not come into contact with unprotected ground surfaces or migrate into groundwater supply systems.

5.4.4 (iv) Mitigate effects of equipment failure and power outages

A standby power generator will supply emergency power to all critical systems in the event of a general power failure. Other pieces of equipment or systems identified as critical to safety or efficient operations have been designed with redundant backup systems or manual overrides to allow safe, uninterrupted operations.

5.4.5 (v) Prevent undue exposure of personnel to hazardous waste

Section III, Waste Analysis Plan, describes the hazardous characteristics of the wastes managed at the facility and procedures used to identify the presence of toxic or health-threatening waste constituents. The majority of these wastes can be handled safely by using appropriate eye protection, rubber gloves, and respirators. Some wastes require special precautions to ensure adequate protection of personnel.

High concentrations of extremely toxic, carcinogenic, or otherwise high risk waste materials are identified and restricted from entering the facility. Systech has developed and maintains a health and safety exposure/risk modeling program which allows determination of manageable concentrations of these materials. These manageable special wastes are thus identified as requiring management by specially trained personnel. Personnel will employ specialized handling procedures, using additional personal protection and/or monitoring measures.

Section VII, Personnel Training, outlines the training, information, procedures and equipment provided to personnel which allow them to assess and minimize their risk of exposure to hazardous waste constituents.

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5.5 Ignition/Reaction Precautions

This section fulfills the requirements of 40 CFR §270.14(b)(9) and OAC 3745-50-44(A)(9) by presenting a description of the precautions to prevent accidental ignition or reaction of ignitable, reactive, or incompatible wastes, as required to demonstrate compliance with 40 CFR §264.17 and OAC 3745-54-17. This includes documentation demonstrating compliance with 40 CFR §264.17(c) and OAC 3745-54-17(C).

The procedures described here are designed to ensure that precautions are taken with wastes which might (1) generate extreme heat or pressure, fire or explosions, or violent reactions; (2) produce uncontrolled flammable fumes, dust or gases in sufficient quantities to threaten human health or the environment; (3) produce uncontrolled flammable fumes or gases in quantities to pose a risk of fire or explosion; (4) damage the structural integrity of the device or facility; (5) by similar means threaten human health or the environment.

5.5.1 Identification of Ignitable or Reactive Characteristics

The first step in the prevention of undesirable reactions is the effective identification of the chemical and physical properties of the wastes which could initiate or support an unwanted reactive situation. This identification process is a function of the Waste Analysis Plan, described in detail in Section III. The identification of potentially dangerous characteristics begins with a critical review of the Generator Qualification Survey Form and an analysis of the qualification sample.

All wastes are analyzed prior to approval, at the time of shipment, and prior to final use at the facility. This analytical information will form the basis for determining how the waste will need to be managed within the facility and how that waste will need to be segregated from or combined with other wastes in order to avoid unwanted reactions. For example, wastes which are listed as D003 and are reactive with water will not be accepted at the facility.

During each of these analyses the waste is specifically tested for potential incompatibility problems. The receiving analysis identifies incompatibilities between incoming shipments and wastes already in storage, confirms that the proposed storage and processing plans are indeed appropriate, and provides information on the extent of the processing requirements. An example of the information which can be provided by these analyses follows:

If any problems are noted during any of the waste evaluations, such as heat generation, evolution of gas, or phase separation, then more detailed evaluations are performed. These evaluations are based on the procedures specified in the ASTM D34 Proposal P168, "Proposed Guide for Estimating the Incompatibility of Selected Hazardous Wastes Based on Binary Chemical Reactions," 1986, and the procedures specified in 46 CFR 150.105 for testing

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compatibilities of hazardous waste cargoes.

5.5.2 Precautions to Prevent Ignition

Ignitable wastes are physically separated and protected from sources of ignition or reaction, including, but not limited to: open flames, smoking, cutting and welding, hot surfaces, frictional heat, sparks (static, electrical, or mechanical), spontaneous ignition, and radiant heat.

The facility is designed and operated to minimize the risk of ignition of flammable wastes. The following subsections provide an overview of some of these features.

5.5.2.1 Facility Design and Layout

Tank systems, container storage, and processing areas for ignitable wastes are physically isolated from storage and handling systems for other waste types. They are also physically separated from truck and equipment traffic and cement plant activities to the greatest extent possible. This isolation helps to remove them from many potential sources of ignition.

Smoking and non-smoking areas are established and enforced. "NO SMOKING" signs are clearly posted; smoking and open flames are prohibited within 50 feet of ignitable waste storage and processing areas.

Specific efforts have been made to minimize ignition sources around ignitable or combustible waste materials. All systems are carefully designed to minimize and safeguard the few unavoidable sources of ignitable liquid or vapor. The majority of all volatile organic vapors are contained in closed loop systems and/or are captured in charcoal filters. Tank systems are painted light, reflective colors to minimize solar heating and possible vapor generation. Tanks are operated at atmospheric pressure and are equipped with lightning grounding devices. All electric motors used in the organic waste area are ignition-proof, and all electrical systems are properly grounded.

5.5.2.2 Unloading Procedures

Systech has developed safety rules and unloading procedures (Section 5.4.1 and 5.6 Appendix 2), which are given to all transporters prior to their first delivery to the facility. These procedures are designed to minimize the risks associated with transferring ignitable wastes from trucks to tanks and are strictly enforced by facility personnel.

Tank trucks and railcars are electrically grounded prior to unloading to minimize the potential for static charges. All tank systems are filled through submerged piping, which also minimizes the risk of static charges.

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5.5.2.3 Maintenance Procedures

The training program, detailed in Section VII, has been designed specifically to ensure that personnel recognize the hazards of working with ignitable waste materials. They are trained to avoid hazardous situations through safe work practices and to respond immediately to potential hazards.

Approval of any repair or maintenance work performed in the organics areas must be obtained before work may begin. Spark-proof tools are available for maintenance or repair work. No welding or other spark-producing maintenance is done without first using an organic vapor sensor to thoroughly check the area for potential leaks or the presence of flammable vapors. Special fire inspections are conducted at regular intervals to identify and eliminate potential sources of ignition.

5.5.2.4 Fire Prevention Training for Personnel

A significant precautionary measure against fires is the on-going fire prevention training which all facility personnel receive. This training includes recognizing and preventing situations which could generate extreme heat; cause spontaneous ignition; or cause electrical, static, or mechanical sparks. The Training Program is described in Section VII.

5.5.3 Precautions to Prevent Incompatibility Reactions

Uncontrolled reactions due to waste-to-waste incompatibility are prevented by identification of potentially incompatible waste streams. Compatibility testing performed during the qualification and receiving analyses identifies potential incompatibilities. Screening procedures include checking for unwanted reactions when incoming waste samples are mixed with stored waste samples. Based on the laboratory findings, the material will be unloaded into the appropriate compatible tank, building, or storage area for handling/processing.

Tanks designated for storage of organics conform to specifications in Table 2-1 of the National Fire Protection Association's (NFPA) 1981 "Flammable and Combustible Liquids Code." The tanks are operated at ambient pressure.

Each tank facility will be labeled to designate what kind of material is stored there. Unloading connections are labeled to minimize potential operator errors.

Figure 4.2, Dimensional Plan, illustrates that there are no container storage areas within 50 feet of the property boundaries, in accordance with 40 CFR §264.176 and OAC 3745-55-76.

Once a tank or container is used for one type of waste, it will not be used for an incompatible waste type until it has been thoroughly cleaned.

5.6 Appendix 1
Inspection Logsheets

OHIO EPA - DMWM
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DAILY INSPECTION LOG

DATE: _____ INSPECTOR: _____

TIME: _____

EQUIPMENT	TYPE OF PROBLEM	STATUS	DATE & NATURE OF REPAIR/REMDIAL ACTION
MONITORING EQUIPMENT			
Tank Level Gauges	Proper Function		
Fuel Flow Indicator	Proper Function		
Torch Pressure Gauge	Proper Function		
Feed Pressure Gauge	Proper Function		
Temperature Gauge	Proper Function		
OPERATING & STRUCTURAL EQUIPMENT			
Pipes (Above and Below Grade), Valves, & Fittings	Deterioration Leaks		
Storage Area	Leaks, Spills		
Off Loading Area/Truck	Leaks, Spills		
Off Loading Area/Rail	Leaks, Spills		
Truck heel removal	Leaks, Spills		
Waste Pumps	Power, Pressure Drop		
Filters	Pressure Increase		
Overfill Control & Level Indicator	Proper Function		
Sump Pumps	Power, Clogging		
Containers	Leaks, Spills, Deterioration, Aisle Space, Tightness of Lids, Leaks in Flanges, Corrosion		
Drum Storage Area	Leaks, Spills		
Systech Portable Containers: Accumulation Area	Leaks, Spills, Accumulation Dates		
Dikes	Cracks, Deterioration		
Base	Erosion, Cracks In Base, Deterioration		
Area Surrounding tank farms	Leaks, Vegetation		
Tanks (External) - Includes all Haz tanks. (OL-1, OL-2, OL-3, OL-4, OL-5, OL-6, OL-7, OL-8, OL-9)	Corrosion, Leaks, Bulges, discoloration, cracks, buckles, malformation of seals, corroded pipes		
Tank Ladder (tanks OL-1 thru OL-9)	Damage, Structural Stability		
Tanks Structural Supports (tanks OL-1 thru OL-9)	Cracking, Deterioration, Corrosion		
Tank Monitoring Ports (tanks OL-1 thru OL-9)	Evidence of Leakage		
Direct-Burn Unload Pad	Leaks, Spills, Cracks	Not Constructed	
Drop and Hook Pad	Leaks, Spills, Cracks	Not Constructed	
SAFETY & EMERGENCY EQUIPMENT			
Protective Clothing	Adequate Supply		
Face Shields	Adequate Supply		
Half-Face Chemical Respirators	Seals, Air Delivery		
Emergency Shower & Eyewash	Water Pressure, Leaks, & Drainage		
Safety Glasses	Adequate Supply		
Warning Signs	Legibility, No Obstructions		
Organic Vapor Sensor	Proper Function		
Absorbent Material	Adequate Supply		
Containment Booms	Adequate Supply		
55 Gallon Drums	Adequate Supply		
First Aid Supplies	Adequate Supply		
Fire Extinguishers	Need for Recharging		
Foaming Generator & Foam Concentrate	Proper Functioning		
Fire Control Water	Lubrication, Stuck Valve		
Emergency Alarm	Power Failure, Damage		
Walkie-Talkies	Proper Function		
Goggles	Adequate Supply		
Security Cameras	Functioning Properly		
Emergency shutdown switch, fire hose, low risk spark tools, clean solvent	Functional and Available.		

MONTHLY INSPECTION LOG

Inspector's name/title: _____

Date of inspection: _____

Time of inspection: _____

Waste Management Area: Security Devices

Specific Item	Types of Problems	Status (x) OK () if not	Observations	Date & Nature of Repair/ Remedial Action
Facility Fences	Corrosion, damage	_____	_____	_____
Gates and lock	Corrosion, damage	_____	_____	_____
Security Camera Functioning Properly	Systech Views	_____	_____	_____
Nozzles	Deterioration or Deformation	_____	_____	_____

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ANNUAL INSPECTION LOG

Inspector's name/title: _____

Date of inspection: _____

Time of inspection: _____

Waste Management Area: Safety and Emergency Equipment

Specific Item	Types of Problems	Status (x) if ok () if not	Observations	Date & Nature of Repair/Remedial Action
Telephone system	Power failure			
Emergency lighting system (auxiliary)	Battery failure, proper function			

Waste Management Area: Operating and Structural Equipment

Specific Item	Types of Problems	Status (x) if ok () if not	Observations	Date & Nature of Repair/Remedial Action
Protective coating on tanks	Rust spots, blisters			
Tank (internal)	Corrosion (ultrasonic inspection)			

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Systech Environmental Corporation

Paulding Systech Facility

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5.6 Appendix 2 Transporter Requirements and Procedures

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Paulding Systech Facility

USEPA ID No.: OHD 005048947

Ohio Permit No.: 03-63-0595

RECEIVING PROCEDURE

The following are the procedures established for receiving combustible materials shipped to the cement facility for use as supplemental fuels.

1. Trucks arriving for delivery of the liquid supplemental fuels will proceed directly to the SYSTECH laboratory area.
2. Upon arriving at the SYSTECH laboratory, the driver will present his documentation to the SYSTECH Facility Manager or his alternate and will assist SYSTECH personnel in obtaining a core sample suitable for analysis
3. After a sample has been taken, the driver will be presented a "Scales Permit" and will proceed to the scales for weighing in. NOTE: The scale master is unauthorized to weigh any shipment of supplemental fuels without the "Scales permit."
4. After the weigh in is completed, the driver will proceed to the supplemental fuels off-loading area and will await approval for hookup and discharge. Approval for off loading will only be granted after the quality assurance tests have been completed and will be under the supervision of SYSTECH personnel. Any hookup or pumping prior to approval of the SYSTECH representative is unauthorized.
5. The driver must comply with all SYSTECH and cement company safety rules and operating procedures. The driver must stay with his truck during the entire pumping sequence and be able to take corrective actions should a problem arise.
6. Upon completing the delivery, the driver is responsible to aid SYSTECH personnel in the cleanup of any spills.
7. After the delivery has been completed, the driver will surrender the "Scales Permit" to the scale master.
8. OTHER DELIVERY REQUIREMENTS
 - a. Material is received during one shift only, Monday through Friday (hours confirmed through Facility Manager) and is prescheduled in 2-hr time slots.
 - b. In emergencies, material can be received after 7 p.m. and on weekends, but only if prior notice is received by SYSTECH personnel. An additional fee will be charged to the party responsible for the late delivery.

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Systech Environmental Corporation

Paulding Systech Facility

USEPA ID No.: OHD 005048947
Ohio Permit No.: 03-63-0595

**BULK
SAFETY PROCEDURES AND OPERATING REGULATIONS**

1. NO SMOKING in the laboratory.
2. NO SMOKING within 50' of tanker
3. NO SMOKING within 50' of tank farm or unloading area.
4. No eating or drinking in the unloading area.
5. Drivers must provide and wear hard hats, safety glasses or goggles, and steel toed shoes or boots at all times.
6. Trucks and trailers must be grounded before and during off-loading.
7. Unloading during an electrical storm is prohibited.
8. Loads must be properly placarded.
9. Speed limit within the plant facility is 10 mph.
10. Drivers should be outside their truck (within 25 ft.) and be able to observe connections while off-loading or, at the very least, be able to react in an emergency situation.
11. Hatches on trailers must be closed and secured during any movement of the trailer and open while off-loading in order to vent the trailer.
12. Where applicable, drivers should assist SYSTECH personnel in monitoring the filter pressure while off-loading and be prepared to stop pumping in case of an emergency.
13. Drivers are responsible for helping SYSTECH personnel to clean up any spills resulting from hooking up or unhooking hoses.
 - a. Kiln dust will be available for this purpose.
 - b. Drums for absorbed spill material will also be available.
14. In the event of an en route accident, leakage, or other incident, Transporter shall immediately notify the SYSTECH receiving facility and supply a written report to SYSTECH within twenty-four (24) hours.
15. Drivers are responsible for ensuring that the valves on their trailers are in operating condition and assisting in operation of the valves.
16. If scraping bottom solids is desired or required by the transporter or generator, it is the driver's responsibility.
17. Where applicable, driving through the truck wash is prohibited.

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Systech Environmental Corporation

Paulding Systech Facility

USEPA ID No.: OHD 005048947
Ohio Permit No.: 03-63-0595

**PORTABLE CONTAINERS
SAFETY PROCEDURES AND OPERATING REGULATIONS**

1. No smoking in the laboratory.
2. No smoking within 50 feet of a truck.
3. No smoking within 50 feet of process buildings or loading/unloading area.
4. No eating or drinking in the unloading area.
5. Drivers must provide and wear hard hats, safety glasses or goggles, and steel-toed shoes or boots at all times.
6. Trucks and trailers must be hooked to dock before and during off-loading.
7. Unloading outside during an electrical storm is prohibited.
8. Loads must be properly placarded.
9. Speed limit within the plant is 10 mph.
10. Drivers should be outside of their truck (within 25 feet) while off-loading or, at very least, be prepared to react in an emergency situation.
11. Drivers are responsible for helping to clean up any liquid waste spills in the process of off-loading.
 - a. Kiln dust will be available for this purpose.
 - b. Drums for adsorbed spill material will also be available.
12. In the event of an en route accident, leakage, or other incident, Transporter shall immediately notify the SYSTECH receiving facility and supply a written report to SYSTECH within twenty-four (24) hours.
13. Where applicable, driving through the truck wash is prohibited.

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Systech Environmental Corporation

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SECTION VI CONTINGENCY PLAN

Systech Environmental Corporation
P.O. Box 266
Paulding, OH 45879
(419) 399-4835

6.1 Introduction

The Systech Environmental Corporation (Systech) Facility located at County Road 176, Paulding County, Paulding, Ohio is a permitted hazardous waste treatment, storage, and disposal (TSD) facility. It receives prequalified waste materials from regulated hazardous waste generators or marketers in one of three manners: bulk liquids in tanker trucks, railcar tankers, or small containers, i.e., 55-gallon drums or 300-gallon totes. Systech, as the owner and operator of this permitted TSD facility, processes these waste materials for use as an alternate fuel in the manufacture of cement by the co-located Lafarge North America (Lafarge) cement plant. These materials are hazardous primarily because they are ignitable, toxic, or a listed hazardous waste.

When these materials are unloaded from their transit containers, they are temporarily stored in tanks until they can be blended, processed, or used directly by the adjacent Lafarge cement plant. All waste materials are blended, processed, and controlled to the extent that their physical and chemical characteristics have been made compatible with the material, process, or regulatory requirements of cement manufacturing. Figure 6.1 is a site plan of the facility.

The waste management facility was designed and will be operated to ensure that a spill, fire or explosion does not occur. Section V – Procedures to Prevent Hazards of the Part B application describes how Systech will operate the facility to prevent these hazards from occurring. Should, however, it ever become necessary to implement the Contingency Plan, personnel are thoroughly trained to act immediately. The Contingency Plan is designed to minimize hazards to human health and the environment in the event of a fire, explosion, or release of hazardous wastes or hazardous waste constituents to the air, soil, or surface water. This plan would be implemented if any of these hazards were ever to occur.

The purpose of this Section VI – Contingency Plan is to describe the manner in which the waste management facility would respond to these types of emergencies resulting from its operations. Copies of the Contingency Plan and all revisions to it will be maintained at the facility. A copy of the Contingency Plan handbook is appended in Section 6.11 Appendix 6.1; this handbook is a copy of the one that employees are trained to use whenever the Contingency Plan is activated. This Contingency Plan has been prepared in accordance with 40 CFR §§264.50 and 270.14(b)(7) and with Rules 3745-50-44(A)(7) and 3745-54-50 thru - 56 of the Ohio Administrative Code.

February 2013
Revision 1- June 2013
Revision 2-November 2013

Contingency Plan

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With the exception of an explosion or significant fire, the Emergency Coordinator is the primary person who will initiate implementation of the Contingency Plan. In the case of an explosion or significant fire, employees are trained to initiate an evacuation to the appropriate Rally Point. Employees will determine the appropriate rally point by assessing the wind direction and relative speed after observing one of the windsocks located at the facility. Windsocks are located on top of the CKD storage silo on top of the hill to the north and west of the facility and on the top of the Lafarge ammonia storage building to the west and south of the facility, and all employees are trained to move downwind of potential vapors or events. The role of the Emergency Coordinator is more fully described in the next section.

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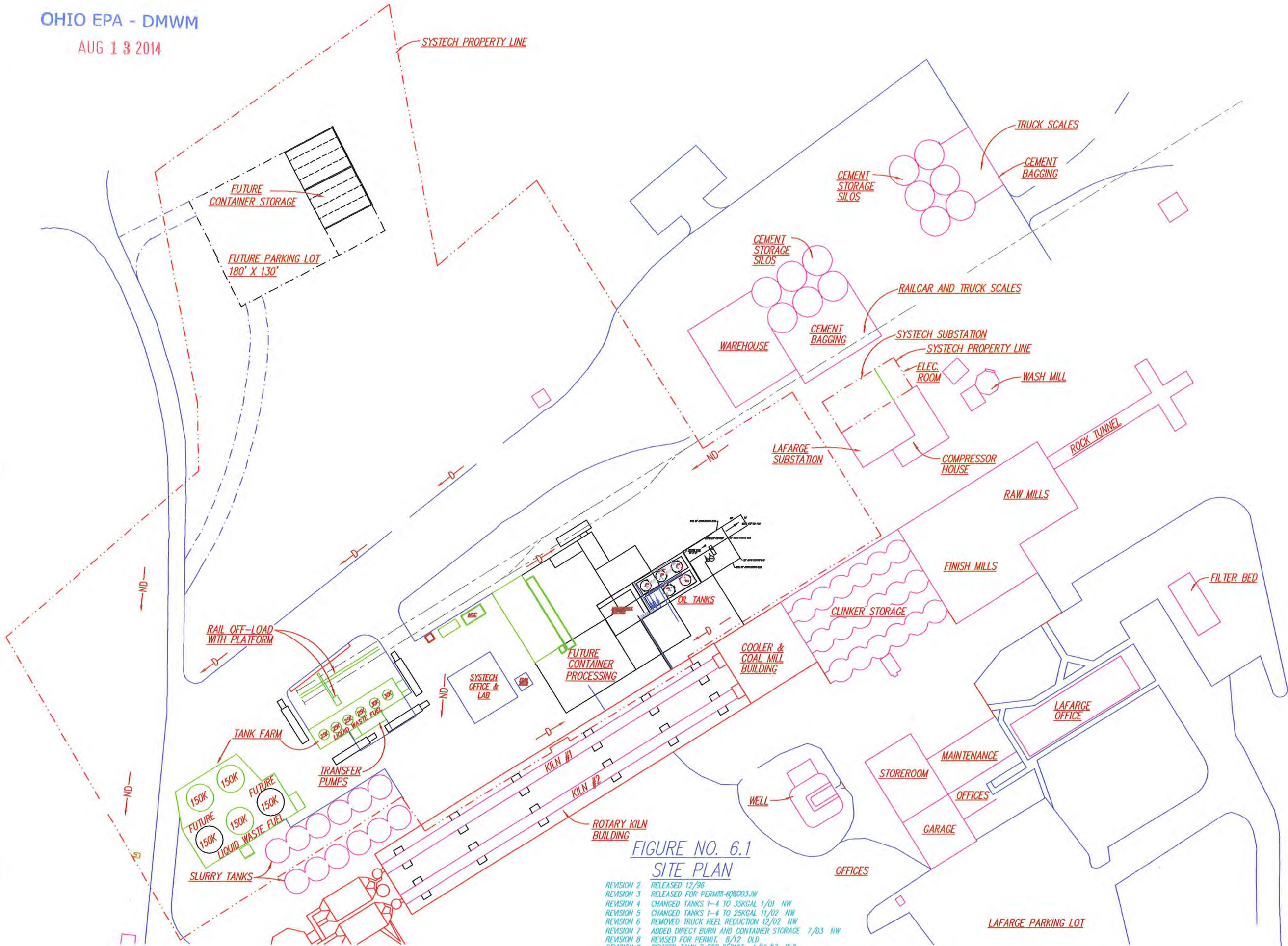


FIGURE NO. 6.1
SITE PLAN

REVISION 2 RELEASED 12/96
REVISION 3 RELEASED FOR PERMIT 608003.JW
REVISION 4 CHANGED TANKS 1-4 TO 35K GAL 1/01 NW
REVISION 5 CHANGED TANKS 1-4 TO 25K GAL 11/02 NW
REVISION 6 REMOVED TRUCK HEEL REDUCTION 12/02 NW
REVISION 7 ADDED DIRECT BURN AND CONTAINER STORAGE 7/03 NW
REVISION 8 REVISED FOR PERMIT 6/12 DLD
REVISION 9 REVISED TANK 7 FOR PERMIT 1/16/13 DLD

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6.2 Emergency Coordinator

The key figure in implementing the Contingency Plan is the Emergency Coordinator. The Emergency Coordinator or his or her alternate will be available to facility personnel at all times. The Emergency Coordinator, who is responsible for coordinating all emergency response measures, is thoroughly trained on and familiar with:

1. All aspects of the facility's Contingency Plan,
2. All operations and activities at the facility,
3. The location and characteristics of waste handled,
4. The location of all records within the facility, and
5. The facility layout.

Frequent inspection and active participation on a daily basis by the Emergency Coordinator will minimize the chance of a major accident. His or her specific responsibilities and duties during and following an emergency incident are described in Appendix 6.1.

The emphasis on immediate response to hazard conditions requires that the Emergency Coordinator be free to use his judgment in an emergency situation. Therefore, the Primary Emergency Coordinator and his alternate are authorized to commit all necessary resources in the event of an emergency.

Mr. Jeff Hunyor has been selected as the primary Emergency Coordinator for this facility. He holds a B.S. in Chemistry. He has been employed with this company since 1999 and is presently the Facility Manager.

Mr. Chris Price has been selected as the alternate Emergency Coordinator for this facility. He has been employed with this company since 2003 and is presently the facility's Lead Maintenance Operator.

6.3 Implementation

The Contingency Plan will be implemented whenever an incident including a medical emergency involving hazardous waste at the facility threatens or has the potential to threaten human health or the environment. Since the facility is relatively small (the active portion of the facility is only about 3 acres), the most likely areas where an emergency will occur is the truck or rail offload areas or one of the tank farms, or the container processing building (see Fig. 6.1 to see the locations of these areas). The Contingency Plan would be implemented in the event of an explosion, fire, or release.

Fire or explosion

In the case of fire or explosion, the Contingency Plan will be implemented when any of the following events occur:

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1. A fire.
2. Use of water and/or chemical fire suppressant could result in contaminated runoff.
3. An imminent danger of an explosion exists or an explosion occurs.

Spills or material release

In the case of a spill or material release, the Contingency Plan will be implemented when any of the following events occur:

1. The spill could cause the release of toxic liquids or fumes.
2. A contained spill threatens contamination of groundwater or surface waters.

6.4 Emergency Response Procedures

Appendix 6.1 in section 6.11 describes the procedures that employees are to use to respond to an emergency. For those emergency situations where the procedures are not self-implementing, the Emergency Coordinator when notified of an emergency situation, he or she will immediately investigate the event and order the appropriate emergency response. Primarily in the case of an explosion or significant fire, the personnel will immediately proceed to the appropriate rally point as determined by observing the wind direction as indicated by one of the windsocks, and await further instruction from the Emergency Coordinator. The windsocks are located on top of the CKD storage silo on top of the hill to the north and west of the facility and on the top of the Lafarge ammonia storage building to the west and south of the facility, and always move to the rally point downwind of the event. If the incident requires emergency assistance, the Emergency Coordinator will contact the appropriate local, state, or federal agencies.

Facility personnel will alert others to the existence of a possible emergency situation by voice or visual contact, electric alarm systems, intercom telephones, or radios. The alarms are clearly audible throughout the active process areas of the facility. The telephone and alarm activation switches are located near all unloading and processing areas. The telephone system will be used to summon emergency response support teams and necessary agencies.

6.4.1 Fire and/or Explosion

Employees who are trained in fire prevention and response will be on standby during all general emergencies. If an incipient fire should occur, these trained employees will concentrate on minimizing the risk of an explosion and on preventing the fire from spreading to nearby areas until outside assistance has arrived. Firefighting will not be done at the risk of injury to the employees involved. If the fire is beyond the capabilities of trained employees, the local Fire Department will be available for assistance.

The following actions will be taken in the areas affected by the fire or explosion:

- a. The Emergency Coordinator will be contacted.

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- b. Work involving waste materials will be shut down immediately.
- c. All feed lines and additional equipment will be shut down as necessary and practical.
- d. The affected area will be cleared of all employees not actively involved in fighting the fire. These persons are to report to the designated rally points.
- e. Any injured persons will be removed and medical treatment will be administered by qualified personnel.

6.4.2 Spills or Material Release

Spills or visible releases of material are not expected to occur; however, the incidental release of small quantities of waste (typically less than one pound) will not pose a significant threat of fire or damage to human health or the environment. Such spills may occur during sampling, equipment maintenance, container storage or off-loading operations. In most cases, these incidental spills will occur outside buildings or enclosures where adequate ventilation is present to dissipate solvent vapors quickly. The recommended practice for such incidental spills is to apply absorbent materials, depending on the quantity of material released. For any containers found to be leaking, Systech will immediately determine the nature of the leak and if possible stop the leak. If the leak can not be stopped, then the drum will immediately be processed or overpacked to await processing. Any release from the tank system to the environment (except a leak or spill that is less than or equal to one pound and immediately contained and cleaned up) will be reported to the Director of the Ohio EPA, within 24 hours of detection.

Small spills which may occur in the laboratory must be handled differently. If adequate ventilation is readily available, as in the case where the spill occurs under a fume hood, simply absorbing the spilled material and properly disposing of the residue is recommended. Most likely these materials can be reprocessed through the container or tank systems as fuel for the kilns. Any soils or other contaminated clean up materials will be containerized, stored and subsequently sent off site for proper disposal. Small spills of volatile materials which may contaminate the work environment within the laboratory must be evaluated and addressed immediately. However, in general, small spills do not present a significant risk to human health and the environment and can be routinely handled.

Major spills¹ or releases may occur due to overturned containers or the rupture of hoses, pipelines, equipment connectors, tank trucks or the receiving tank. Secondary spill

¹ A major spill is the reportable quantity of a material, as defined in 40 CFR §302, or, if no reportable quantity is listed, 100 pounds.

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containment is, therefore, essential; major spills will be immediately contained within that enclosure until personnel can respond. Should a release occur during tank truck or railcar unloading, the operator will immediately close the appropriate manually-activated emergency valve to shut down the flow of materials from the vehicle and to the tank system.

The following actions will be taken in the areas affected by a major spill:

- a. If an employee discovers a waste spill or release or a process upset resulting in a vapor release, he/she will immediately report it to the Emergency Coordinator.
- b. If possible to do so without personal risk, facility personnel should stop the flow and attempt to determine the cause of the release.
- c. To determine the nature and extent of the spill, the Emergency Coordinator will investigate the spill and check the analytical records and inventory data. He or she will evaluate the hazard potential and assign trained personnel to employ the emergency response equipment to clean the spill.
- d. All personnel who are not assigned to cleaning the spill will be excluded from the area.
- e. All waste shipments will be postponed until the spill has been properly handled.
- f. Regulatory agencies and emergency assistance teams will be contacted. In accordance with OAC 3745-66-96(D), any release from a tank system to the environment will be reported to the Director of the OEPA within 24 hours, except for a leak or spill that is less than or equal to a quantity of one pound and that is immediately contained and cleaned up.
- g. Freestanding liquids will be pumped to a storage tank, wherever practicable. Once the pumpable liquids have been removed, absorbent will be applied to any remaining spilled materials. The absorbent used for clean-up will then be transferred to portable containers and stored until arrangements can be made for proper management. These materials would be reintroduced into the tank or container systems and subsequently used as fuel in the cement kiln. If they could not be managed this way, they would be sent off-site to an approved disposal facility.
- h. In the event of a spill or other emergency, the EC will assess the need for establishing protective zones. These zones will be located in a safe area that provides an adequate distance from the area where the emergency or spill exists taking in to account the nature of the material or emergency involved, i.e., flammable or toxic liquid, smoke, the location, the wind speed and direction, and other climatic conditions that may require affected individuals to be inside or out. There may also be decontamination stations established in these protective zones if contact with the material may occur.

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6.4.3 Prevention of Recurrence of Spread of Fires, Explosions, or Releases

During an emergency, the Emergency Coordinator will take all reasonable measures necessary to ensure that fires, explosions, and releases do not occur, recur, or spread to other hazardous waste at the facility. These measures will include stopping processes and operation, collecting and containing released waste, and removing or isolating containers.

In particular, the shut-down of mechanical equipment will reduce the possibility of sparking or heat generation that may result in fires or explosions. Therefore, all equipment not required for emergency response will be turned off and isolation valves will be closed, if this can be done without undue hazard to personnel. Also, by stopping the movement of material in the affected system, the likelihood of additional releases is minimized.

If the facility stops operations in response to a fire, explosion, or release, the Emergency Coordinator will direct the shut-down of the system. After system shut-down is accomplished, it will be necessary to monitor all pressure gauges and level indicators for evidence of system changes. If changes develop, steps must be taken to immediately identify and remedy the condition. The affected area must be carefully inspected periodically for leaks, including but not limited to, looking for drips, sprays, pooling of liquids, or wet areas. Piping and tanks or containers must be examined as soon as practical for any evidence of failure, including cracks, ruptures, or abnormal distortions.

6.4.4 Incompatible Wastes

The Emergency Coordinator will ensure that no waste that may be incompatible with the released material is treated, stored or disposed of until clean-up procedures are completed. In the event of an emergency, all waste deliveries and processing will be suspended in the affected area. This will ensure that no waste that may be incompatible with any released material is treated, stored, or disposed.

6.4.5 Duties of Clean-up Personnel

Clean-up personnel will perform the following tasks:

- (1) Make certain all untrained and unnecessary persons are removed from the affected area.
- (2) Put on protective clothing and equipment.
- (3) Remove all ignition sources and use spark-proof and explosion-proof equipment in containment and clean-up.
- (4) Isolate the source of the spill or release and make any appropriate temporary repairs.
- (5) Remove any equipment or materials nearby that could interfere with

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clean-up actions.

- (6) If released materials have not been effectively contained by existing systems, prevention of further migration of the waste to soils or surface waters will be accomplished by using readily available absorbent or other materials to divert, contain or absorb the release.
- (7) Place all containment and clean-up materials in containers for proper disposal.
- (8) Place all contaminated soil in containers for proper disposal.
- (9) Clean or dispose of contaminated equipment and clothing, as necessary.
- (10) Within 24 hours of the release, if possible, all waste materials will be removed from the leaky tank system and transferred to appropriate storage. All wastes released to secondary containment systems will also be removed within 24 hours, if possible.
- (11) Decontamination of affected areas would be undertaken, as required, to maintain a safe work environment and to minimize any potential environmental impact.

6.5 Emergency Equipment

The complete list of emergency equipment is in the Contingency Plan Handbook, as are maps showing the location of the equipment. The Contingency Plan Handbook is included in Section 6.11 Appendix 6.1.

6.6 Evacuation Plan

Except in the case of an explosion or major fire, the Emergency Coordinator will be responsible for determining which emergency situations require evacuation of the facility.

The facility employs a radio communication system to initiate evacuation. A fire alarm, which would also signal an evacuation, is located in the storage area. All employees will be familiar with the location of the fire alarm. In addition to the alarm, the internal telephone system and the radio system can be used to notify key personnel of the nature of the emergency and recommended plan of action.

In the event that total evacuation of the facility is called for by the Emergency Coordinator, the actions to be taken are listed in the Contingency Plan handbook, See Section 6.11 Appendix 6.1.

6.7 Coordination Agreements

A copy of the Contingency Plan and all revisions to it will be sent to each of the agencies/organizations listed below. They will be asked to review the plan and respond with

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regard to their willingness to provide the requested emergency services.

Agency/Organization

Paulding County Sheriff's Department
South William Street
Paulding, OH 45879
419-399-3791

Cecil Fire Department
Cecil, OH 45821
419-399-3819

Paulding County Hospital
Rural Route 2
Paulding, OH 45879
419-399-4080

Paulding Emergency Medical Service
Paulding, OH 45879
419-399-3791

Paulding County Health Department
419-399-3921

In accordance with 40 CFR §264.37 and Rule 3745-54-37 of the Ohio Administrative Code, the facility has contacted the appropriate organizations to make the following arrangements:

1. Arrangements to familiarize police, fire departments, and emergency response teams with the layout of the facility, properties of hazardous waste handled at the facility and associated hazards, places where facility personnel would normally be working, entrances to and roads inside the facility, and possible evacuation routes;
2. Agreements with State emergency response teams, emergency response contractors and equipment suppliers; and
3. Arrangements to familiarize local hospitals with the properties of hazardous waste handled at the facility and the types of injuries or illnesses which could result from fires, explosions or releases at the facility.

Informal working relationships have been established with local agencies and organizations for provision of emergency services. The facility will formalize and document these arrangements to the extent this is possible. An example of the Emergency Response Agreement, which the agencies and organizations listed above will be asked to execute, is included in Appendix 6.2.

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6.8 Post-Emergency Maintenance Procedures

6.8.1 Storage and Treatment of Released Materials

Immediately after an emergency, the Emergency Coordinator will make arrangements for treatment, storage, or disposal of recovered wastes, contaminated soil or surface water, or any other contaminated materials. Unless demonstrated otherwise, all spilled materials would be considered to be hazardous and would be handled as such.

Any hazardous materials generated as a result of an emergency would first be stabilized. Spilled liquids would be pumped into appropriate containers or absorbed onto a suitable material and then placed in containers. Solids would also be containerized as soon as practical after an incident. Absorbent booms will be utilized to decontaminate surface water. In the event that using these absorbent booms is not practical, materials will be pumped to a container or other vessel, such as a truck to hold until the materials can be categorized and the appropriate reuse or disposal option identified. Affected areas would be cleaned and then inspected to ensure that all spilled materials have been removed to an acceptable extent.

If any hazardous material were released outside of the containment area, steps would be taken as soon as possible to contain, isolate, and remove the released materials. This would prevent migration of the material beyond the immediate, affected area. If contamination of the area occurs, depending on instructions from regulatory agencies or other responsible authorities, the area would be excavated and the removed materials isolated from rainfall and run-on in an appropriate container or containment area. A sampling and analytical plan based on the particular situation would be developed to determine the extent, if any, of contamination.

All containerized hazardous material collected as a result of a release or other incident would be immediately labeled and placed in an appropriate storage area. After the material has been properly characterized, a disposal plan can be developed. Such a plan may include, but will not be limited to: blending with other materials and using this mixture as fuel, direct injection into the hot end of the kiln, or off-site disposal.

6.8.2 Equipment Maintenance

Space will be provided in the decontamination facility to allow for removal of contaminated protective clothing. Contaminated equipment will be cleaned at the container building which contains running water, electricity, catch buckets and containers. Clothing which must be discarded will be sealed in containers and subsequently disposed at an appropriate facility. Clothing which can be cleaned will also be placed in containers until the cleaning and decontamination can be accomplished.

After an emergency event, all emergency equipment will be cleaned so that it is fit for use, or it will be replaced. Contaminated equipment will be rinsed with clean

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solvent where necessary. Any resulting contaminated solvent will be retained in a catch bucket or container and transferred into the fuel storage tanks.

Before operations are resumed, an inspection of all safety equipment will be conducted as discussed in the Procedures to Prevent Hazards chapter. The Agency and other appropriate authorities will be notified that post-emergency equipment maintenance has been performed, and operations will be resumed.

6.8.3 Tank and Secondary Containment System Repair or Closure

Following a spill or release including visible releases, the tanks and secondary containment systems will be repaired in accordance with OAC 3745-66-96(E) and 40 CFR §264.196(e). Unless these requirements can be satisfied, the leaking tank system will be closed in accordance with OAC 3745-66-97 and 40 CFR §264.197. The requirements of OAC 3745-66-96(E) and 40 CFR §264.196(e) are the following:

- (1) If the cause of the release was a spill that did not damage the integrity of the system, the system may be returned to service as soon as the released waste is removed and repairs, if necessary, are made.
- (2) If the cause of the release was a leak from the primary tank system into the secondary containment system, the primary system must be repaired prior to returning the tank system to service.
- (3) If the source of the release was a leak to the environment from a component of a tank system without secondary containment, the facility must provide the component of the system from which the leak occurred with secondary containment that satisfies the requirements of OAC 3745-66-93 and 40 CFR §264.193 before it can be returned to service, unless the source of the leak is an aboveground portion of a tank system that can be inspected visually. If the source is an aboveground component that can be inspected visually, the component must be repaired and may be returned to service without secondary containment as long as the appropriate certifications by an independent, qualified professional engineer are obtained. If a component is replaced to comply with these requirements, that component must satisfy the requirements for new tank systems or components in OAC 3745-55-92 and 3745-55-93 and 40 CFR §§264.192 and 264.193. Additionally, if a leak has occurred in any portion of a tank system component that is not readily accessible for visual inspection (e.g., the bottom of an inground or onground tank), the entire component must be provided with secondary containment in accordance with OAC 3745-55-93 and 40 CFR §264.193 prior to being returned to use.

6.8.4 Certification of Major Repairs

If the facility has repaired a tank system in accordance with the above

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requirements and the repair has been extensive (e.g., installation of an internal liner or the repair of a ruptured primary containment or secondary containment vessel), the tank system will not be returned to service unless the certification has been obtained by an independent, qualified, registered, professional engineer in accordance with OAC 3745-50-42(D) and 40 CFR §270.11(d) that the repaired system is capable of handling hazardous wastes without release for the intended life of the system. This certification will be submitted to the Agency within seven days after returning the tank system to use.

6.9 Amendments to the Contingency Plan

The Contingency Plan will be reviewed and immediately amended, if necessary, whenever:

- a. The facility permit is revised;
- b. The plan fails in an emergency;
- c. Changes occur in the facility's design, construction, operation, maintenance or other circumstances which materially increase the potential for fires, explosions, or releases of hazardous waste or hazardous waste constituents, or changes occur in the response necessary in any emergency;
- d. The list of Emergency Coordinators changes;
- e. The list of emergency equipment changes.

The Contingency Plan will be reviewed and updated, if necessary, at least annually.

The Emergency Coordinator is responsible for all revisions to all copies, on a periodic basis and on an "as needed" basis. When revisions are necessary, the Emergency Coordinator will send the revisions to all sections of the plant which maintain a copy of the Contingency Plan. He will also send the necessary revisions to all off-site agencies which maintain copies, requesting that the changes be made and that he be notified when that has been accomplished. A copy of the memorandum which is included with revisions and which asks for such notification is shown below. He or she will post the response memoranda in the log.

Memorandum--Receipt of Contingency Plan Modifications

To: Systech Environmental Corporation
From: (Emergency Response Agency)
Re: Contingency Plan Revision
Date:

This agency has received the copy of Revision #___ to Section #___, dated ____, and has amended our copy of your Contingency Plan accordingly. We have completed this update and are returning this memorandum to so notify you.

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6.10 Recordkeeping and Incidents

The Facility Manager or Emergency Coordinator will notify the Ohio EPA Department and other appropriate State and local authorities that the facility is in compliance with 40 CFR §264.56(h) and Rule 3745-54-56(H) of the Ohio Administrative Code before operations are resumed in the affected areas of the facility. In order to do so, he must be able to confirm that no waste which was incompatible with the released material was treated, stored, or disposed of until the clean-up procedures were completed. He must also confirm that all emergency equipment was cleaned and fit for its intended use before operations were resumed.

The Facility Manager or Emergency Coordinator will also note in the operating record the time, date, and details of any incident which requires implementing the Contingency Plan.

Within 15 days after the incident, he will also submit a written report to the Department Ohio EPA. The report will include the following information:

1. Name, address and telephone number of the owner or operator;
2. Name, address and telephone number of the facility;
3. Date, time and type of incident (e.g., fire);
4. Name and quantity of material(s) involved;
5. The extent of injuries, if any;
6. An assessment of actual or potential hazards to human health or the environment, where this is applicable;
7. Estimated quantity and disposition of recovered material that resulted from the incident.

These records will be available to the Director of the OEPA, or his authorized representative, for inspection.

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6.11 Appendix 6.1

Contingency Plan Handbook

Systech Environmental Corporation
P.O. Box 266
Paulding, OH 45879
(419) 399-4835

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6.11.1 Fire/Explosion Response and Procedures

INITIAL RESPONSE

1. DO NOT enter any area that would jeopardize your safety.
2. Assess the extent and magnitude of the event including wind speed and direction.
3. Notify Emergency Coordinator and personnel of emergency; sound a general alarm.
4. Proceed to appropriate rally point and await further instruction

FIRE FIGHTING PROCEDURE

1. For incipient fires, begin using nearest available portable extinguisher.
2. Stop flow of material, if possible.
3. Second person on scene: go for additional portable extinguisher, preferably a 150 lb. extinguisher.
4. Prepare to activate foam system.

SUSTAINED RESPONSE

1. Employ proper protection equipment.
2. Use monitoring equipment to assess safety of area.
3. If necessary, contact an outside fire department for assistance.

FIRE DEPARTMENT GUIDANCE

1. Emergency Coordinator and Systech shift manager will help fire department personnel to decide if the fire should be put out or allowed to burn under control.
2. Use only as much water as absolutely necessary, due to the potential for additional contamination.
3. Allow only emergency vehicles into the facility during the emergency.

CONTAINMENT AND CLEANUP

1. Contain any spilled material or contaminated water by using absorbent or absorbent booms.
2. Pump free liquids into fuel tank or vehicle for transport/disposal.
3. Collect all contaminated absorbent for disposal.

EMERGENCY TERMINATED

1. Complete written description of event while details are still fresh in your mind.
2. Begin equipment and area decontamination.

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SPILL RESPONSE AND PROCEDURES

INITIAL RESPONSE

1. DO NOT enter a hazardous area especially if a confined space without proper personnel protective equipment--respirator, gloves, rubber boots, goggles, monitoring badges.
2. Stop waste flow by closing valves or shutting off pumps--if this can safely be done.
3. Stop all unloading or transfer activity to isolate affected area.

NOTIFICATION AND PROCEDURE

1. Notify Emergency Coordinator and other personnel.
2. Continue procedures to stop spill.
3. Contain spill as much as possible while attempting to stop spill.
4. To contain spill:
 - a. Use absorbent booms
 - 1) Use these in tandem (one placed a few inches behind the other) to help control the flow of material.
 - 2) Oil sorbent booms should be used on any water that could possibly be contaminated; they would serve as backups on material that might get by the tandem sorbent booms.
 - b. Use absorbent:
 - 1) Use a drum truck to move barrels of dust.
 - 2) Barrels can be turned upside down and rolled on edge to create an "instant" dike.
 - 3) Use front end loader buckets of dust.
 - c. Use mechanical means:
 - 1) Ditch with shovels.
 - 2) Ditch with a front end loader.

SUSTAINED RESPONSE

1. Use on-site monitoring equipment to determine safety of area.
2. If there is a need for outside emergency help, the Emergency Coordinator will contact the appropriate outside agency.
3. Pump free liquids into fuel tank or vehicle for transport/disposal.
4. Collect all contaminated absorbent for disposal.

EMERGENCY TERMINATED

1. Complete written description of event while details are still fresh in your mind.
2. Begin equipment and area decontamination.

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6.11.2 Emergency Contacts

Cecil Fire Department Cecil, OH 45821	(419) 399-3819	FIRE
Paulding County Sheriff's Department South William Street Paulding, OH 45879	(419) 399-3791	SHERIFF
Paulding County Hospital Rural Route 2 Paulding, OH 45879	(419) 399-4080	HOSPITAL
Paulding Emergency Medical Service Paulding, OH 45879	(419) 399-3791	AMBULANCE
Paulding County Health Department	(419) 399-3921	
Ohio Environmental Protection Agency Emergency Response Team	(800) 282-9378	
United States Environmental Protection Agency National Response Center	(800) 424-8802	
United States Environmental Protection Agency Region V Emergency Response	(312) 886-4186	

OUTSIDE CONTRACTORS (For Example)

Haz Mat Response	(800) 229-5252
Charles Kauser Excavating	(419) 399-5150
Environmental Remediation Services Inc.	(260) 489-7062

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Please Note: Pages of this application which contain facility staff personal/home phone number information have been removed from this web-available version of the document

To review redacted copies of these removed pages, please contact DMWM's record management staff at 614-644-2621.

Thank you.

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6.11.4 Emergency Evacuation Procedures

PURPOSE: Plan for safe evacuation in the event of an emergency.

RESPONSIBILITIES:

1. Except in certain situations like an explosion or significant fire, the Emergency Coordinator is responsible for implementing the evacuation procedure. He will notify personnel of the need for an evacuation. In the event of an explosion or significant fire, the employees should initiate the evacuation themselves and proceed to the appropriate rally point and await further instruction from the Emergency Coordinator.
2. Employees and visitors will be directed to the proper exit and their assigned safe area outside.

PROCEDURE:

1. The Emergency Coordinator will notify personnel if an evacuation may be necessary.
2. The Emergency Coordinator will assess the conditions including wind direction and speed and order an evacuation to the appropriate rally point or other actions required. If wind direction is toward the primary rally point, the Emergency Coordinator will direct all personnel via radio to the alternative rally point.
3. When an evacuation is announced, stop work. Personnel should use the closest available exit.
4. All employees must leave the facility and report to the designated assembly area. Do not run. Do not linger in entranceways or driveways. Stay together in your assigned safe area.
5. The Emergency Coordinator will make certain that all employees have cleared the facility.
6. The Emergency Coordinator will notify personnel when it is safe to reenter the facility.
7. Stay outside the facility until notified to reenter.

EVACUATION ROUTES:

1. The diagrams of the facility show the routes to use when evacuating; refer to maps posted in each building for evacuation routes.
2. The designated assembly area for the facility is shown in Figure 1.

EMERGENCY PRECAUTIONS:

1. Keep calm, think, avoid panic and confusion.
2. Know all exit locations--be sure you know the safest and quickest way out of all buildings.
3. Do not lock office doors when vacating the facility. The Emergency Coordinator and emergency support personnel must have visual access to all areas to ensure that the facility is clear of personnel.
4. Do not delay evacuation of the facility for any reason.
5. Do not assist in fire control unless properly trained and qualified.
6. When evacuating the facility, WALK to the nearest safe exit. Report to the safe areas away from the buildings and wait for instructions.

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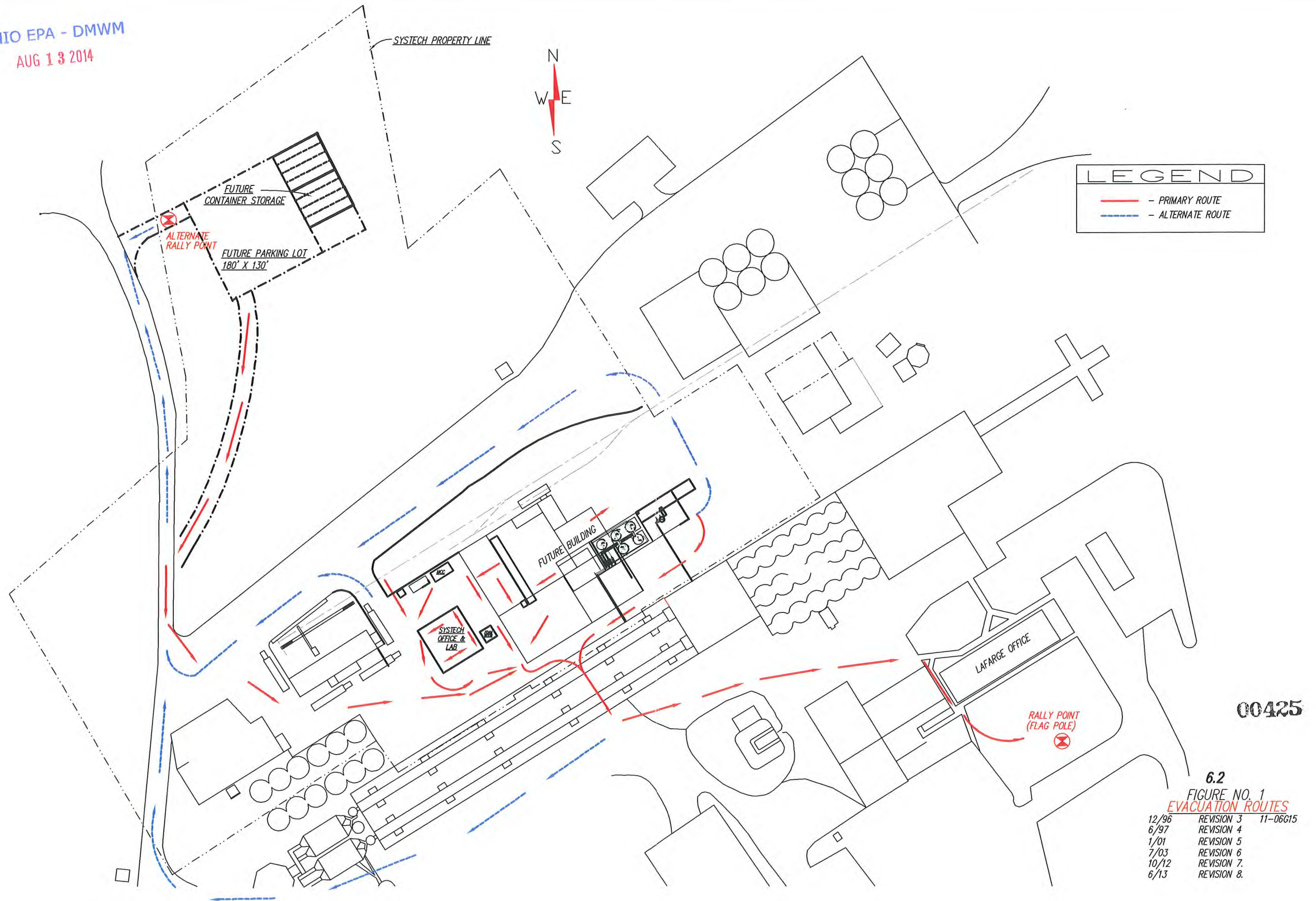
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7. Keep out of the way, stay clear of the facility, and DO NOT interfere with emergency operations.
8. Do not reenter the facility until instructed to do so.

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6.11.5 List of Emergency Equipment

Following is a list of the currently available emergency equipment. Figure 2 shows where personnel can locate the necessary equipment.

INTERNAL COMMUNICATION SYSTEMS

EMERGENCY EQUIPMENT	LOCATION	OUTLINE OF CAPABILITIES
emergency response sirens	processing area, container building	audible throughout active process areas of facility; communicates emergency situation to personnel and Emergency coordinator
walkie talkies	lab; all personnel	internal communication
emergency shutdown switch	control room, direct-burn unload-pad and tank farm	shut off primary feed pumps to kiln

EXTERNAL COMMUNICATION SYSTEM

EMERGENCY EQUIPMENT	LOCATION	OUTLINE OF CAPABILITIES
telephones	office, laboratory	call outside agencies for emergency assistance

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FIRE EXTINGUISHING SYSTEMS²

EMERGENCY EQUIPMENT	LOCATION	OUTLINE OF CAPABILITIES
extinguishers: three 125-lb ABC	fuel area	for use on Type A,B and C fires. (Type A--ordinary combustible materials such as wood, cloth, paper, rubber and many plastics. Type B--flammable liquids, oils, greases, tars, oil base paints, lacquers, and flammable gases. Type C--energized electrical equipment.)
extinguishers: two 125-lb ABC	container building	see above
extinguisher: one 125-lb ABC	Direct Burn Unload-Pad	see above
extinguisher: one 125-lb ABC	Drop and Hook Pad	see above
extinguishers: six 20-lb ABC	container building	see above
extinguishers: two 20-lb ABC	filter area and burn tank	see above
extinguishers: two 20-lb ABC	Direct Burn Unload-Pad	see above
extinguishers: two 20-lb	Drop and Hook Pad	see above
extinguisher: one 10-lb ABC	sample storage area	see above
extinguishers: two 20-lb ABC	off-loading pads	see above
extinguishers: one 20-lb ABC	truck heel removal area	see above

² Substitution of larger or additional fire extinguishers may be made for those listed here without notifying OEPA of a change in the emergency equipment list.

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extinguishers: six 10-lb ABC	lab	see above
foam generator and foam concentrate	south of tank farm	automatic response to control fire
foam system	container building burn tank containment area	automatic response to control fire
fire hoses	near truck unloading pad	control fire

SPILL CONTROL EQUIPMENT

EMERGENCY EQUIPMENT	LOCATION	OUTLINE OF CAPABILITIES
absorbent	tank farm, off-loading pads, direct-burn unload-pad, drop and hook pad, container building	contain, absorb, and clean up spills
organic vapor sensor	office of Emergency Coordinator	exposure monitoring
overpack drums	container building	receptacle for leaking or damaged containers
tank level gauges	tanks, lab	indicate level of liquid in tank
dikes	all tanks, direct-burn unload pad, drop and hook pad	secondary containment
sump pumps	all dikes	collect spilled material within secondary containment
pump	near tank farm	move liquids from containment to tanks
solvent absorbent booms (4-10 ft. in length)	off-loading pads	dike, absorb spills, move drums around and clean up spills

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front loaders	*	spill containment and clean up
dump trucks	*	see above

*Available under contract from Lafarge Cement Plant operations.

OTHER EMERGENCY EQUIPMENT

EMERGENCY EQUIPMENT	LOCATION	OUTLINE OF CAPABILITIES
first aid supplies; bandaids, gauze bandages, tape, butterfly bandages, antibacterial ointment, splints, aspirin, syrup of ipecac, eyewash, local/topical anesthetics	first aid station and fuel lab	immediate first aid for minor injuries
emergency eyewash fountain and drench showerhead	fuel area, lab, drop and hook pad, direct burn off-load pad	immediate treatment for personnel in case of contact with hazardous materials
protective clothing and equipment: hardhats, protective eyewear, steel-toed boots/shoes, plastic aprons & gauntlets, chemical resistant boots, polyethylene and rubber gloves, rainsuits, chem-resistant suits, face shields, protective eyeglasses, half-face respirators, chemical cartridge respirators	locker room, lab	protect personnel from possible hazards
Low spark risk tools	container process area, maintenance shop	equipment maintenance
clean solvent	lab	rinse contaminated equipment

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SYSTECH PROPERTY LINE

FUTURE
CONTAINER STORAGE

FUTURE PARKING LOT
180' X 130'

TRUCK SCALES

RAILCAR & TRUCK SCALES

SYSTECH PROPERTY LINE

CLINKER STORAGE

6.3
FIGURE NO. 2
LOCATION OF EMERGENCY EQUIPMENT

REVISION 4 4/97 11-06G06
REVISION 5 6/97 JW RELEASED FOR PERMIT
REVISION 6 7/03 NW ADDED DIRECT BURN AND CONTAINER STORAGE
REVISION 7 1/13 DLD REVISED LOCATION OF EMERGENCY EQUIPMENT PER PLANT REQUEST

LEGEND

COMMUNICATION EQUIPMENT

- S - EMERGENCY RESPONSE SIREN
- T - TELEPHONE AVAILABLE
- W - WALKIE TALKIE

FIRE EXTINGUISHING SYSTEMS

- - 250# ABC
- - 150# ABC
- ◊ - 140# ABC
- △ - 125# ABC
- ◻ - 20# ABC
- - 10# ABC
- G - FOAM GENERATOR W/ FIRE HOSES
- C - FOAM CONCENTRATE
- ▨ - FOAM SYSTEM
- ⊕ - WATER HYDRANT

SPILL CONTROL EQUIPMENT

- D - ABSORBANT
- B - SOLVENT ABSORBENT BOOM
- VS - ORGANIC VAPOR SENSOR
- P - PORTABLE PUMP
- K - OVERPACK DRUM

OTHER EMERGENCY EQUIPMENT

- ⊗ - PROTECTIVE EQUIPMENT
- F - FIRST AID SUPPLIES
- E - EMERGENCY EYEWASH FOUNTAIN
- S - EMERGENCY SHOWERHEAD
- Z - EMERGENCY SHUTDOWN SWITCH

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6.11.6 Duties of the Emergency Coordinator

Whenever there is an imminent or actual emergency situation whether it is a fire, explosion or a spill, the Emergency Coordinator must take the following actions immediately.

Mark time accomplished:	Action to be taken:
	Activate internal facility alarms or communication systems to notify personnel.
	Notify appropriate coordinated emergency response agencies, as needed. Go to Emergency Services List.
	Identify the following characteristics of any released material*:
	the character
	exact source
	Amount
	areal extent
	Assess possible hazards to human health or the environment: Consider direct and indirect effects. Effects of gases generated? Effects of hazardous surface water run-off from fire control? Effects of chemicals used to control emergency? Groundwater contamination. Criteria the EC should use to make this assessment are: location of the fire, size of the fire, wind direction and speed, activities occurring at or near the fire, its proximity to workers <u>to ensure that all workers are instructed to keep downwind of the vapors or event.</u>
	Will this emergency threaten human health or the environment outside of the facility?
	a. Notify appropriate local authorities that an evacuation may be necessary. Go to list of local authorities (page 18). Be available to help decide on evacuation.
	b. Notify Ohio EPA Emergency Response Team, 1-800-282-9378; Region Office of the EPA, 1-312-886-4186; and National Response Center, 1-800-424-8802, when necessary.

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	<p>Include the following in any such report:</p> <ol style="list-style-type: none">1. Name and telephone number of reporter;2. Name and address of facility;3. Time and type of incident (for example, fire);4. name and quantity of material(s) involved, to the extent known;5. Extent of injuries, if any;6. Possible hazards to human health or the environment outside the facility.
--	--

*This step may be accomplished by observation by the EC or by a review of facility records or manifests, or, if necessary by chemical analysis. As part of the RCRA training and formal education, most facility staff have a general knowledge of the materials handled at the facility and can assist with the characterization of the materials in the event of an emergency.

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Mark time accomplished:	Action to be taken:
	Take all reasonable measures necessary to ensure that the emergency does not spread to other hazardous materials at the facility. When necessary,
	a. Halt operations.
	b. Collect and contain released waste.
	c. Remove or isolate containers.
	If facility operations must be stopped, monitor equipment for leaks, pressure buildup, gas generation, or ruptures.
	Following an emergency:
	Provide for treating, storing or disposing of recovered waste, contaminated soil or surface water, or any other material that results from the emergency.
	Ensure than:
	a. No waste that may be incompatible with the released material is treated, stored, or disposed until clean-up procedures are completed.
	b. All emergency equipment is cleaned and fit for its intended use before operations are resumed.

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6.12 Appendix 6.2

Emergency Response Agreement

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SYSTECH LETTERHEAD

Agency Contact
Agency Address

Re: EMERGENCY RESPONSE AGREEMENT

Dear [Agency Contact]:

The Systech Environmental Corporation is engaged in an energy recovery program involving the use of combustible liquid wastes as supplemental fuel in the kiln at the Paulding Cement Plant. These wastes are classified as hazardous under current state and federal regulations. These regulations require that operators of hazardous waste facilities be prepared to respond effectively to emergency conditions. This includes a requirement that a Contingency Plan be made available to agencies who provide emergency services. As described in the enclosed Contingency Plan, we are requesting that you enter into an Agreement for Emergency Assistance at our Paulding Facility.

Our employees have been trained in the proper handling of these materials and on how to respond to emergencies. They have also been provided with special equipment designed for working with these wastes. However, we recognize that an emergency could develop which would require assistance from outside professionals.

We have prepared an Agreement for Emergency Assistance, and two copies are enclosed. The Agreement identifies the properties of materials that will be handled and the emergency response facilities at our facility. Please keep one copy of this Agreement for your files and return the other in the enclosed, self-addressed stamped envelope.

If you have any questions or require additional information regarding our supplemental fuel program, please call me at 419-399-4835.

Sincerely,

SYSTECH ENVIRONMENTAL CORPORATIONEmergency Coordinator
Enclosures

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AGREEMENT FOR EMERGENCY ASSISTANCE
BY AND BETWEEN SYSTECH ENVIRONMENTAL CORPORATION
AND _____

This agreement has been prepared to make arrangements for emergency services to be provided by _____ in the event of emergencies that might result from fires, explosion, or major releases involving hazardous wastes at:

Systech Environmental Corporation
County Road 176
P.O. Box 266
Paulding, OH 45879
Phone: 419-399-4835

Any request for emergency assistance will be issued by means of telephone communication by the primary Emergency Coordinator, the alternate Emergency Coordinator, or their designee.

The materials primarily being handled at the Paulding facility are organic compounds which have been used as industrial solvents. The materials received are mostly xylene, toluene, methyl ethyl ketone, acetone and mixed hydrocarbon compounds which are contaminated with pigments, plasticizers, sludges and small quantities of other solvents. The metals barium, chromium, and lead can also be present. A list of organic materials which may be accepted for use as fuel is enclosed for your use. If an emergency arises, the specific compounds involved will be immediately identified by consulting material inventory and analysis records.

A copy of the Systech Environmental Corporation Contingency Plan, which describes emergency response procedures, identifies the type and location of emergency equipment, and sets forth emergency assistance requirements, is enclosed with this Agreement.

_____ agrees to provide emergency assistance to the Systech Environmental Corporation, at their request, if an incident occurs which requires facilities, equipment or expertise not available at the facility.

Systech Environmental Corporation

Agency

By: _____

By: _____

Date: _____

Date: _____

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Paulding Systech Facility

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SECTION VII PERSONNEL TRAINING

7.1 Introduction

In accordance with 40 CFR §270.14(b)(12) and OAC 3745-50-44(A)(12), this section briefly outlines how Systech provides initial and continuing training for those employees whose duties require involvement in the waste management program. Systech has developed training programs designed to identify, evaluate and control safety and health hazards and to provide for emergency response. The programs include employee monitoring which identifies any risks associated with each of the substances identified in the waste management program.

The training programs detail safe work practices and standard operating procedures. Classroom instruction and on-the-job training (OJT) describe possible hazards, personnel responsibilities, engineering controls used to provide a safe workplace, the use of personal protective equipment, emergency response procedures, medical surveillance policy, recognition of symptoms, and sources of medical assistance.

All facility employees receive a general orientation, including a video presentation, describing the waste management programs. General orientation training also includes information on the characteristics of waste materials, material safety data, handling of hazardous wastes, sanitation and personal hygiene, medical surveillance, work practices and specialized training for workers actively involved in the management of hazardous waste. All employees are instructed about implementation of the Contingency Plan, emergency communications, and alarm activation methods.

Training for employees actively working with hazardous wastes is more detailed and is designed to ensure that personnel are able to respond effectively to emergencies. All waste management facility personnel are either trained or instructed in procedures to:

- respond to spills and fires or explosions,
- inspect and repair or replace emergency equipment,
- maintain and activate waste feed cut-off systems,
- initiate facility shutdown operations,
- protect themselves from harmful exposure through proper use of personal protective equipment and procedures.

Both classroom instruction and continuing OJT is required for all waste management facility personnel. No employee is allowed to work unsupervised until he has successfully completed training to ensure that he can perform his duties safely and in compliance with applicable hazardous waste management requirements.

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Paulding Systech Facility

USEPA ID No.: OHD 005048947

Ohio Permit No.: 03-63-0595

7.2 Personnel Training Program

7.2.1 Training Program Overview/40 CFR §264.16(a)(1) & OAC 3745-54-16(A)(1)

The training program is composed of classroom sessions and numerous OJT activities. These combine to provide a level of training directly related to the level of involvement with the waste management program, level of responsibility, and specific job functions of the respective personnel.

7.2.2 Program Description

Personnel classroom training sessions depend on their degree of involvement with the waste management activities at the facility. All waste management facility personnel receive the New Hire Orientation. All personnel who are to be actively engaged in the operation or maintenance of the waste management facility receive additional training covered in the Waste Management Facility Positions training session. All Systech personnel receive additional training presented in the Systech Positions training session.

7.2.3 Program Outline/40 CFR §264.16(a)(3) & OAC 3745-54-16(A)(3)

The detailed outline of the contents of each of the three classroom training sessions is presented in [7.3 Appendix 7.1 including an example of the training documentation.](#)

7.2.4 Qualifications of Training Personnel/40 CFR §264.16(a)(2) & OAC 3745-54-16(A)(2)

The Systech Facility Manager coordinates training activities for facility personnel, with support from Systech's corporate office.

The Facility Manager designates a trainer for new facility personnel. This trainer will have completed initial RCRA training, the facility's annual review training, and specific training on how to present the material in the training manual. The trainer may also attend off-site training seminars.

The Facility Manager and experienced supervisory personnel who are skilled in the current methods of facility operation coordinate OJT activities. Supervisors oversee OJT since they must decide whether the trainees have mastered the skills necessary to perform the tasks called for in their job descriptions. The personnel who provide OJT will be selected because of the ability and knowledge they have demonstrated in their particular areas.

7.2.5 Completion of Initial Training/40 CFR §264.16(b) & OAC 3745-54-16(B)

Within six months of assignment to waste management positions, all newly hired, transferred, or cross-trained personnel receive classroom instruction and OJT which

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relates specifically to their assigned duties. All existing personnel have already received the appropriate level of training or are currently enrolled in the training program.

Mastery of specific job skills and procedures is accomplished through supervised OJT activities. In general, all newly hired, transferred, or cross-trained waste management facility personnel will be assigned to assist fully trained, experienced personnel as they perform their jobs. New employees will often temporarily assist in activities which are peripheral to their primary job function so that they gain a more complete appreciation of the overall operation of the facility. Supervisory personnel observe and evaluate the performance and competence of the trainees over the course of their apprenticeship.

7.2.6 Annual Training Review/40 CFR §264.16(c) & OAC 3745-54-16(C)

At least once each year, waste management facility personnel attend a training review and update program. This program is an abbreviated review of the introductory training outline (see [7.3 Appendix 7.1](#)), coupled with a detailed review of existing emergency response procedures contained in the Contingency Plan.

Emphasis is placed on discussions of any changes in wastes, equipment, operations, procedures, or regulations that affect the Contingency Plan and emergency response activities. Personnel attending the class review and discuss in detail any operational concerns, difficulties, malfunctions, incidents, or regulatory compliance problems which occurred in the previous year.

7.2.7 Documentation Maintained at Facility/40 CFR §264.16(d) & OAC 3745-54-16(D)

40 CFR §264.16(d) and OAC 3745-54-16(D) require that certain records relating to the training of hazardous waste facility personnel be maintained at the facility. Systech complies with these regulations by maintaining the following items at the facility as part of the Operating Record:

- (1) Job title for each position at the facility relating to hazardous waste management and the name of the employee(s) filling each position.
- (2) Written job descriptions for each position, including the requisite skill, education, qualifications, and duties of the employees assigned to each position.
- (3) Written descriptions of the type and amount of both introductory and continuing training that will be given to each person filling a position.
- (4) Records documenting that the appropriate training or job experience described above has been given to and successfully completed by each of the facility personnel.

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7.2.8 Recordkeeping/40 CFR §264.16(e) & OAC 3745-54-16(E)

Training records on current personnel will be kept until closure of the facility.
Training records on former employees will be kept for at least three years from the date the employee last worked at the facility.

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7.3 Appendix ~~7.1~~

Systech Training Program

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Paulding Systech Facility

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APPENDIX 7.1
SYSTECH TRAINING PROGRAM

- Section I. What Is Fuel Quality Waste?
- A. Definition, Sources, and Standards
 - Definition
 - Standards
 - Sources
 - Labels/Placards
 - B. Basic Characteristics of FQW
 - Vapors
 - Ignitability
 - C. Hazards Associated with FQW
 - Fire/Explosion
 - Health Effects
- Section II. Cement Manufacturing
- A. Limestone Quarry and Crusher
 - B. Raw Grinding
 - C. The Kiln
 - D. Finish Grinding
 - E. Wet and Dry Process Kilns
 - F. Emission Control Systems
 - Internal Dry Gas Scrubbing
 - Particulate Controls
 - Multiclone
- Section III. Regulations, Permits, and Inspections
- A. Government Regulations
 - B. Permits

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C. Inspections and Audits

External

Internal

Section IV. Waste Approval/Rejection Process

A. How Systech Qualifies New Customers

Customer Requalification Policy

Scheduling

Analyses of Shipments

Documentation

B. Rejection Policy

Reasons for Rejecting FQW

Notification Procedure

What Happens to a Rejected Waste Shipment

Section V. Health and Welfare Program

A. Medical Examinations

Preplacement

Annual

Termination

B. Monitoring Programs

Vapors and Dusts

Noise

Heat Stress

Other Tests

Section VI. Basic Operations Training--Work Practices

A. Personal Protective Clothing and Equipment

The Need for Protective Clothing and Equipment

Types of Protective Clothing and Equipment

Care of Personal Protective Equipment

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- B. Respirators
 - C. Housekeeping, Maintenance, and Personal Hygiene
 - Housekeeping
 - Maintenance
 - Personal Hygiene
 - D. General Safety Procedures
 - General Rules
 - Equipment Safety
 - Electrical Systems
 - E. Lockout-tagout Procedures
 - F. Semi-enclosed Space/Closed Space (Vessel) Entry Procedures
 - Semi-enclosed Space Entry Procedures
 - Closed Space/Vessel Entry Procedures
-
- Section VII. Emergency Personnel
 - Section VIII. Contingency Plan
 - Section IX. Contingency Plan Review
 - Section X. Site Tour
 - Section XI. Systech 101 Final Review

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Training Record

Employee:

Date	Subject	Instructor	Duration (min)	Safety Training
2012 1/25/2012	2011 Safety Incident Review	Trent Hesselschwardt	25	x
2/7/2012	Annual First Aid	American Red Cross	60	x
3/23/2012	SNCR System Intro	Trent Hesselschwardt	35	x
4/19/2012	Energy Isolation: Systech/Lafarge std. review	Trent Hesselschwardt	40	x
	Arc flash review	Chris Price		
5/3/2012	Facility Tornado Drill	Trent Hesselschwardt	15	x
5/21/2012	Systech WAH STD review	Trent Hesselschwardt	30	x
	Fall protection inspection	Trent Hesselschwardt		
6/26/2012	Sun Prevention & Awareness	Sam Alford		x
	"5 Steps to Safety" Discussion	Trent Hesselschwardt		x
	Safety Scavenger Hunt	Trent Hesselschwardt	120	x
7/20/2012	Annual RCRA/DOT Training	Trent Hesselschwardt	60	x
	Truck/Rail Receiving-offloading review			
8/10/2012	Review of Storm Emergency Incident/Procedure	Jeff Hunyor	25	x
		Trent Hesselschwardt		
9/27/2012	New cell phone policy review	Trent Hesselschwardt	25	x
	Safety glasses program review			
	Incident review			
	Safety goals review			
10/9/2012	Fire Extinguisher Training	Van Wert Fire Dept.	15	x
11/16/2012	Agitation safety review	Mike Eggelston	30	x
12/17/2012	Winter Safety Review	Trent Hesselschwardt	35	x
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7.3 APPENDIX 7.2

Job Descriptions

AUG 13 2014

TITLE: Administrative Assistant **DATE:** 11/13/12
DEPARTMENT: Site Services **STATUS:** Non-exempt – GR 7
REPORTS TO: Lead CSR **LOCATION:** Fredonia
Site Manager Paulding

ASSIGNED STAFF: NA

OBJECTIVE:

Works with a minimum of supervision performing specific detailed assignments, such as checking regulatory paperwork against existing permits for regulatory and health and safety compliance, as well as general office duties.

PRINCIPAL DUTIES & RESPONSIBILITIES:

* Denotes essential functions.

1. * Performs miscellaneous office duties such as copying, filing, entering computer data and creating routine reports.
2. * Prepares correspondence and/or form letters; also, creates specialized and more complex reports and documentation such as (i.e. labor tracking, C.O.D.'s, contractor training and insurance information, and control device reporting) upon request.
3. * Enters manifest information into the computer; checks manifest and LDR to ensure accuracy/acceptability of material, and documents manifest discrepancies. This position is the first line of regulatory compliance with manifesting and because of this it requires a great deal of detail and accuracy. Must learn and apply permit and regulatory controls with regard to manifests.
4. * Works with Accounts Receivable to make sure all necessary information and documents are available for the centralized billing.
5. * Provide customers with information on a daily basis.
6. * Answers telephone, handles mail and processes and tracks purchase orders.
7. * Assist laboratory with paperwork, samples, etc. as needed. Also assist customer service representative (s) with customer issues as needed.
8. * Maintains inventory of supplies as required.
9. * Maintains quality of office equipment through ordering service and overseeing maintenance agreements.

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10. * Wears all levels of PPE as required.
11. * Provide backup in the absence of the Customer Service Representative.
12. * Acts in a safety conscience manner in the workplace and promotes safety with the other site employees.
13. Assist in other work areas of the facility when necessary to meet site emergencies or production priorities
14. * Works scheduled or non-scheduled overtime as necessary to meet site production priorities or emergencies.

ON-GOING TRAINING AND EDUCATION: The person in this position is expected to:

1. complete required regulatory, governmental and safety training such as RCRA and MSHA for this position and/or any other positions throughout the site where they can be of assistance,
2. participate in approved workshops and classes which will improve skills and assist one in staying current in the technical aspects of his/her work responsibilities and
3. participate in internal workshops for individual and work team development.

JOB SPECIFICATIONS:

1. Team Orientation: The ability to work cooperatively in a professional team-oriented environment.
2. Technical knowledge: Has basic math and above average computer skills, with knowledge of office procedures.
3. Communication skills: Command of all oral and written communication skills necessary to communicate with site and corporate personnel, transporters and generators and to correctly draft documents.
4. Problem-solving ability: Ability to set own work priorities and to recommend solutions for administrative issues.
5. Annual Physical: Individuals in this position must pass the prescribed annual health physical provided by the company (except Whitehall - not Hazardous Waste).

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Administrative Assistant**QUALIFICATIONS:**

These skills, abilities and knowledge are normally acquired by a high school vocational course of study in office procedures and/or related experience.

WORK ENVIRONMENT:

Normal, pleasant office environment.

DISCLAIMER:

This job description identifies the general duties and minimum level of skills required to perform this job. It is not intended to represent a comprehensive inventory of all duties, responsibilities and qualifications required of employees assigned to this job.

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TITLE: Process Operator I **DATE:** 11/13/12
DEPARTMENT: Operations **STATUS:** Non-exempt – GR 7
REPORTS TO: Production Supervisor **LOCATION:** Fredonia
Shift Supervisor Paulding
Tulsa

ASSIGNED STAFF: NA

OBJECTIVE:

Trained in one process area and works with a minimum of supervision, unloading hazardous (i.e., flammable) and/or non-hazardous materials; and processing or blending the material for reuse as a fuel.

PRINCIPAL DUTIES & RESPONSIBILITIES:

* Denotes essential functions.

1. * Unloads and processes material following established procedures. Proficient in use of a forklift or other mobile equipment.
2. * Responsible for following Systech policies and permits for proper handling of waste.
3. * Performs, upon request, routine maintenance on designated equipment.
4. * Maintains a clean and orderly work area. Well organized.
5. * Ability to operate heavy equipment such as bobcat, track mobile (move and position railcars), stinger and remote controlled agitation crane.
6. * Inspect and recondition customer portable Fuel Quality Waste tanks.
7. * Wears all levels of PPE as required.
8. * Acts in a safety conscience manner in the workplace and promotes safety with the other site employees.
9. * Assist in other work areas of the facility when necessary to meet site emergencies or production priorities.
10. * Works scheduled or non-scheduled overtime as necessary to meet site production priorities or emergencies.

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ON-GOING TRAINING AND EDUCATION: A person in this position is expected to:

1. complete required regulatory, governmental and safety training such as Systech Safety Procedures, RCRA and MSHA for this position and/or any other positions throughout the site where they can be of assistance,
2. participate in approved workshops and classes which will improve skills and assist one in staying current in the technical aspects of his/her work responsibilities and
3. participate in internal workshops for individual and work team development.

JOB SPECIFICATIONS:

1. Team Orientation: The ability to work cooperatively in a professional team-oriented environment.
2. Proficiency: Proven proficiency to work in one process area, including demonstrated problem solving skills.
3. Driving Requirements: Maintain a valid driver's license in order to operate equipment that requires a drivers license to operate.
4. Communication Skills: Good written and oral communication skills in order to give and receive instructions, explain procedures and identify operational problems. Basic computer skills and the ability to complete reporting requirements.
5. Protective Gear: Ability to wear protective equipment such as hard hat, safety glasses or goggles, Tyvek suits, steel-toed shoes, gloves, supplied air and respiratory equipment while working in all areas.
6. Physical Abilities: Ability to perform physical tasks such as climbing, lifting, and bending.
7. Annual Physical: Individuals in this position must pass the prescribed annual health physical provided by the company.

QUALIFICATIONS:

These skills are normally acquired through a minimum of a high school education or equivalent. Advanced training may be required to accommodate site needs.

WORK ENVIRONMENT:

This position requires the incumbent to work outside and in the process buildings – this may include exposure to heat, cold, dust and noise in the processing of flammable waste materials. This work may require the use of Tyvek suits, safety glasses, respirators, supplied air respirators and/or gloves.

DISCLAIMER:

This job description identifies the general duties and minimum level of skills required to perform this job. It is not intended to represent a comprehensive inventory of all duties, responsibilities and qualifications required of employees assigned to this job.

TITLE: Process Operator II **DATE:** 11/13/12
DEPARTMENT: Operations **STATUS:** Non-exempt – GR 8
REPORTS TO: Production Manager
Production Supervisor **LOCATION:** Fredonia
Lead Maint Operator Paulding
Operations Supervisor Tulsa

ASSIGNED STAFF: NA

OBJECTIVE:

May be trained for and work in two of more process areas with a minimum of supervision, unloading hazardous (i.e., flammable) and non-hazardous materials and processing or blending the material for reuse as a fuel.

PRINCIPAL DUTIES & RESPONSIBILITIES:

* Denotes essential functions.

1. * Unloads and processes material following established procedures. Use of a forklift or other mobile equipment may be required.
2. * Responsible for following Systech policies and permit for the proper handling of waste.
3. * Performs, as requested, routine and complex (i.e. changing of pumps) maintenance on designated equipment.
4. * Inspect all equipment and provide routine maintenance, recording inspections and maintenance.
5. May complete inspections and reports to meet EPA, MSHA and State Fire Marshall Standards.
6. * Ability to operate heavy equipment such as bobcat, track mobile (move and position railcars), stinger and remote controlled agitation crane.
7. * Inspect and recondition customer portable Fuel Quality Waste tanks.
8. * Maintains a clean and orderly work area.
9. * Wears all levels of PPE as required.
10. * Acts in a safety conscience manner in the workplace and promotes safety with the other site employees.

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Process Operator II

11. * Assist in other work areas of the facility when necessary to meet site emergencies or production priorities.
12. * Works scheduled or non-scheduled overtime as necessary to meet site production priorities or emergencies.

ON-GOING TRAINING AND EDUCATION: A person in this position is expected to:

1. complete required regulatory, governmental and safety training such as Systech Safety Procedures, RCRA and MSHA for this position and/or any other positions throughout the site where they can be of assistance,
2. participate in approved workshops and classes which will improve skills and assist one in staying current in the technical aspects of his/her work responsibilities and
3. participate in internal workshops for individual and work team development.

JOB SPECIFICATIONS:

1. Team Orientation: The ability to work cooperatively in a professional team-oriented environment.
2. Proficiency: Proven proficiency to work in one or more process areas including demonstrated problem solving skills.
3. Driving Requirements: Maintain a valid driver's license in order to operate equipment that requires a drivers license to operate.
4. Communication Skills: Good written and oral communication skills in order to give and receive instructions, explain procedures and identify operational problems. Basic computer skills and the ability to complete reporting requirements.
5. Protective Gear: Ability to wear protective equipment such as hard hat, safety glasses or goggles, Tyvek suits, steel-toed shoes, gloves, supplied air and respiratory equipment while working in all areas.
6. Physical Abilities: Ability to perform physical tasks such as climbing, lifting, and bending.
7. Multiple Tasks: Experience, on-the-job training and other training provide this person with the ability to handle multiple tasks.

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Process Operator II

8. Annual Physical: Individuals in this position must pass the prescribed annual health physical provided by the company.

QUALIFICATIONS:

These skills are normally acquired through a minimum of a high school education (or equivalent) and on-the-job training. Advanced training may be required to accommodate site needs.

WORK ENVIRONMENT:

This position requires the incumbent to work outside and in the process buildings – this may include exposure to heat, cold, dust and noise in the processing of flammable waste materials. This work may require the use of Tyvek suits, safety glasses, respirators, supplied air respirators and/or gloves.

DISCLAIMER:

This job description identifies the general duties and minimum level of skills required to perform this job. It is not intended to represent a comprehensive inventory of all duties, responsibilities and qualifications required of employees assigned to this job.

TITLE: Lead Maintenance Operator **DATE:** 11/13/12
DEPARTMENT: Operations **STATUS:** Non Exempt -GR 10
REPORTS TO: Facility Manager **LOCATION:** Paulding

ASSIGNED STAFF: Maintenance technician and production operatives

OBJECTIVE:

Field Supervision Role:

Supervises operations and maintenance activities to ensure:

- the safety of Systech employees and any other persons on Systech premises
- regulatory compliance is respected
- the integrity of equipment is not compromised
- production goals are met
- cost control is maintained

Continuous Improvement Role:

- identify opportunities and contribute solutions to enhance operational effectiveness
- provide project support in scoping and execution of projects and contractor management as appropriate
- coordinate and/or execute improvements in industrial management systems (i.e. refinement of site maintenance program, development of multi-year capex plans, etc)

PRINCIPAL DUTIES & RESPONSIBILITIES

1. Direct line supervision including disciplinary action of production and maintenance personnel.
2. Maintains and supports field personnel by assessing and controlling risks to personal safety, the environment, and equipment. Ensures regulatory compliance is respected.
3. Responsible for ensuring all staff is properly trained when carrying out maintenance and production assignments, which includes lab staff when they help out in that role.
4. Organizes and supervises activities of production and maintenance personnel to ensure production goals are met, a reliable supply of fuel is tendered to the cement kilns and cost control is maintained. Determines overtime schedule.
5. Assist Site Manager with Performance Reviews for the production and maintenance staff.

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Operations Supervisor

6. Assists the Site Manager with the build-up of the operations and capex budgets, monitors progress against the budget and takes corrective actions to ensure the budget is respected.
7. Ensures safety, quality, and cost-effectiveness of third-party vendors and services used for maintenance or production purposes is maintained.
8. Provides project support in scoping and execution of projects and contractor management as appropriate.
9. Communicate to Lafarge plant supervisors any issues that may arise affecting them and or necessitate their help.
10. Given the small size of the team, the Operations Supervisor routinely provides hands-on support to operations personnel to move the operations forward.

ON-GOING TRAINING AND EDUCATION: A person in this position is expected to:

1. complete required regulatory, governmental and safety training such as RCRA and MSHA for this position and / or any other positions throughout the site where they can be of assistance,
2. participate in approved workshops and classes which will improve skills and assist one in staying current in the technical aspects of his/her work responsibilities

JOB SPECIFICATIONS:

1. Demonstrates a principled yet pragmatic understanding of how to accomplish work safely with a full respect for the environment. Principled in the sense that work will not proceed unless risks are effectively controlled. Pragmatic in the sense of finding effective ways of controlling risks that can be incorporated "naturally" into the way work can be effectively executed.
2. Very well-organized. The role demands the ability to move in and out of the field to supervise and execute tactical day-to-day issues while leaving sufficient time to properly plan activities that can range from multi-week to multi-year time horizons.
3. Has a solid technical background and aptitude to be able to make pragmatic short-term fixes and yet identify long-term solutions to various mechanical and operational systems. Specific knowledge on hydraulics, pumps, and agitation systems must be acquired quickly as they comprise the core of the production process.
4. Able to effectively scope out projects, develop meaningful timelines, and craft budgets necessary to monitor and control the desired outcomes.
5. Requires a superior set of interpersonal skills:

- strong listening skills to solicit the creativity and ideas of front-line employees and technical experts
- good negotiating skills to manage third party vendors and contractors
- solid conflict resolution skills, with an ability to help all sides to an issue scope out the real problem(s) and find constructive solutions
- superior communication, feedback and coaching skills, as time for interaction on a hectic day may be rather limited

PHYSICAL REQUIREMENTS:

The role is a hands-on supervisory function so the incumbent must be capable of performing a number of physical demands such as climbing, lifting, bending, and pulling in work stations and locations that may not be well designed from an ergonomics perspective. The difficulty of these tasks can be compounded by outdoor environments with exposures to heat, cold, and inclement weather. This work may require PPE, including the use of Tyvek suits, safety glasses, respirators, supplied air respirators and/or gloves.

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TITLE: Customer Service Representative (CSR) **DATE:** 11/13/12

DEPARTMENT: Operations **STATUS:** Exempt – GR 10

REPORTS TO: Lead Customer Serv Rep **LOCATION:** Fredonia
Site Manager Paulding

ASSIGNED STAFF: NA

OBJECTIVE:

To oversee customer services activities and effectively communicate between sales, site personnel and customers. Ensure site goals and provide sales support for the site.

PRINCIPAL DUTIES & RESPONSIBILITIES:

* Denotes essential functions.

1. * Acts as liaison between customers, the corporate office, laboratory or operations personnel on such issues as shipment, regulatory issues (land ban and others), manifesting and qualifications.
2. * Coordinates and works with the lab and sales representatives to complete qualification approvals, quote letters, and contracts.
3. * Provides sample and customer information to assists the sales, operations and laboratory teams.
4. Prepares reports and correspondence for operations and sales teams as needed.
5. * Assist with or conducts, as assigned, customer audits and facility tours.
6. * Schedules shipments - coordinates schedule with lab, operations, and customers.
7. * Maintains customer contact with assigned accounts, including limited travel to customer sites.
8. * Manages multiple priorities within all levels of the company, applying effective problem solving skills.
9. * Maintains customer files with up-to-date contracts and pricing schedules.
10. Coordinate customer scheduling and processing needs outside of the regular workday as required. May be required to carry a cell phone or pager to complete duties.
11. * Wears all levels of PPE as required.

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Customer Service Representative

12. * Acts in a safety conscience manner in the workplace and promotes safety with the other site employees.
13. * Assist in other work areas of the facility when necessary to meet site emergencies or production priorities.
14. * Works the required amount of time to meet site production priorities or emergencies.

ON-GOING TRAINING AND EDUCATION: A person in this position is expected to:

1. complete required regulatory, governmental and safety training such as RCRA and MSHA for this position and/or any other positions throughout the site where they can be of assistance,
2. participate in approved workshops and classes which will improve skills and assist one in staying current in the technical aspects of his/her work responsibilities and
3. participate in internal workshops for individual and work team development.

JOB SPECIFICATIONS:

1. Team Orientation: the ability to work cooperatively in a professional team-oriented environment.
2. Technical skills: Proven knowledge of regulatory, permit and manifest documents in order to correctly answer customer inquiries. Thorough knowledge of operations and sales in order to coordinate activities. Above average computer skills.
3. Communication skills: All necessary oral and written skills in order to effectively communicate to internal and external customers. Proven telephone and presentation skills in order to maintain good customer relations.
4. Annual Physical: Individuals in this position must pass the prescribed annual health physical provided by the company.

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Customer Service Representative

QUALIFICATIONS:

These skills are normally acquired through a Bachelor's degree or the equivalent of four to six years in a combination of college study and work experience. Preferably the experience will be in a job with considerable customer contact and/or work in the waste quality fuel industry.

WORK ENVIRONMENT:

Normal, pleasant office environment.

DISCLAIMER:

This job description identifies the general duties and minimum level of skills required to perform this job. It is not intended to represent a comprehensive inventory of all duties, responsibilities and qualifications required of employees assigned to this job.

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TITLE:	<u>Chemist</u>	DATE:	11/13/12
DEPARTMENT:	Operations	STATUS:	Exempt – GR 11
REPORTS TO:	Laboratory Manager	LOCATION:	Fredonia Paulding

ASSIGNED STAFF: NA

OBJECTIVE:

To conduct the technical evaluation of all samples that the company uses in its co-processing operation - to perform laboratory analyses and procedures to establish the acceptability of materials for use as a fuel.

PRINCIPAL DUTIES & RESPONSIBILITIES:

* Denotes essential functions.

1. * Interprets the results of chemical and procedural analyses of samples to establish their chemical and physical properties.
2. * Conducts laboratory procedures on waste and raw material samples to determine chemical and physical properties and their acceptability for processing.
3. Evaluates technical laboratory equipment, instruments, and hardware/software needs and advises what upgrades or enhancements are appropriate.
4. Participates in technical training of company personnel in evaluation techniques.
5. * Conducts laboratory equipment troubleshooting, maintenance and calibration to ensure optimal analytical conditions and data quality objectives.
6. * Complies with state and federal regulations, as well as the site's WAP, SAMM and established QA/QC procedures.
7. May assist in determining/evaluating production capacity issues such as off-loading railcars.
8. Requires knowledge of permit & waste stream acceptability. Determine/evaluates production flow rates when applicable.
9. May sample waste loads according to procedure, as necessary.
10. * Passes lab procedures proficiency test within one year of starting position.

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Chemist

11. * Responsible for determining/communicating PPE requirements to operating personnel as recommended by compound model.
12. Trains other lab personnel and oversee workflow as required.
13. * Wears all levels of PPE as required.
14. * Acts in a safety conscience manner in the workplace and promotes safety with the other site employees.
15. Assist in other work areas of the facility when necessary to meet site emergencies or production priorities.

ON-GOING TRAINING AND EDUCATION: A person in this position is expected to:

1. complete required regulatory, governmental and safety training such as RCRA and MSHA for this position and/or any other positions throughout the site where they can be of assistance,
2. participate in approved workshops and classes which will improve skills and assist one in staying current in the technical aspects of his/her work responsibilities and
3. participate in internal workshops for individual and work team development.

JOB SPECIFICATIONS:

1. Team Orientation: The ability to work cooperatively in a professional team-oriented environment.
2. Technical Knowledge: Proven knowledge of technical and toxicological compound analysis techniques; knowledge of complex laboratory equipment, instruments, and hardware/software applications used in compound evaluation; knowledge of co-processing and waste management operations and accompanying permitting and regulatory requirements.
3. Communication skills: Command of all oral and written communication skills necessary to translate technical laboratory processes and procedures to both technical and non-technical audiences - ability to instruct other laboratory personnel in clinical procedures and methods of analysis and results interpretations. Above average computer skills and the ability to complete reporting requirements.

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Chemist

4. Problem-solving: Demonstrated ability to perform complex laboratory procedures to analyze samples; ability to determine appropriate laboratory procedures, select a sampling technique, perform the necessary analytical analyses, and reach a conclusion with recommendations.
5. Annual Physical: Individuals in this position must pass the prescribed annual health physical provided by the company.

QUALIFICATIONS:

A Bachelor's Degree in physical or life science, preferably in chemistry or with a chemistry minor, is the preferred educational preparation. A Bachelor's Degree and the completion of the science curricula equivalent to a degree in physical or life science may be substituted. Additionally, three to five years of related production or research laboratory experience is preferred. An advanced scientific degree (i.e., masters) and one to two years of related laboratory experience or equivalent would also meet the education and experience requirements of this position.

JOB DEMANDS:

Work requires the ability to maintain strict adherence to laboratory protocols where procedural errors or omissions can be adverse to short-range and long-range company operations.

WORK ENVIRONMENT:

Work in the site laboratory requires the use of a fume hood, Tyvek suits, safety glasses, respirator, supplied air respirators and gloves up to 100% of the time when working with various waste materials of known and unknown nature.

DISCLAIMER:

This job description identifies the general duties and minimum level of skills required to perform this job. It is not intended to represent a comprehensive inventory of all duties, responsibilities and qualifications required of employees assigned to this job.

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TITLE: Laboratory Manager **DATE:** 11/13/12
DEPARTMENT: Operations **STATUS:** Exempt
REPORTS TO: Facility Manager **LOCATION:** Fredonia
Paulding (2nd in command)
ASSIGNED STAFF: Chemists **JOB CODE/GRADE:** 13

OBJECTIVE:

Under general supervision, oversees the operations of site laboratory facility including the review and interpretation of analytical waste material procedures and diagnostic tests to ensure only acceptable waste materials are utilized at the facility. Participates as a member of the site management team and makes recommendations for budgeting, goals and strategy.

PRINCIPAL DUTIES AND RESPONSIBILITIES:

1. Supports site operating goals with regard to safety, profitability, productivity and compliance.
2. Assure safe working conditions for employees by enforcing company safety standards and pushing behavior based safety amongst all employees. Oversees site compliance with health and safety policies as required.
3. Performs routine to complex chemical analyses on waste material samples using a variety of laboratory equipment such as gas chromatograph and atomic absorption to analyze chemical properties of waste materials.
4. Manages, develops, and instructs chemists and lab technicians in the use of analytical equipment, diagnostic procedures and interpretation of waste samples and establishes work flow, including priorities.
5. Oversees tank tender documentation, certifying the quality and content of blended waste fuel substances and communicating with the cement plant regarding analytical data.
6. Reviews and approves interpretation of analytical tests results obtained by chemists and lab technicians.
7. In conjunction with the Production Manager, develops calibration tables and determines procedures for blending of waste fuel materials and tendering of tanks.
8. Guided by the site Waste Analysis Plan (WAP), counsels with corporate lab manager on new analytical procedures, interpretation and analysis of waste materials, and training techniques or instructions for new or modified chemical procedures.

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1. Maintain and upgrade WAP, work with permitting and other appropriate staff to ensure proper and compliant modifications are made to WAP and other related permit documents.
10. Maintains detailed knowledge of technical laboratory procedures and protocols used in analyzing the chemical and physical properties of waste materials.
11. Maintains an effective work force to achieve site goals. Hires, supervises, trains, and appraises all assigned personnel.
12. Wears all levels of PPE as required.
13. Assist in other work areas of the facility when necessary to meet site emergencies or production priorities.

ON-GOING TRAINING AND EDUCATION: A person in this position is expected to:

1. Complete required regulatory, governmental and safety training such as RCRA, MSHA and/or OSHA for this position and/or any other positions throughout the site where they can be of assistance.
2. Participate in approved workshops and classes which will improve skills and assist one in staying current in the technical aspects of his/her work.
3. Participates in internal workshops for individual and work team development.

JOB SPECIFICATIONS:

1. Team Orientation: The ability to work cooperatively in a professional team-oriented environment.
2. Technical Knowledge: Demonstrated knowledge of waste and raw material compound analysis including operation and application of specialized laboratory equipment such as gas chromatograph, mass spectrometer, atomic absorption, and Ion chromatograph; proven knowledge of standard procedures and protocols used in evaluation of waste and raw material compounds. Understands and can operate within the site WAP.
3. Communication Skills: Command of all skills necessary to relate technical waste material evaluations to both technical and non-technical audiences; proven ability to prepare oral and written evaluations of compound properties including management presentations.
4. Problem-solving: Demonstrated ability to apply complex analytical tests and protocols to waste materials and determine or interpret chemical properties of such materials.

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Management Skills: Demonstrate ability to oversee the completion of multiple projects including the prioritization, assignment and direction of work for laboratory staff.

6. Annual Physical: Individuals in this position must pass the prescribed annual health physical provided by the company.

QUALIFICATIONS:

These skills, abilities and knowledge areas are normally acquired by achievement of a bachelor degree in physical or life sciences and 3 to 5 years of related laboratory experience.

JOB DEMANDS:

The position requires the ability to make evaluations concerning the chemical properties of various compounds where lab procedures or protocols may yield uncertain conclusions.

WORK ENVIRONMENT:

Work requires the use of respiratory protection and tyvek when working with various waste and raw materials of known and unknown nature.

DISCLAIMER:

This job description identifies the general duties and minimum level of skills required to perform this job. It is not intended to represent a comprehensive inventory of all duties, responsibilities and qualifications required of employees assigned to this job.

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TITLE: Facility Manager **DATE:** 11/13/12
DEPARTMENT: Operations **STATUS:** Exempt - GR 16
REPORTS TO: Director of Fuel Quality Waste **LOCATION:** Paulding

ASSIGNED STAFF:

Lab Manager (Fredonia and Paulding)
Production Manager (Fredonia)
Lead Maint Operator (Paulding)
Maintenance Supvr & Proj Mgr Operator (Fredonia)
Facility Safety Coordinator (Fredonia)
Administrative Assistant (Paulding)
Customer Service Rep. (Paulding, Lead: Fredonia)

OVERALL RESPONSIBILITY:

To provide leadership and management to the overall operation of the Systech Facility, ensuring the attainment of corporate and facility goals. To serve as a business partner with the Facility's Cement operation, a company representative and spokesman with the regulatory and government agencies and to serve as a liaison with the community. This position holds the leadership and responsibility for the regulatory, financial and safety risk involved in the operation of the facility. It is also a major objective of the Facility Manager to recognize new business projects and to participate in the necessary steps that may lead to implementation of these projects. The Facility Manager has the major responsibility for staffing, staff development, personnel issues and ensuring the welfare and safety of the facility employees.

PRINCIPAL DUTIES AND RESPONSIBILITIES:

*Denotes essential functions.

Safety, Environment and Regulatory Development and Compliance*

- Continue to exceed all regulatory standards while continuing to develop each facility's processing capabilities
- Promote innovation and implementation of best practices in behavior based team safety
- Demonstrate Visible Safety leadership with all team members.
- Acts in a safety conscious manner in the workplace and promotes safety with the other facility employees.
- Conducts frequent facility walk-throughs looking for safety and environment improvement opportunities.
- Ensure successful implementation and practice of Group standards
- Create a bottom up Safety First culture
- Strive to be world class through establishing goals that require knowledge of the most update practices and benchmarking (e.g., fire prevention, detection and suppression standards, risk minimization through clear load qualification, blending and unloading process, etc). Share findings and processes with other teams
- Ensure Safety Committee is working well at each facility. Personally review any medical incident and communicate lessons learned to the broader organization

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- Ensure compliance with regulatory, health and safety policies.
- Responsible for implementation of and compliance with the regulatory, health and safety policies.
- Ensures an active strategy and focus with the sales and regulatory groups.
- Identify, direct and prioritize regulatory matters in the development of regulatory permitting and environmental management program.

Operations*

- Provide coaching and oversight to FQW facility supervisors and lead personnel. Ensure operations are run with the utmost concerns for safety and well being of Systech employees, local communities and other stakeholders. Never compromise; never take shortcuts on health and safety.
- Provide management a timely and accurate monthly financial forecast for the balance of the year to include volumes, revenue, operating cost, labor and capital projects. Keep in mind close coordination with the cement plant is necessary to insure accurate FQW fuel needs for the balance of the year.
- Responsible for the facility's compliance with company internal financial procedures and to insure facility has adequate internal controls to protect company assets.
- Anticipate process bottlenecks and identify most effective CAPEX/OPEX ways to tackle them.
- Develop, implement and manage budgets for annual operating cost, labor and capital projects.
- Thoroughly understand the facility's P&L and constantly work on ways to make the operations safer and better
- Responsible for the optimization of facility productivity and customer service quality

Communications*

- Establish and maintain communications with Cement Plant management, customers and local community organizations that have shared interest in Systech's business.
- Participate in facility, community, state and regional organizations/meetings to foster public relations and support of Systech's business.

People Development*

- Implement effective facility organization and staffing levels to meet facility objectives. Responsible for encouraging and developing work teams throughout the facility operation.
- Develop pragmatic SMART goals to challenge direct reports. Provide necessary feedback and resources to ensure timely achievement of milestones
- Employ situational management to coach team members to reach individual and group goals
- Develop supervisor IDP plans and ensure progress for management potential.

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Facility Manager

- Encourage cross pollination with team members of other Systech locations and/or job functions
- Assess resource needs according to business goals and align mid to longer term human resource vision
- Completes all required training such as RCRA, MSHA and other On-The-Job Training

POSITION REQUIREMENTS:

Management Skills: Demonstrated ability to effectively provide leadership to a work team operation and develop and manage budgets and projects. A person who can supply the appropriate leadership for problem analysis, decision-making and timely action in the operations environment.

Communication Skills: Command of necessary oral and written communication in order to train staff, gather information, represent the facility at meetings, develop project recommendations, and make presentations to staff, customers, regulatory agencies, legislators and community interest groups. Above average computer skills with the ability to complete correspondence, presentations, and reporting requirements.

Problem-Solving Skills: Demonstrated ability to define problems, identify needs, devise an approach to problem resolution and interpret results.

Regulatory Knowledge: Demonstrated ability to understand and lead a facility in compliance with regulatory and environmental programs.

QUALIFICATIONS:

These skills, abilities, and knowledge are normally acquired by obtaining an undergraduate degree in business, engineering, or science and five years of related people and project management experience, including two years of waste management experience or equivalent.

WORK ENVIRONMENT:

Systech provides a comfortable office, including a conference room, located in a facility near a Lafarge Cement Plant. The Facility Manager often observes, meets with and holds group meetings with Systech staff – this work often requires being in the outdoor environment of an operational FQW facility.

DISCLAIMER:

This job description identifies the general duties and minimum level of skills required to perform this job. It is not intended to represent a comprehensive inventory of all duties, responsibilities and qualifications required of employees assigned to this job.

TITLE: Technical Manager

DATE: 07/20/01

DEPARTMENT: Operations

STATUS: Exempt – GR 14

REPORTS TO: Vice President of Operations

LOCATION: Dayton

ASSIGNED N/A
STAFF:

OBJECTIVE:

To direct the technical (laboratory) evaluation of existing and prospective materials or substances for use in co-processing or waste management processes of company or third-party cement facilities; to direct the company's laboratory quality assurance efforts; to provide ongoing technical training to company laboratory personnel and represent company interests with outside parties and committees.

PRINCIPAL DUTIES & RESPONSIBILITIES:

1. Directs Systech's technical committee which reviews and updates laboratory methods and quality assurance practices.
2. Develops laboratory quality assurance and control procedures for assessing laboratory performance. Coordinates the implementation of the QA/QC program, and interprets and communicates the results.
3. Counsels with site laboratory personnel regarding laboratory procedures including procedure standardization to adhere to company policy and conducts on-site field laboratory audits.
4. Directs the development and administration of site laboratory audits to evaluate facility laboratory performance.
5. Develops annual and long-range plans for the technical services department, including procurement of equipment, software/hardware, and instruments.
6. Remains current knowledge of technical laboratory procedures and protocols used in analyzing chemical and physical properties, of waste materials.

JOB SPECIFICATIONS:

Technical knowledge: Demonstrated knowledge of waste and raw material compound analysis, including operation and application of specialized laboratory equipment such as gas chromatograph, mass spectrometer, atomic absorption spectrophotometer and microwave digestion unit; proven knowledge of standard procedures and protocols used in evaluation of waste and raw material compounds; proven knowledge of company business operations including co-processing facilities and material handling processes.

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Communication skills: Command of all skills necessary to relate technical evaluations and risks to both technical and non-technical audiences; proven ability to prepare oral and written evaluation of compound properties, including presentations to senior management.

Problem-solving: Demonstrated ability to devise new scientific procedures or protocols to evaluate the properties of waste or new material compounds; ability to interpret chemical procedures to establish composition and properties of various compounds, including the ability to decide and to pursue additional testing or verification procedures.

Management skills: Demonstrated ability to oversee the completion of multiple projects including the prioritization, assignment and direction of laboratory and non-laboratory personnel.

QUALIFICATIONS:

These skills, abilities and knowledge areas are normally acquired by achievement of a bachelors degree in physical or life sciences and 7 to 10 years of related clinical or research laboratory experience; or an advanced scientific degree (i.e., masters) and 3 to 5 years of related laboratory experience.

JOB DEMANDS: Work requires the ability to make evaluations concerning the properties of various compounds where procedures or protocols may yield uncertain conclusions. Approximately 20% travel time is required.

WORK ENVIRONMENT: Normal, pleasant office environment in the Dayton office – work at the Systech sites is usually in a laboratory setting.

DISCLAIMER:

This job description identifies the general duties and minimum level of skills required to perform this job. It is not intended to represent a comprehensive inventory of all duties, responsibilities and qualifications required of employees assigned to this job.

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Systech Environmental Corporation

USEPA ID No.: OHD 005048947
Ohio Permit No.: 03-63-0595

SECTION VIII CLOSURE PLAN & FINANCIAL REQUIREMENTS

8.1 Introduction

The purpose of this Closure Plan is to ensure that the waste management facility will be closed pursuant to 40 CFR 270.14(b)(13), 264.112-115, 264.178 and 264.197. The subjects discussed in this section are:

- a. The closure plan,
- b. The closure cost estimate,
- c. The financial assurance mechanism for closure,

A copy of this Closure Plan, and all revisions to it, will be maintained at the facility until completion of closure certification has been submitted and accepted. The Director will be notified in writing of intent to close the waste management facility at least 45 days before the beginning date of final closure activities. In accordance with 40 CFR §264.115 and OAC 3745-55-15, within sixty days of completion of final closure, Systech Environmental Corporation and an independent, registered professional engineer will submit certification to the Director of the Ohio EPA that the waste management facility has been closed in accordance with the specifications in the approved Closure Plan.

A post-closure plan is not required since the waste management activities do not include land disposal of hazardous wastes. However, if clean closure could not be accomplished, a post-closure plan would be prepared.

In the event of closure, all shipments of waste would be discontinued and the existing inventory would be processed and used in the kiln in the routine manner. The tank and container storage areas and all ancillary equipment would be decontaminated, and all waste residues would be removed from the premises. Therefore, there would be no waste inventory remaining at the facility following closure and there would be no waste remaining which could be released.

The facility's other permits include:

Ohio Air Permit No. 0363000002T026 for a 25,000-gallon tank
Ohio Air Permit No. 0363000002T027 for a 25,000-gallon tank
Ohio Air Permit No. 0363000002T028 for a 25,000-gallon tank
Ohio Air Permit No. 0363000002T029 for a 25,000-gallon tank
Ohio Air Permit No. 0363000002T008 for a 30,000-gallon tank
Ohio Air Permit No. 0363000002T009 for a 30,000-gallon tank
Ohio Air Permit No. 0363000002T007 for a 150,000-gallon tank
Ohio Air Permit No. 0363000002T010 for a 150,000-gallon tank
Ohio Air Permit No. 0363000002T011 for a 150,000-gallon tank
Ohio Air Permit No. 0363000002P018 for Mixer #1
Ohio Air Permit No. 0363000002P019 for Mixer #2
Ohio Stormwater Permit No. OHR000005 for stormwater discharge

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Ohio Permit No.: 03-63-0595

The facility does not anticipate requesting any waivers or exemptions to this Closure Plan.

The discussion of financial requirements is in accordance with 40 CFR §264.142, 264.143, and 264.147 and OAC 3745-55-42, 3745-55-43, and 3745-55-47.

8.2 General Facility Description

The Paulding Systech Facility is an existing, off-site, hazardous waste management facility. The facility's primary components are the analytical laboratory, the storage and processing tank systems, and the container storage and processing areas. Waste materials are analyzed, unloaded, temporarily stored, and then processed so that they can be safely used in the manufacture of Portland cement.

Table 8.1 provides a brief overview of the general types and maximum amounts of waste materials which will be used in the manufacture of Portland cement.

Table 8.1
Waste Types and Quantities

Types of Wastes Managed *	Maximum in Storage
<u>Tank Storage Systems</u> Organic Liquids	910,000 gal
<u>Container Storage Facilities</u> Organic Liquids and Sludges	228,000 gal

* Because the facility's chemical list changes with the receipt of new wastes based on the current codes/constituents in the Part A, Systech will supply the actual list to the OEPA before closure takes place.

8.3 Facility Location Information

The facility is located on land owned by Systech and is adjacent to the Lafarge cement plant. It is three miles north of Paulding, on County Road 176, in Crane Township, Paulding County, Ohio.

The mailing address is:
Systech Environmental Corporation
11397 Road 176
P.O. Box 266
Paulding, Ohio 45879

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Systech Environmental Corporation

USEPA ID No.: OHD 005048947
Ohio Permit No.: 03-63-0595

The facility's legal property descriptions are as follows:

Description of Land (Parcel No. 1)

SW3, Sec. 26, T-3-N, R-2-E,
Crane Township, Paulding Co., Ohio.

~~Parcel No. 1~~

A parcel of land situated in the Southwest Quarter (1/43) of Section 26, T-3-N, R-2-E, Crane Township, Paulding County, Ohio, and is more particularly described as follows:

Commencing at an iron pin marking the Southwest corner of said Section 26; thence S 89°-48'-05" E, along the South line of said Section 26 a distance of 1213.22 feet to a PK Nail; thence N 33°-47'-20" E, a distance of 248.84 feet to an iron pin and the TRUE PLACE OF BEGINNING; thence N 32°-56'-10" W a distance of 392.32 feet to an iron pin; thence N 46°-23'-50" E a distance of 746.53 feet to an iron pin; thence S 34°-53'-10" E distance of 349.68 feet to an iron pin; thence N 55°-06'-50" E a distance of 117.74 feet to a "+" chiseled in concrete; thence S 34°-53'-10" E a distance of 191.82 feet to a "+" chiseled in concrete; then S 55°-10'-45" W a distance of 255.73 feet to a "+" chiseled in concrete; thence S 34°-49'-15" E a distance of 10.79 feet to a point; thence S 55°-10'-45" W a distance of 161.00350.91 feet to a point "+" ~~chiseled in concrete~~; thence N 34°-49'-15" W a distance of 5.1637.44 feet to a point "+" ~~chiseled in concrete~~; thence S 57°-1003'-4550" W, a distance of 262.5423.50 feet to a point an iron pin; thence S 34°-49'-15" E, a distance of 5.16 feet to a point; thence S 55°-10'-45" W a distance of 166.41 feet to a "+" chiseled in concrete; thence N 34°-49'-15" W, a distance of 37.44 feet to a "+" chiseled in concrete; thence S 57°-3'50" W a distance of 262.54 feet to a point and the PLACE OF BEGINNING.

Containing 8.6925 acres of land more or less but subject to all easements and restrictions public or private.

Description of Land (Parcel No. 3)

SW33, Sec. 26, T-3-N, R-2-E
Crane Township, Paulding Co., Ohio

~~Parcel No. 3~~

A parcel of land situated in the Southwest Quarter (1/43) of Section 26, T-3-N, R-2-E, Crane Township, Paulding County, Ohio, and is more particularly described as follows:

Commencing at an iron pin marking the Southwest corner of said Section 26; thence S 89°-48'-05" E along the South line of said Section 26 a distance of 1213.22 feet to a PK Nail; thence N 33°-47'-20" E a distance of 248.84 feet to a point an iron pin; thence N 32°-56'-10" W a distance of 392.32 feet to an iron pin; thence N 46°-23'-50" E a distance of 251.9521.06 feet to an iron pin and the TRUE PLACE OF BEGINNING; thence N 4°-03'-50" W a distance of

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~~75.2680.00~~ feet to a ~~pointn-iron pin~~; thence N 13°-24'-05" W a distance of ~~260.59432.24~~ feet to an ~~iron pin-point~~; thence N ~~5176°-2835'-3555"~~ E a distance of 3195.7744 feet to an ~~iron pin-point~~; thence S 13°-24'-05" E a distance of ~~295.00320.00~~ feet to an iron pin; thence S 46°-23'-50" W a distance of ~~380359.11-00~~ feet to an iron pin; ~~thence S 33°-47'-20" W, 32.66 feet to a railroad-spike~~ and the PLACE OF BEGINNING.

Containing 2.079993 acres of land more or less but subject to all easements and restrictions public and private.

Description of Land (Parcel No. 4)
SW33, Sec. 26, T-3-N, R-2-E
Crane Township, Paulding Co., Ohio
~~Parcel No. 4~~

A parcel of land situated in the Southwest Quarter (1/43) of Section 26, T-3-N, R-2-E, Crane Township, Paulding County, Ohio, and is more particularly described as follows:

Commencing at an iron pin marking the Southwest corner of said Section 26; thence S 89°-48'-05" E along the South line of said Section 26 a distance of 2105.67 feet to a point; thence N 0°-11'-~~2055"~~ E a distance of 850.18 feet to a "+" chiseled in concrete and the TRUE PLACE OF BEGINNING; thence S 55°-06'-50" W a distance of 93.00 feet to an iron pin; thence N 34°-53'-10" W a distance of 40.00 feet to a "+" chiseled in concrete; thence N 55°-06'-50" E a distance of 93.00 feet to a "+" chiseled in concrete; thence S 34°-53'-10" E a distance of 40.00 feet to a "+" chiseled in concrete and the PLACE OF BEGINNING.

Containing 0.085 acres of land more or less but subject to all easements and restrictions public and private.

Description of Land
SW3, Sec. 26, T-3-N, R-2-E
Crane Township, Paulding Co., Ohio

A parcel of land situated in the Southwest Quarter (1/4) of Section 26, T-3-N, R-2-E, Crane Township, Paulding County, Ohio, and is more particularly described as follows:

Commencing at an iron pin marking the Southwest corner of said Section 26; thence S 89°-49'-05" E along the South line of said Section 26 a distance of 1213.22 feet to a PK nail; thence N 33°-47'-20" E a distance of 216.18 feet to a railroad spike and the TRUE PLACE OF BEGINNING; thence N 32°-56'-10" W a distance of 399.57 feet to an iron pin; thence N 46°-23'-50" E a distance of 30.53 feet to an iron pin; thence S 32°-56'-10" E a distance of 392.32 feet to an iron pin; thence S 33°-47'-20" W a distance of 32.66 feet to a railroad spike and the PLACE OF BEGINNING.

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Containing 0.273 acres of land more or less but subject to all easements and restrictions public and private.

8.4 Topographic Map

Figure 8.1 in 8.9Appendix 1 is a topographic map of the facility; its scale is 1" = 50'.

8.5 Facility Security Provisions

Only those persons specifically involved with the activities of the waste management facility are authorized to be in the area. Surveillance of the entire waste management area from any location is relatively easy due to the small area that it occupies. Ample lighting is provided throughout the site.

The boundary of the cement plant property is secured on three sides with a six-ft high, chain-link fence topped with barbed wire. A deep ditch runs along the fourth side of the plant's property. There is a gate which controls access to the waste management facility. Visitors and contractors entering the waste management facility must check in at the cement plant office and sign a visitor logbook before receiving authorization to enter the waste management area. The contact person is responsible for informing visitors or contractors of special precautions or safety procedures in the waste management area.

A television camera and monitor provide continuous surveillance and aid in identifying unauthorized entry or emergency conditions. The pictures from the television camera are displayed on monitors in the cement plant control room, which is manned 24 hours a day. In the event that intruders are observed, they would be asked to identify themselves and explain the purpose of their presence. Systech would use its discretion in dealing with intruders; options would range from promptly escorting unauthorized persons from the property to calling the police and filing charges for trespassing.

Warning signs are posted around the facility to prevent unknowing entry by unauthorized personnel. These signs say, "DANGER--UNAUTHORIZED PERSONS KEEP OUT," and, "DANGER--NO SMOKING, OPEN FLAMES OR LIGHTS." They are legible from a distance of twenty-five feet and are visible from all angles of approach.

8.6 Closure Plan

8.6.1 Closure Performance Standard/40 CFR §264.111 & OAC 3745-55-11

This Closure Plan was designed to ensure that, after closure, the waste management facility:

- (1) will not require further maintenance and control;
- (2) will minimize or eliminate threats to human health and the environment; and

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(3) will prevent the escape of hazardous waste, hazardous waste constituents, or contaminated run-off to the soil, groundwater, surface water, or atmosphere.

8.6.2 Final Closure Activities/40 CFR §264.114 and OAC 3745-55-14

The procedures for final closure, including waste removal, clean-up, and decontamination activities, are described in the following sections. The closure cost estimates are based on using third-party, outside contractors. However, it is more reasonable to assume that the majority of the activities would be conducted in a routine manner by the facility employees.

8.6.3 Maximum Inventory/40 CFR §264.112 and OAC 3745-55-12

Tables 8.2 and 8.3 provide a detailed list of storage units and their maximum capacities. Figure 8.2 in 8.9 Appendix 1 shows the layout of the site. There could be as much as 910,000 gallons of wastes stored in tanks and 228,000 gallons in containers. The maximum inventory capacity for the entire facility is 1,138,000 gallons.

Upon initiating the closure plan, all shipments of additional waste would be discontinued; if possible, the existing waste inventories would be processed in a routine manner. Closure costs are estimated assuming that the inventory would be managed by a third-party contractor. Specifically, the inventory would need to be:

- a. Characterized (assuming shipment analysis records are unavailable);
- b. Removed from storage (bulk and containers);
- c. Transported to an appropriate off-site facility; and
- d. Used as fuel, treated or otherwise destroyed.

Table 8.2
Container Systems Design Summary

ORGANICS

	<u>West Bay</u>	<u>Middle Bay</u>	<u>East Bay</u>
Maximum number of 4'x 4' pallets	126	240	90
Maximum capacity in gallons (pallets x 500 gal)	63,000	120,000	45,000

Direct Burn Unload-Pad Maximum Capacity: 6,000 gallons
Drop and Hook Area Maximum Capacity: 48,000 gallons

(Note: Though total capacity of the container management areas is greater than 228,000 gallons, the facility is limited to no more than 228,000 gallons of waste in containers at any one time)

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Table 8.3
Tank Systems Design Summary

Tank ID #	Tank Volume (gallons)	Dimensions (d x h in ft.)	Construction Materials	Waste Types
OL-1	25, 000	12 x 30	Mild Steel	OL
OL-2	25,000	12 x 30	Mild Steel	OL
OL-3	25,000	12 x 30	Mild Steel	OL
OL-4	25, 000	12 x 30	Mild Steel	OL
OL-5	30,000	12 x 35	Mild Steel	OL
OL-6	30,000	12 x 35	Mild Steel	OL
OL-7	150,000	30 x 30	Mild Steel	OL
OL-8	150,000	30 x 30	Mild Steel	OL
OL-9	150,000	30 x 30	Mild Steel	OL
OL-10*	150,000	30 x 30	Mild Steel	OL
OL-11*	150,000	30 x 30	Mild Steel	OL

* These tanks are permitted, but have not been built.

8.6.4 Closure of the Tank System

The tank system is assumed to be suitable for use in managing liquid fossil fuel oils or process water after waste management activities are discontinued. Therefore, this closure plan does not make provisions for the demolition and removal of the tank systems from the premises. After disposal of the waste inventory as above, the steps necessary to clean the tanks to the extent that the conditions of the closure performance standard are met are as follows:

- a. Remove any sludges, solids or other residuals. Systech shall manage and dispose of these residual wastes as hazardous waste. Because the facility's chemical list changes with the receipt of new wastes based on the current Part A, Systech will supply the current list to OEPA before closure takes place. This could be accomplished by serially transferring and agitating a small quantity of liquid waste, fuel oil or water from tank to tank. Collected rinse water could be accumulated in a

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tank truck for later disposal. Alternatively, removal of residuals could be accomplished manually with self-contained breathing apparatus and a non-sparking shovel. The materials would be accumulated in containers. The technique of choice would be decided based on quantities of residuals present and relative cost of manual labor versus disposal of larger quantities of contaminated rinse water.

b. Decontaminate tanks. This could be accomplished via steam cleaning equipment, high pressure spray with degreasing detergents or other appropriate cleaning technology. Empty tanks would be cleaned one at a time with rinse waters or condensates being pumped through the ancillary plumbing systems to a designated holding tank (last tank to be decontaminated) or directly to a tanker truck. This material would be sampled (in-line flow composite samples) at various locations and over time to verify the effectiveness of the decontamination process. The samples would be obtained by taking either a core sample or by sampling from ports located at different levels of the tank. This ensures a representative sample from the tanks. The third rinse water or condensate sample would be analyzed via SW 846 methods for parameters indicative of the hazardous constituents of the original waste material.

The following procedures are proposed for use by the contractors:

Method
8260C40 volatile organics

Method 8270D semi-volatile organics

Method
6010C7420 Pb, As, Ba, Cd, Cr, Hg, Se, Ag

When the rinse water or condensate samples meet the rinseate clean standards listed below, the decontamination process should be considered complete. This would indicate that any further rinse waters from the tank system could be effectively treated at the waste water treatment plant without risk to human health or the environment. It will be important to distinguish between free-flowing samples of rinse waters coming from the tank system and core samples taken from tanker trucks due to the probable contaminant levels present in most waste-hauling vehicles.

The facility will meet the following rinseate clean standards:

- 1) 15 times public drinking water maximum contaminant level (MCL) for hazardous waste constituents as promulgated in 40 CFR 141.12 and OAC Rule 3745-81-12 for organics and 40 CFR 141.11 and OAC 3745-81-11 for inorganics; or
- 2) If an MCL is not available for a particular contaminant, then 15 times the maximum contaminant level goal (MCLG) as promulgated in 40 CFR 141.50 shall be used as the clean standard. If the MCLG is zero, use fifteen times the contaminant's practical quantitation limit in ground water; or
- 3) If the product of 15 times the MCL or MCLG exceeds 1 mg/l or neither an MCL nor a MCLG is available for a particular contaminant, 1 mg/l shall be used as the clean

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standard; or

4) If the MCL or MCLG is less than the contaminant's analytical detection limit using methods found in U.S. EPA Publication SW-846, "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods," the SW-846 analytical detection limit shall be used at the clean standard.

5) The final rinseate will be analyzed to determine if it is a hazardous waste and will be handled according to OAC rules.

The facility will comply with any more stringent clean standards that may be in effect at the time of closure.

Based on 3 rinses at 10% of the volume of the tanks, the estimated amount of rinseate generated would be 87,600 gallons. Truckloads of rinse water or condensate would be managed according to the level of contamination in the truck contents, as determined by core sampling and subsequent analysis for hazardous characteristics; i.e., ignitable, toxicity characteristic, etc. Most shipments would be expected to require incineration as the treatment of choice; however, best available technology in the future may indicate other effective treatment options.

c. Decontaminate concrete containment systems associated with tank farm and truck and rail unloading areas with steam cleaning equipment, degreasing detergents or other appropriate technology, as above. The rinse waters or condensates will be pumped from sumps to the designated holding tank or to tanker truck and sampled and analyzed as above to verify the effectiveness of the decontamination process. Since all concrete containment surfaces likely to be in contact with waste materials would have been coated or treated with waste impermeable sealants, there should be very little difficulty in effectively cleaning the containment areas. Collected rinse waters would be managed as described above for tank rinse waters.

8.6.5 Closure of Container Management Buildings

Once decontaminated, the container management buildings are assumed to be suitable for use as a general industrial warehouse. Therefore, no provisions have been made in this closure plan for the demolition and removal of these buildings from the premises. Once the waste inventories in containers have been removed, the steps necessary to effect closure of the container management buildings are as follows:

a. Decontaminate container processing systems, using steam cleaning equipment, degreasing detergents or other solvents as appropriate. Decontamination should proceed from mixing vessels and on through the plumbing system following the routine process material flow. All rinse waters or condensates can be directed to the tank farm area for collection via tank system plumbing and thus effect the decontamination of these fixtures at the same time. No waste or rinse waters will be sent to previously decontaminated areas including the tank farm to prevent

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recontamination of other areas. Effective decontamination will be verified by sampling and analyzing the rinse waters or steam condensates for hazardous constituents, as described above. Collected rinse waters or condensates will be managed as described above for tank rinse waters.

b. Decontaminate concrete containment systems in the container building, direct-burn unload pad, drop and hook area, and truck and rail unloading areas. This will be accomplished in similar manner to the decontamination of the containment systems described for the tanks.

8.6.6 Ancillary Equipment Decontamination

The piping, pumps, valves, filters and general plumbing associated with the tank systems, truck and rail unloading areas and container building will be partially or completely decontaminated during the processes described above. Rinse waters can be recirculated through the various legs of the system, sampled and analyzed as above, as a final verification of the decontamination process.

8.6.7 Decontamination of Equipment Used During Closure

Equipment that is used during closure activities that will be re-used for other activities later will be decontaminated after all other decontamination is complete. The method used will be the same as the decontamination of tanks and equipment. Rinse materials will be handled the same as designated in the tank decontamination section of this part (8.6.4). The proposed location for decontamination of the equipment will be the bulk truck off load area.

8.6.8 Contaminated Soil

The facility was designed and will be operated to eliminate the possibility of soil contamination in the event of a spill or leak. However, should a spill or leak affect unprotected soil, samples will be taken and analyzed to determine the extent of contamination.

8.10 Appendix 2 contains a soil sampling and analysis plan. The plan is designed to determine the type and extent of any soil contamination at the site and to determine appropriate remedial actions, if any, to be completed prior to certification of closure.

All technical details of the plan are specifically subject to approval by the OEPA prior to initiation of any activities.

8.6.9 Wastes Generated During Closure

All waste generated during closure operations will be handled and disposed of per applicable regulations including Land Disposal Restrictions. During closure, wastes will

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be stored in an appropriate staging area. Drum waste will be stored in the current drum storage area as this area is best suited for this purpose. Liquid hazardous waste will be staged in Tank 7 during closure operations.

8.6.10 Schedule for Closure/40 CFR §264.112-113 & OAC 3745-55-12 and -13

The Director will be notified of intent to close the waste management facility at least 45 days before the beginning of final closure activities. Within 90 days after receipt of the final shipment of waste materials, all hazardous waste inventories will have been treated or disposed. Within 180 days after receipt of the final shipment of waste materials, all closure activities will have been completed in accordance with the approved closure plan.

In accordance with 40 CFR §264.115 and OAC 3745-55-15, within sixty days of completion of final closure, Systech Environmental Corporation and an independent, registered professional engineer will submit certification to the Director of the Ohio EPA that the waste management facility has been closed in accordance with the specifications in the approved Closure Plan.

The proposed schedule for closure is presented in Table 8.4. Based on estimates of the life of the quarry, the facility would be expected to close in coming from Lafarge ~2098.

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Table 8.4. Projected Schedule of Closure Activities

Closure Activity	Day Started	Day Completed
1. Disposal of waste inventories	Day 1	Day 90
2. Decontamination of tanks	Day 60	Day 120
3. Decontamination of container management areas	Day 60	Day 120
4. Decontamination of ancillary equipment	Day 90	Day 120
5. Disposal of decontamination residuals and rinses	Day 60	Day 120
6. Soil sampling and analysis	Day 120	Day 150
7. Removal of any contaminated soil	Day 120	Day 150
8. Completion of closure	Day 150	Day 180
9. Submission of certification to the Director	Day 180	Day 240

8.6.11 Amendments/40 CFR §264.112 & OAC 3745-55-12

Any major modifications to the existing equipment, structures, or procedures related to the administration of the waste management system will result in revisions in this Closure Plan accordingly. The Closure Plan will be reviewed annually for any necessary updates. All requests for modifications to the Closure Plan will be made in writing to the Regional Administrator.

The Facility Manager is responsible for updating the Closure Plan and will ensure

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that all copies of the Closure Plan are updated as necessary by sending out any amendments and requiring a response when the changes have been incorporated into the copies of the Plan.

8.6.12 Certification of Closure

In accordance with 40 CFR §264.115 and OAC 3745-55-15, within sixty days of completion of final closure, Systech Environmental Corporation and an independent, registered professional engineer will submit certification to the Director of the Ohio EPA that the waste management facility has been closed in accordance with the specifications in the approved Closure Plan.

The certification document will include the following information:

1. The activities conducted during the closure of the facility;
2. The testing and analyses that were performed during the closure of the facility;
3. The criteria used to evaluate the adequacy of the closure;
4. A schedule of the inspections conducted during the closure; and
5. Documentation of closure, as required by the Ohio EPA.
6. Documentation of waste removed from the site during closure including waste inventories, tank and container residuals, rinseate, and contaminated soils.

8.7 Closure Cost Estimate/40 CFR §264.142 & OAC 3745-55-42

An estimate of the closure cost for the facility has been developed and the major cost factors are detailed in Table 8.5. In all situations the worst case scenario has been assumed; for example, all costs have been based on hiring outside contractors. This might be required if all operations, technical, and engineering staff had been dismissed, leaving only management personnel to supervise environmental contractors.

The major cost factor would be due to the need to transport and dispose the entire maximum inventory of waste off-site. This situation would only arise if both cement kilns at the plant had become inoperable and no additional waste could be processed on-site or redirected to one of the other network sites. Generous disposal fees have been projected to reflect possible additional need for waste characterization, removal from storage, transportation, and off-site disposal by a third party contractor. During a planned phase-out of operations, rather than an abrupt termination of operations, waste inventories would be worked off in a routine production mode and nearly all of these projected costs would be avoided.

Additional costs for contractor decontamination of tank systems, container management facilities, all secondary containment systems, and ancillary equipment have been generously

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estimated to include decontamination procedures, as well as sampling, analysis, transportation, and disposal of decontamination residuals and rinse waters. Table 8.5 details these and the balance of the costs associated with soil sampling, analysis, and removal of any contaminated soils, as well as administrative costs and contingency funds. This is an estimate of a low-probability, worst-case scenario. No salvage value or economic benefit has been assigned to these fuel quality wastes or incorporated into the closure costs.

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TABLE 8.5

Paulding, OH		Projected Closure Costs		2010 Dollars	
<u>Off-site Transportation/Disposal of maximum Waste Inventory</u>		Quantity	Cost: \$ /unit	cost	
Bulk Liquids (gal)		910,000	0.392	\$357,079	
Rinsate (gal)		275,000	1.506	\$414,136	
Containers (gal)		228,000	3.542	\$807,612	
Subtotal				\$1,578,827	
<u>Contracted</u>					
<u>Decontamination Services</u>					
Tanks		11	11057.09	\$121,628	
Tank system auxiliary equipment		1	40243.00	\$40,243	
Tank secondary containment areas		4	8048.25	\$32,193	
Container storage/processing areas		6	8048.33	\$48,290	
Container secondary containment		6	8048.33	\$48,290	
Container processing equipment		3	8048.33	\$24,145	
Truck heel removal equipment		1	13674.00	\$13,674	
Subtotal				\$328,463	
<u>Soil Sampling and Analysis</u>		1	96582	\$96,582	
<u>Disposition of Contaminated Soil (tons)</u>					
Labor (hours)		120	81.66	\$9,799	
Transport (tons)		120	42.43	\$5,091	
Disposal (tons)		120	807.06	\$96,847	
Subtotal				\$111,737	
<u>Closure certificate</u>					
Labor (hours)		40	161.20	\$6,448	
Expenses (days)		5	161.20	\$806	
Subtotal				\$7,254	
SUBTOTAL			2010 Sub Total	\$2,122,863	
Inflation Factor 2011		1.009	2011 Adjusted	\$2,141,969	
Inflation Factor 2012		1.021	2012 Adjusted	\$2,186,950	
Inflation Factor 2013		1.017	2013 Adjusted	\$2,224,128	
Inflation Factor 2014		1.014	2014 Adjusted	\$2,255,266	
Inflation Factor 2015		1.014	2015 Adjusted	\$2,286,840	
Inflation Factor 2016		1.01	2016 Adjusted	\$2,309,708	
Inflation Factor 2017		1.013	2017 Adjusted	\$2,339,734	
Inflation Factor 2018		1.018	2018 Adjusted	\$2,381,850	
Inflation Factor 2019		1.023	2019 Adjusted	\$2,436,632	
Inflation Factor 2020		1.017	2020 Adjusted	\$2,478,055	
10% Adminstrative				\$247,805	
10% Contingencies				\$247,805	
TOTAL				\$2,973,666	



Please Note: Pages of this application which contain financial assurance mechanism details specific to policy or account numbers have been removed from this web-available version of the document.

To review redacted copies of these removed pages, please contact DMWM's record management staff at 614-644-2621. Thank you.

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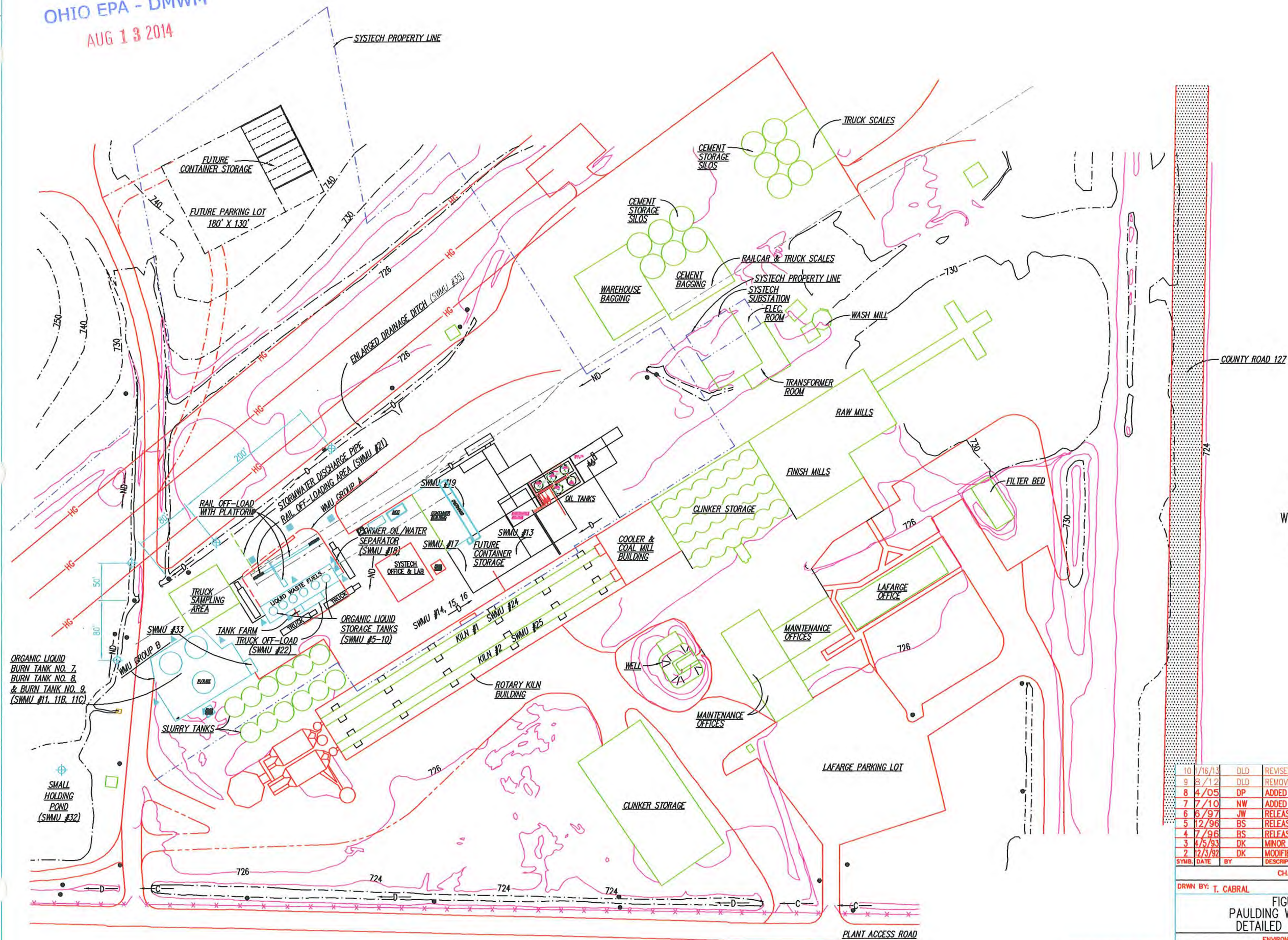
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8.9 Appendix 1

Figures

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LEGEND	
	= PROPERTY LINE
	= GRID MATCHLINE
	= GRAVEL
	= 10' CONTOURS
	= 2' CONTOURS
	= APPROVED CAPITAL
	= TANK FARM
	= CONTAINER PROCESSING
	= DRY WASTE FUELS
	= PYROLYZER
	= SYSTECH FACILITY BOUNDARY
	= NATURAL DRAINAGE
	= STORM CULVERT
	= STORM DITCH
	= CITY WATER SUPPLY
	= PROCESS WATER SUPPLY
	= FENCE
	= POWER POLE
	= PROPOSED SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS
	= PROPOSED SOIL BORINGS
	= PROPOSED GEOTECHNICAL SOIL BORING LOCATION
	= PROPOSED SOIL BORING AT PERIMETER OF RAIL OFF-LOADING AREA

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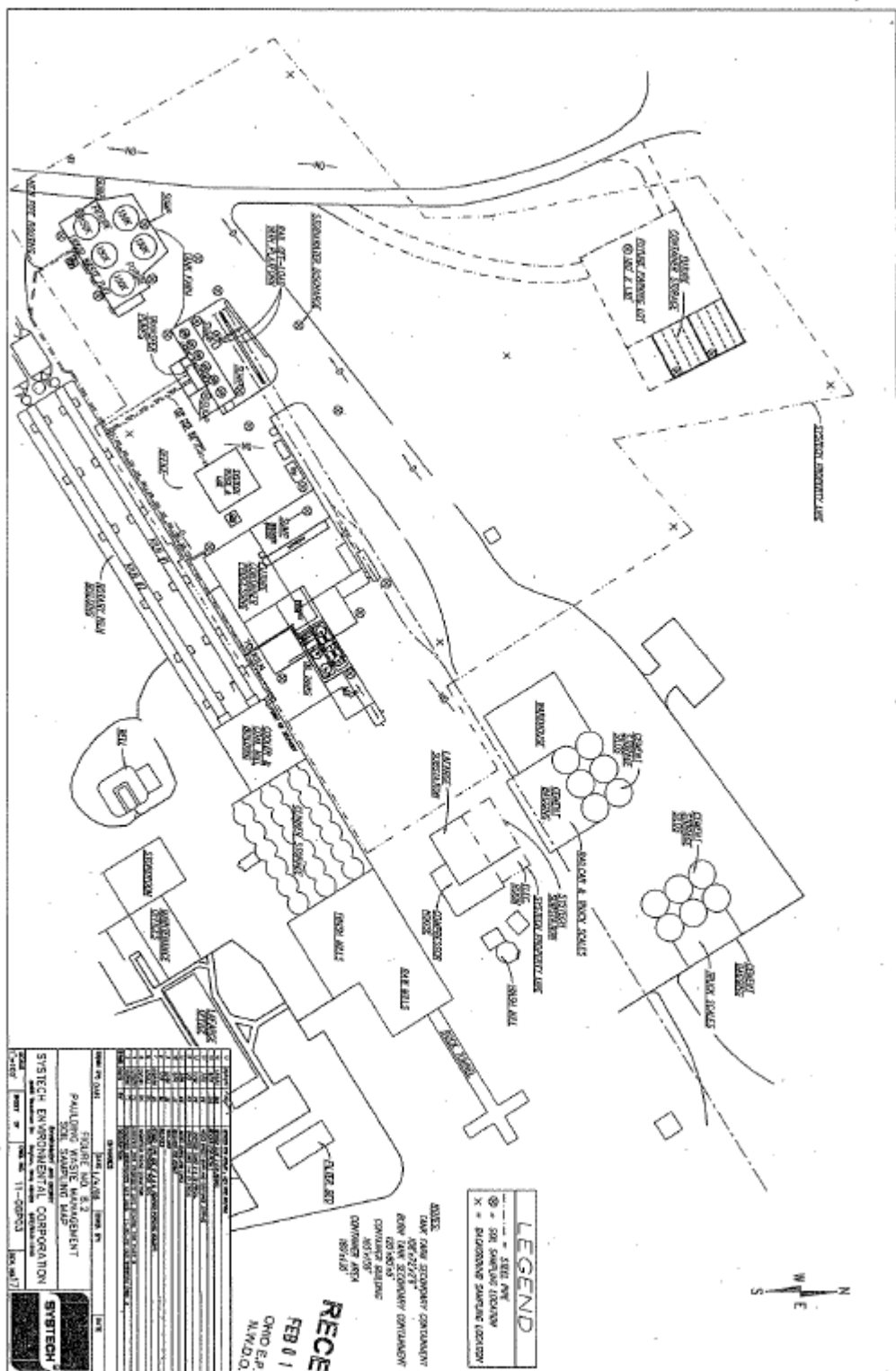
SCALE: 100 ft.

SYMB.	DATE	BY	DESCRIPTION
10/16/13	DLD		REVISED COLORS ON DRAWING FOR PERMIT
9/3/12	DLD		REMOVED HEEL REMOVAL SYSTEM, ADDED MCC, OFFICE, FOAM ROOM.
8/4/05	DP		ADDED SWMUs
7/7/10	NW		ADDED DIRECT BURN AND CONTAINER STORAGE
6/6/97	JW		RELEASED FOR PERMIT
5/12/96	BS		RELEASED
4/7/96	BS		RELEASED
3/4/93	DK		MINOR REVISION PER G.H.
2/12/92	DK		MODIFIED ROAD LOCATION

CHANGES		
DRWN BY: T. CABRAL	DATE 10/16/91	CHKD. BY: DATE
FIGURE NO. 8.1 PAULDING WASTE MANAGEMENT DETAILED TOPOGRAPHIC MAP		
ENVIRONMENT AND ENERGY SYSTECH ENVIRONMENTAL CORPORATION 3085 WOODMAN DRIVE DAYTON, OHIO 45420 937-643-1240		
SHEET OF	DWG. NO. 11-06G10	REV. NO. 10

Unless Otherwise Specified all units are in feet and inches (12"-0").
Tolerances are: feet / inches
Feet 0.1
Feet-inches 1/8
Fraction 1/8 inch
Angles 0.03
0.10

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8.10 Appendix 2

Soil Sampling and Analysis Plan

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Soil Sampling Plan & Analysis

8.10.1 Introduction

This Soil Sampling and Analysis Plan has several objectives:

- * Identify indicator chemicals for contamination determination
- * Identify soil sampling locations
- * Provide a sample collection protocol
- * Specify the analytical method for analyzing the samples
- * Interpret the resultant analysis data
- * Provide alternatives for additional quantification, if required.

The facility (Figure 8.2) consists of receiving areas for the waste materials, storage areas for the fuel, a laboratory, and a fuel supply system for injecting the fuel into the cement kiln. Combustible waste materials are delivered to the facility via railroad tank cars, trucks, and containers. Potential areas for accidental release are the storage areas and transfer locations.

8.10.2 Selection of Indicator Analytes

The waste material used as fuel quality waste at the facility varies in composition on a day-to-day basis. Systech will analyze for all hazardous waste constituents that were handled in the units being closed and their degradation products. Systech may negotiate with Ohio EPA to reduce these analytes at the time of closure. The actual constituent list will be mutually agreed upon by Systech and Ohio EPA. The analyses would follow the procedures listed as EPA method ~~8260C020~~ as described in US EPA document SW-846. Analysis for TCLP total metals will also be used as a indicator analyte only after establishing a background level with respect to each metal.

8.10.3 Determination of Sampling Locations

In order to effectively sample for possible contamination, each receiving area, transfer point, and storage area needs to be identified. As mentioned above, those are the rail car unloading area, the truck unloading area, the truck heel removal area, the tank storage area, the drop and hook pad, the direct burn unload pad, and the container management building. Each of these units was designed and constructed to minimize environmental contamination which could result from leakage or spills.

For example, the rail car unloading unit has a containment system which is bermed and sloped into a sump. The tank storage area has a similar construction. Its containment system consists of a diked area of poured concrete. The unloading area for bulk truck loads has a concrete pad sloping to a sump. The floor of the container storage building is of concrete

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sloping to several catch basins or sumps. Therefore, the most likely source of soil contamination would be just beyond and below these containment systems.

Soil samples will be collected from locations shown in Figure 8.2. These sites will be located just beyond the concrete foundations for each structure. In addition, each of the containment basins or sumps would be sampled. This would necessitate boring through the concrete in order to expose the soil surface allowing soil sample collection.

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Systech shall obtain twelve background samples. Samples will not be taken in areas of past solid or hazardous waste management, in areas of concentrated air pollution, near roads, parking lots or railroad tracks, near storm drains or ditches, near areas of spill, or material handling areas or pipelines, or in fill areas. Systech will propose these sampling areas at the time of closure and will be mutually acceptable by Systech and OEPA. Systech may also use "Ohio farm soils" data in lieu of performing background sampling.

8.10.4 Sampling Procedures

In areas where multiple samples will be taken, the soil sampling protocol will consist of collecting samples at 6-inch intervals to a depth of two (2) feet with one of these samples being taken at a depth of five (5) feet. In areas where single samples are taken, they will be taken at a depth of two feet. If limestone is encountered before a depth of five feet the sampling will be terminated. A drill rig with 2 to 4-inch hollow stem augers and a split-spoon sampler will be used to collect the soil samples.

Where Systech is coring through concrete, a sample of the fill material, if present, will be obtained. In addition, at a minimum, a sample from the first six inches of native soil will be taken. Sampling will continue at each location until the full horizontal and vertical extent of contamination is determined. The method for determining further contamination is discussed in Section 8.10.7 Alternate Actions. Systech shall submit a groundwater sampling plan if contamination is detected in the soil at the interface with limestone or bedrock or if there is reason to believe that the groundwater may be contaminated.

All sampling equipment will be thoroughly cleaned before using. This means that the drill rig and all equipment will be steam cleaned before arriving on-site. Between sampling locations, auger flights and split-spoon sampler will be cleaned by the following steps:

- Step 1 - Scrub the instrument with a nonphosphate detergent
- Step 2 - Scrub with tap water
- Step 3 - Rinse with copious amounts of tap water
- Step 4 - Rinse with distilled, deionized water
- Step 5 - Wrap in aluminum foil or plastic.

The technician performing this decontamination will be wearing disposable, latex gloves.

The soil sample containers will be 100 ml wide-mouth bottles. The bottles will be of glass and have a teflon-lined cap. They will be decontaminated by the analytical laboratory selected to perform the chemical analyses. This laboratory must be able to attain the practical quantification limits prescribed in SW-846 (see Section 8.10.5). In addition, they must have an approved quality assurance/quality control plan which describes their internal checks for

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accuracy and precision.

Because the BTEX compounds are volatile, the collected soil samples must be placed within the sample containers as soon as possible after removal. Also, the sample bottles are to be stored at 4°C from the time of collection until analyzed at the laboratory. The exact location and time of collection will be recorded by the field technicians on standard "field log sheets." The information that will be recorded includes:

- Sample location
- Sample identification number (lab number)
- Sample source (e.g., soil sediment, ground water)
- Type of sample (e.g., grab or composite)
- Personnel present
- Weather conditions
- Date and time of sample collection
- Container number of each sample collected
- Analytes to be tested for
- Signature and date of field log completion.

Also, the "chain-of-custody" forms will be completed for each sample. Information that appears on the forms includes:

- Sample source
- Collector's name
- Purpose of sample collection
- Date of sample collection
- Sample identification number
- Sample location
- Container number of each sample
- Container size, type, preservatives used
- Parameters analyzed for at the laboratory
- Destination of the sample
- Name, date, time and signature of each person possessing the samples
- Shipping shuttle number.

The chain-of-custody form is signed by each individual responsible for the sample containers. The form will accompany the samples in the shuttle being sent to the laboratory. Custody is defined as actual physical possession. At the time of custody transfer, the individual relinquishing possession will observe as the transferee inspects the samples for integrity and number, dates, and signatures.

In the field the sampling team members will use disposable, latex gloves to reduce contamination of personnel, sampling equipment, and the collected soil samples. These gloves will be removed after completing soil collection (extracting the soil and filling the sample bottles) at each individual location. New disposable, latex gloves will be used at the

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next sampling point (not to be confused with sample depth as the two intervals constitute one sample location).

Also, the sampling instrument will be decontaminated before leaving each soil sample location. The steps are as described above. The only refinement will be the collection and drumming up of the cleaning liquids to prevent spreading any potential contaminants. [The 55 gal drum(s) will be marked and dated before being temporarily stored while awaiting the laboratory results. Disposal will be consistent with the applicable state and federal regulations.]

Each day, after taking the last soil sample and decontaminating the sampling equipment, the split-spoon sample will be used to prepare an equipment rinseate blank. This entails handling the equipment in the same manner as used during soil sample collection (using latex gloves, opening and closing the sample jars, etc.), except the field technicians pour distilled, deionized water over and through the split-spoon. This will detect any contamination introduced by an inappropriate field technique. Other quality control measures will include: trip blanks, field blanks, duplicates, and distilled, deionized water blanks. These serve as checks on sampling technique and the integrity of the samples.

8.10.5 Analytical Method

Soil samples will be analyzed according to EPA Method SW-846 method 8260 for organics, method 8270 for semi-volatile organics, method 6010 for metals and method 7470 for mercury. Systech will use appropriate sample containers for soils to be analyzed for organics, semi-volatile organics, and metals as specified in SW-846.

If analysis is used for background samples in lieu of Ohio Farm Soils, the above methods will also be used for their analysis.

8.10.6 Data Interpretation

The overall objective of this sampling and analysis plan is to determine if the activities at the facility have contaminated the surrounding soil. Soil clean levels shall be non-detect for non-naturally occurring compounds in the soils. Naturally occurring compounds shall be either Ohio Farm Soils concentrations or two times the mean concentration plus two standard deviations of the background concentrations.

In the alternative, Systech may submit a risk-based closure plan for Ohio EPA review and approval. Any such plan shall include a demonstration that the proposed plan (1) will be protective of human health and the environment and (2) complies with applicable standards for risk-based closure plans for RCRA units.

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8.10.7 Alternate Actions

If any of the sample locations exceed the action level standard a sample will be collected from the same location and depth to verify contamination. After verification of contamination a plan will be designed and implemented to delineate the contamination. This plan will be based on establishing a grid pattern around the contaminated area. The total grid area will be approximately a 20' diameter circle subdivided into four equal areas. Four samples will be collected from a systematic grid, with one collected to represent each of the areas within the circle as shown in Figure 8.3. Based on the results of this additional soil sampling and analyses, two alternatives will be considered: (1) to remove the contaminated soils, up to but not including the clean sample location, followed by proper disposal, or (2) close in place. The determination will be made based on an environmental risk assessment.

Figure 8.3

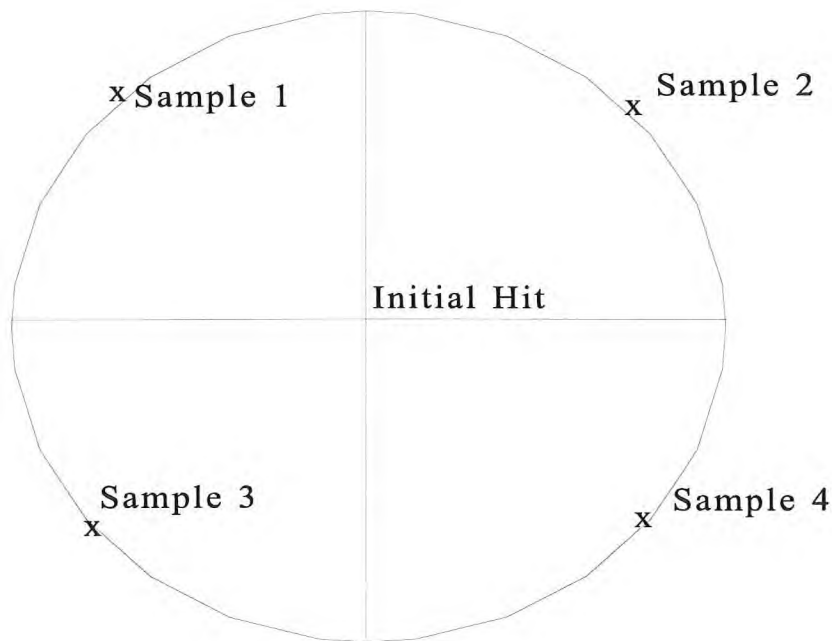


Figure 8.3: Systematic (circle grid points) Sampling with 20 ft diameter circle with initial "hit" in center of pattern.

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8.11 Appendix 3
Facility Closure - Health and Safety Plan (HASP)

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Facility Closure - Health and Safety Plan (HASP) Paulding Facility

8.11.1 Background

Systech Environmental Corporation is a fully permitted TSDF that processes specific hazardous characteristic and listed hazardous wastes. The wastes received at the facility have been thoroughly characterized and analyzed prior to and at the time of receipt. Waste inventories have been analyzed, stored and processed during the facilities operating history in accordance with Federal and State regulations and facility permits. As such, site closure activities primarily involve inventory removal, decontamination, soil sampling, and soil removal, if required.

The HASP provides unifying guidance to facility and contract personnel for conducting work safely during facility closure using established procedures and plans contained in the facility's hazardous waste permit and the SYSTECH health and safety program. These procedures and plans will be referenced throughout the HASP.

Facility and contractor employee health and safety at the facility is regulated by the Mine Safety and Health Administration under Title 30 CFR Part 56. While the facility implements and complies with MSHA regulations, relevant provisions contained in OSHA regulations, as well as other consensus standards such as NIOSH and ANSI, are used for health and safety guidance and are referenced in the HASP.

8.11.2 Key Personnel

Key facility personnel are identified in the facility Contingency Plan. Individuals responsible for HASP implementation include the Facility Manager and his/her designee. Additionally, the closure contractor(s) are required to assign an individual(s) responsible for contract employee health and safety. Closure activities will be closely coordinated and communicated between site and contract personnel to ensure worker health and safety.

8.11.3 Hazard Analysis

Hazard assessment is a methodology used to identify inherent or potential hazards which may be encountered in the work environment associated with accomplishing a closure activity. At a minimum, the hazard assessment should include the following steps:

- Identification of an operation or job to be assessed,
- Break down of the job or operation into tasks,
- Identification of the hazards associated with each task, and
- Determination of the necessary controls for the hazards

The information obtained during the hazard assessment should be documented in a manner that readily identifies the hazards associated with the task and the controls required to safely carry out the task.

8.11.4 Personnel Protective Equipment

Careful selection and use of PPE is essential to protect the health and safety of facility and contractor employees. The purpose of PPE is to shield or isolate workers from the chemical and physical hazards that may be encountered at the facility during closure.

The PPE required is determined on a task-specific basis. The following should be taken into consideration when selecting and using PPE:

- PPE use and limitations,
- Task duration,
- Maintenance and storage,
- Limitations due to temperature extremes,
- Medical and physical concerns.

8.11.5 Air Monitoring

SYSTECH has established a Personnel Air Monitoring Program to measure and evaluate employee exposures to airborne contaminants associated with waste handling activities including closure. The objectives of the program include:

- Determining the effectiveness of engineering controls and work practices,
- Determining compliance status with established regulatory standards,
- Communicating exposure levels to facility and contract personnel, and
- Determining respiratory protection equipment requirements.

Air sampling or monitoring may be conducted using standard industrial hygiene techniques including real-time instrumentation (e.g. photoionization detector) or sample collection (e.g. passive dosimetry badges).

8.11.6 Safe Work Practices

Written health and safety procedures and guidelines have been established by SYSTECH. The procedures or equivalent contractor procedures will be referenced and implemented during facility closure. Specifically, the following procedures will be referenced:

HSP201 - Confined Space Entry Program (CSEP)

Due to the unique health and safety hazards associated with fuel storage tanks, entry will be performed only when the task cannot be completed externally to the tank. All tank entries will be performed in accordance with the permit system described in this procedure and only by trained and authorized personnel. This procedure contains the provision specified in:

- 29 CFR 1910.146, Permit Required Confined Spaces, and
- ANSI Z117.1-1989, Safety Requirements for Confined Spaces.

HSP202 - Respiratory Protection Program (RPP)

The selection of the proper types of respiratory protection is based upon the nature of the respiratory hazard present or anticipated to be present in the tank farm, container building, and other areas during closure. Evaluating the nature and degree of the exposure hazard present at the facility from decontamination and other closure activities is accomplished through established SYSTECH health and safety programs discussed in this section. This procedure contains the provisions specified in:

- 29 CFR 1910.134, Respiratory Protection,
- ANSI Z88.2, Respiratory Protection,
- ANSI Z88.6, Respirator Use - Physical Qualifications for Personnel, and
- NIOSH 87-116, NIOSH Guide to Industrial Respiratory Protection.

HSP204 - Lockout - Tagout

This procedure establishes written requirements for locking and tagging out energy isolating devices whenever maintenance or servicing is performed on process equipment. This procedure should be used to ensure that process equipment is stopped, isolated from all potentially hazardous energy sources and locked or tagged out before site or contract employees perform any closure activities (e.g. decontamination) where the unexpected start up of the process equipment or release of stored energy could cause injury.

HSG003- Hot Work Permits

This procedure establishes a permit system for performing hot work operations at the facility. The purpose of the procedure is to outline responsibilities and precautions for protecting the facility from the hazards generated during hot work and to prevent fires.

HSG004 - Flammable Liquid Safety

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This procedure establishes safe work practices for safely and efficiently loading and unloading flammable and combustible liquids from bulk trucks, rail cars, tanks and containers.

HSG006 - Fall Protection

This procedure establishes fall protection requirements to protect facility or contract employees assigned to work on elevated surfaces such as tanks, bulk trucks, railcars, or platforms.

8.11.7 Decontamination

The closure performance standards specified in the facility closure plan are designed to ensure that after closure the facility will not require further maintenance and control, will minimize or eliminate threats to human health and the environment, and will prevent the release of hazardous waste to the soil, groundwater, surface water or atmosphere. The closure contractor(s) responsible for inventory management, tank sludge removal, tank and container building decontamination are required to establish work zones and decontamination provisions to minimize employee contamination or releases beyond established work zones.

29 CFR 1910.120(k) does not contain specific procedural development requirements in the area of decontamination. Closure contractor should adopt the methodology presented in the U. S. Environmental Protection Agency (EPA) document titled "Standard Operating Safety Guide" (SOSG). The SOSG establishes the decontamination layout and required procedures based on the level of PPE used at the site. Based on facility operating history and experience, PPE Levels B&C will be employed during closure activities.

The decontamination elements required during the closure should be determined on a task-specific basis. The following should be taken into consideration when preparing decontamination controls:

- Location and layout of decontamination stations and areas,
- Decontamination methods,
- Required decontamination equipment,
- Procedures for collection, storage and disposal of clothing, equipment and any other materials that have not been completely decontaminated.

8.11.8 Site Control

Facility security provisions including 24-hour surveillance, barriers to control entry, and warning signs will be implemented in accordance with the Part B permit application - Section V, Procedures to Prevent Hazards.

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8.11.9 Emergency Response

Emergency response provisions are specified in the facility Part B permit application - Section VI Contingency Plan. This plan outlines the manner in which facility management would respond to emergencies including fires, spills or other releases. The plan includes:

- List of Emergency Coordinators,
- List of emergency contacts (fire, police, ems),
- Evacuation plans,
- Emergency equipment,
- Coordination agreements, and
- Response procedures

8.11.10 Training

In 29 CFR 1910.120(e) different levels of training are required, depending on the task to be performed. Training for facility employee has been designed to meet mandatory training requirement specified by MSHA under 30 CFR Part 46/48. Contractor employees should be trained in accordance with 29 CFR 1910.120 (e) . The training levels vary depending on the tasks to be performed. Generally, contract employee are required to complete 40 hours of off-site instruction and 3 days of supervised field experience. The training program should include the following topics:

- Key personnel responsible for site safety and health,
- Safety, health and other hazards present on site,
- Use of Personal Protective Equipment (PPE),
- Safe work practices and site Standard Operating Procedures (SOPs),
- Safe use of onsite engineering controls and equipment,
- Medical surveillance program requirements, including signs/symptoms of overexposure,
- Site decontamination procedures,
- Site emergency response/action plan,
- Confined space entry procedures, and
- Site spill containment program/procedures.

Additionally, 29 CFR 1910.120 (b)(4)(iii) specifies that a pre-entry briefing be given to each worker, manager, supervisor and/or any other individual associated with the facility.

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8.12 Appendix 4

Financial Assurance Documents



Please Note: Pages of this application which contain financial assurance mechanism details specific to policy or account numbers have been removed from this web-available version of the document.

To review redacted copies of these removed pages, please contact DMWM's record management staff at 614-644-2621.

Thank you.

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SECTION IX RECORDKEEPING

The purpose of this section is to outline the facility's compliance with OAC Regulations 3745-54-70 to 3745-54-77, Manifest System, Recordkeeping, and Reporting.

9.1 Manifest System

After a waste shipment has been sampled and found consistent with the candidate fuel which was prequalified, the shipment will be accepted to be blended into supplemental fuel. The manifest accompanying the shipment will be obtained from the transporter, signed and dated to certify receipt of the waste; any significant discrepancies will be noted on each copy of the manifest. One copy of the completed manifest will be returned to the transporter, one copy will be retained at the facility for at least three years as part of the Operating Record, and a third signed copy will be sent to the generator initiating the shipment within thirty days.

When the facility receives a rail shipment which is accompanied by a manifest or a shipping paper containing all the information required on the manifest, the procedures outlined above for truck shipments will be followed.

Whenever a shipment of hazardous waste is initiated from the facility, Systech will comply with the requirement of §OAC 3745-54-71(C) and provide appropriate manifest documents to accompany the shipments.

9.1.1 Manifest Discrepancies

Manifest discrepancies are differences between the quantity or type of hazardous waste designated on the manifest or shipping paper and the quantity or type of hazardous waste a facility actually receives. Significant discrepancies in type are obvious differences which can be discovered by inspection or waste analysis, such as waste solvent substituted for waste acid or toxic constituents not reported on the manifest or shipping paper. Significant discrepancies in quantity are:

1. For bulk waste, variations greater than ten percent in weight; and
2. For batch waste, any variation in piece count, such as a discrepancy of one drum in a truckload.

Upon discovering a significant discrepancy, an attempt will be made to reconcile the discrepancy with the waste generator or transporter. If the discrepancy is not resolved within fifteen days after receiving the waste, the facility will submit to the OEPA a letter describing the discrepancy, attempts to reconcile it, and a copy of the manifest or shipping paper at issue.

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9.1.2 Unmanifested Waste Reports

If the facility received a waste shipment without an accompanying manifest or shipping paper, a report would be prepared and submitted to OEPA within fifteen days, using EPA form 8700-13B. The report would be designated "Unmanifested Waste Report" and would include the following information:

1. The EPA identification number, name and address of the facility;
2. The date the facility received the waste;
3. The EPA identification number, name and address of the generator and the transporter, if available;
4. A description and the quantity of each unmanifested hazardous waste the facility received;
5. The method of treatment, storage or disposal for each hazardous waste;
6. The certification signed by the authorized representative; and
7. A brief explanation of why the waste was unmanifested, if known.

9.2 Operating Record

A written Operating Record will be maintained at the facility. The Operating Records will be retained until closure of the facility. The Facility Manager will be responsible for maintaining the Operating Record.

As stated above, the Operating Record will include copies of the completed manifests for each shipment accepted for use. The manifest gives a description and the quantity of each waste received, as required by Appendix I. Manifests will be retained for at least three years. Included with this information will be the method(s) and date(s) of the storage and disposal of the wastes.

The Operating Record will include the location of each hazardous waste within the facility, the quantity at each location, and cross-references to specific manifest document numbers, if the waste was accompanied by a manifest.

The results and records of the analyses performed in accordance with the waste analysis plan will be included in the Operating Record. The type of analyses conducted and sampling procedures utilized are described in Section III, Waste Analysis Plan.

Reports of all incidents which required implementation of the Contingency Plan will also be included as part of the Operating Record maintained at the facility. The Contingency Plan section contains additional information regarding preparation and content of these reports.

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Reports on the daily, monthly and annual inspections conducted in accordance with the inspection schedule for the facility will be retained for at least three years in an inspection log as part of the Operating Record. The inspection schedule and further information on compliance with inspection requirements, as well as the inspection report forms, are provided in the Procedures to Prevent Hazards section of this document.

Waste generators will be informed in writing that the facility has the appropriate permits for and will accept the waste the generator is shipping. Copies of these notices to the generators will be kept as part of the Operating Record.

The written closure cost estimate and adjusted cost estimates will be maintained at the facility as part of the facility Operating Record.

Records of the qualifications and initial and continuing training provided to employees will be maintained as part of the Operating Record. These records will be retained until closure of the facility for current employees and for three years from the date of the individual's termination for former employees.

9.3 Biennial Reports

A biennial report will be prepared and submitted to the OEPA by March 1 of each year, as required by the regulations. It will be submitted on the Agency's form. The report will cover facility activities during the previous calendar year. The following information will be provided:

1. The EPA identification number, name and address of the facility;
2. The calendar year covered by the report;
3. The EPA identification number or name and address of each waste producer from which waste was received;
4. The quantity and a description of waste received during the year;
5. The method of treatment, storage or disposal for each hazardous waste;
6. The most recent closure cost estimate; and
7. A certification signed by an authorized representative.

9.4 Additional Reports

The time, date and details of any incident which requires implementation of the

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Contingency Plan will be noted in the Operating Record. Within fifteen days after the incident a written report will be submitted to the OEPA. The information which the report will contain is detailed in Section VI, Contingency Plan.

When final closure is completed, Systech will submit to the Director, by registered mail, a certification that the hazardous waste management facility has been closed in accordance with the specifications in the approved closure plan. The certification will be signed by an officer of Systech and an independent, registered professional engineer.

**SECTION X
CORRECTIVE ACTION REQUIREMENTS****OHIO EPA - DMWM****AUG 13 2014****10.1 Introduction**

In August 1992, A.T. Kearney, Incorporated, a contractor to USEPA, conducted a RCRA Facility Assessment (RFA) at both the Lafarge and Systech facilities. From the RFA, the contractor identified 37 solid waste management units (SWMUs) on both properties. Of these, 20 SWMUs were located on Systech property. Of these 20 SWMUs, US EPA determined that nine needed further investigation under a RCRA Facility Investigation (RFI). The nine were grouped into four locations at the site: Organic Liquid Storage Tanks No. 1-6 (SWMUs # 5-10), Organic liquid burn tank No.7 (SWMU #11), Oil/Water Separator (SWMU #18) and Rail Off-loading area (SWMU #21). As required in Systech's Federal RCRA permit, Systech prepared and submitted to US EPA a RFI Workplan in 1995. US EPA took no action on the RFI Workplan prior to delegating authority for the Corrective Action Program to Ohio EPA.

10.2 RFI Workplan

OPEA required Systech to submit a new RFI Workplan as one of the conditions in Systech's RCRA permit issued by OEPA in 2003. Systech submitted a revised RFI Workplan in October 2003. OEPA issued a Notice of Deficiency (NOD) on March 10, 2005. In this NOD, OEPA suggested that Systech group together those proximate SWMUs that had similar constituents of concern. Systech did group the four sets of SWMUs into two groups: Group A consisted of the Organic Liquid Storage Tanks No. 1-6 (SWMUs # 5-10), Oil/Water Separator (SWMU #18) and Rail Off-loading Area (SWMU #21). Group B consisted of just the Organic Liquid Burn Tank No.7 (SWMU #11). Along with this change the other responses to OEPA's concerns, Systech submitted a final revised RFI Workplan on June 10, 2005. By letter dated June 23, 2005, OEPA approved Systech's RFI Workplan and authorized Systech to initiate work. OEPA, Systech, and its consultant met during July 2005 to clarify final details on the location of background and on-site sampling locations. In August and September, the field work was completed.

The results of the RFI Workplan were submitted to OEPA in a report dated November 22, 2005. As a result of the investigation conducted in 2005, some additional investigation was required by OEPA. This additional investigatory work was outlined in RFI Phase II Workplan which was included as Volume III in the November 2005 RFI report. The main purpose of the Phase II Workplan was to fill in any data gaps identified from the completion of the initial RFI Workplan (now designated as RFI Phase I Workplan) and verify the RFI Phase I findings. The field work for Phase II was September 2006. The initial RFI Phase II sampling report was submitted in January 2009. After a couple of iterations responding to comments and question from OEPA, OEPA approved the report by letter dated October 16, 2012.

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10.3 Corrective Measure Study

Also in January 2009 Systech submitted its Corrective Measures Study (CMS). Some modifications were proposed to the CMS in a November 2009 submission. OEPA is still reviewing the proposed CMS. Since OEPA did not finally approve the RFI Phase II Report until October 2012, Systech has been requested to reaffirm its proposed remedial actions with respect to the shallow groundwater near the oil/water separator (SWMU# 18) and for the stained soil near SWMU 18 (Soil Boring #17, the power pole). At the time of this submission, Systech is still assessing its options. A final CMS will be submitted to OEPA soon. Systech, by letter dated December 12, 2012, committed to incorporate green remediation principals to the extent practicable and feasible in whatever remedial actions taken.

10.1 Introduction

~~The information provided in this section is submitted in accordance with the requirements of OAC 3745-50-44(D). These requirements specify that information for each solid waste management unit (SWMU) at a facility must be submitted to OEPA when the facility is seeking a permit (or permit renewal).~~

~~Systech, an indirectly wholly owned subsidiary of Lafarge North America Inc. (Lafarge), owns a facility located in Paulding County, Ohio which is a permitted RCRA facility. The co-located Lafarge facility is also a permitted RCRA facility.~~

~~On August 26 and 27, 1992, A.T. Kearney Incorporated, a contractor for the US EPA conducted a RCRA Facility Assessment (RFA) at the Systech and Lafarge facilities. The basic purpose of this RFA was to assess the facilities and to determine if there had been any previous potential releases to the environment. The RFA identified 37 SWMU at the combined facilities, 20 of which were on the Systech facility. Based on the RFA report, US EPA determined that nine of these SWMUs needed further investigation under a RCRA Facility Investigation (RFI). Subsequent to the RFI issuance and during the RFI process, US EPA transferred authority for oversight of corrective action to OEPA that now directs the corrective action requirements for the Systech facility.~~

~~These nine locations were grouped into four areas. At the suggestion of OEPA, the nine SWMUs and four locations were combined into two investigatory groups.~~

~~The description on SWMU No. 11 has been updated to include the expansion of the secondary containment structure in 1998 that now includes two additional 150,000-gallon tanks. There are now three 150,000-gallon tanks in located in this area. Two additional 150,000-gallon tanks have been permitted for this area but have not yet constructed.~~

10.2 RFI Workplan

~~As required by Systech's hazardous waste permit, a RFI Workplan addressing the nine SWMUs was submitted to OEPA which Systech did. By letter dated June 23, 2005, OEPA authorized Systech to implement the RFI Phase I Workplan it submitted. The on-site work was completed by September 1, 2005. The completed RFI Phase I Report was submitted and accepted by OEPA in 2006. Based on the results of the Phase I work, OEPA requested some additional site investigation. A RFI Phase II Workplan was developed and submitted to OEPA. OEPA accepted RFI Phase II Workplan in July 2006. The site fieldwork was conducted in September 2006. The revised RFI Phase II Sampling Report was submitted March 12, 2012.~~

~~To summarize the report, there were two areas associated with Group A that were identified as needing corrective action: Oil/Water Separator area for perched groundwater and the power pole (SB17) indicated a potential hot spot for some organic constituents. The remainder of the areas in Group A and all of Group B were determined not to require any further action.~~

~~OEPA accepted the Phase II Sampling Report on October 16, 2012. Therefore, Condition E.5 of Systech's Ohio Hazardous Waste Permit has been satisfied.~~

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~~Corrective Measures Study~~

~~Condition E.8 of Systech's Ohio Hazardous Waste Permit require Systech to submit a Corrective Measure Study (CMS) Workplan no later than January 14, 2013 when the results of the RFI indicated that corrective action was needed. The CMS Workplan was submitted on January 12, 2009. By letter dated December 12, 2012, Systech reaffirmed that there have been no substantive changes to the CMS Workplan as submitted. Systech did commit, to the extent practical and feasible to incorporate green remediation principles into the evaluation and implementation of the corrective measures at the facility.~~

~~Briefly, Systech has proposed the following in the CMS Workplan:~~

~~Monitored Natural Attenuation complemented with Administrative Controls around the area of the Oil/Water Separator with periodic pumping of the perched groundwater for the Oil/water separator area if necessary and appropriate. For the area around the power pole, stained soil will be removed and land disposed of at a permitted landfill.~~

9. Type of Regulated Waste Activity (Mark "X" in the appropriate boxes.)

A. Hazardous Waste Activities

1. Generator of Hazardous Waste

(choose only one of the following three categories or leave blank if not applicable)

- ☒ a. Large Quantity Generator (LQG):
Greater than 1,000 kg/mo (2,200 lbs.)
of non-acute hazardous waste; or
- ☐ b. Small Quantity Generator (SQG)
100 to 1,000 kg/mo (220-2,200 lbs.)
of non-acute hazardous waste; or
- ☐ c. Conditionally Exempt Small Quantity Generator
(CESQG):
Less than 100 kg/mo of non-acute hazardous waste

In addition, indicate other generator activities
(check all that apply)

- ☐ d. Short-Term Generator (generate from a short-term or
one-time event and not from on-going processes). If
"Yes", provide an explanation in the Comments
section.
- ☒ e. United States Importer of Hazardous Waste
- ☐ f. Mixed Waste (hazardous and radioactive) Generator

2. Hazardous Waste Report Generator Status

(choose one if a Reason for Submittal is the Hazardous Waste
Report)

- ☒ a. Large Quantity Generator (LQG):
Greater than 1,000 kg/mo (2,200 lbs.) of non-acute
hazardous waste was generated at the site in any one
month. or
- ☐ b. Small Quantity Generator (SQG)
In one or more months the site generated greater than
100kg (220 lbs) but in no month did it generate more
than 1,000 kg/mo (220-2,200 lbs) of non-acute
hazardous waste, or
- ☐ c. Conditionally Exempt Small Quantity Generator
(CESQG):
The site generated no more than 100 kg (220 lbs) of
non-acute hazardous waste in any one month.
- ☐ d. Non-Generator
The site did not generate any hazardous waste during
the calendar year.

For Items 3 through 7, check all that apply:

3. Transporter of Hazardous Waste

- ☐ a. Transporter
- ☐ b. Transfer Facility (at your site)

- ☒ 4. Treater, Storer or Disposer of Hazardous Waste (at
your site) Note: A hazardous waste permit is required for
this activity.

- ☒ 5. Recycler of Hazardous Waste (at your site) Note: A
hazardous waste permit may be required for this activity.

- ☐ a. 72-hour Recycler

6. Exempt Boiler and/or Industrial Furnace

- ☐ a. Small Quantity On-site Burner Exemption
- ☐ b. Smelting, Melting and Refining Furnace
Exemption

- ☐ 7. Underground Injection Control

- ☒ 8. Receives Hazardous Waste from Off-site

B. Universal Waste Activities

- ☐ 1. Large Quantity Handler of Universal Waste (accumulate
5,000 kg or more). Indicate types of universal waste
managed at your site. (check all boxes that apply):

- | | <u>Managed</u> |
|---------------------------------|--------------------------|
| a. Batteries | <input type="checkbox"/> |
| b. Pesticides | <input type="checkbox"/> |
| c. Mercury Containing Equipment | <input type="checkbox"/> |
| d. Lamps | <input type="checkbox"/> |

- ☐ 2. Destination Facility for Universal Waste
Note: A hazardous waste permit may be required for this
activity.

C. Used Oil Activities

1. Used Oil Transporter

- Indicate Type(s) of Activity(ies)
- ☐ a. Transporter
- ☐ b. Transfer Facility (at your site)

2. Used Oil Processor and/or Re-refiner

- Indicate Type(s) of Activity(ies)
- ☒ a. Processor
- ☐ b. Re-refiner

- ☐ 3. Off-Specification Used Oil Burner

4. Used Oil Fuel Marketer -

- Indicate Type(s) of Activity(ies)
- ☒ a. Marketer Who Directs Shipment of Off-Specification
Used Oil to Off-Specification Used Oil Burner
- ☐ b. Marketer Who First Claims the Used Oil Meets the
Specifications

D. Eligible Academic Entities with Laboratories – Notification for opting into or withdrawing from managing laboratory hazardous wastes pursuant to OAC rules 3745-52-200 through 3745-52-216

- ☐ 1. Opting into or currently operating under OAC rules 3745-52-200 through 3745-52-216 for the management of hazardous wastes in laboratories. Mark all that apply:
- ☐ a. College or University
- ☐ b. Teaching hospital that is owned by or has a formal written affiliation agreement with a college or university
- ☐ c. Non-profit Institute that is owned by or has a formal written affiliation agreement with a college or university
- ☐ 2. Withdrawing from OAC rules 3745-52-200 through 3745-53-216 for the management of hazardous waste in laboratories

10. Waste Codes for Federally Regulated Hazardous Wastes. Please list the codes for the federally regulated hazardous waste handled at your site. List them in the order they are presented in the regulations (e.g., D001, D003, F007, U112). Use an additional page if more space is needed.

	Waste Codes	are listed in item	10.A of the	Hazardous Waste Permit	
		information	form.		

11. Comments

12. Certification. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature of owner, operator, or an authorized representative	Name and Official Title (type or print)	Date Signed (mm-dd-yyyy)
<i>Shawn McMullen</i>	Shawn McMullen, COO	7/28/18

United States Environmental Protection Agency												
HARDOUS WASTE PERMIT INFORMATION FORM												
1. Facility Permit Contact	First Name: Jeff				MI:		Last Name: Hunyor					
	Contact Title: Facility Manager											
	Phone: (419) 399-4835				Ext.: 101		Email: Jeff.Hunyor@Lafarge-na.com					
2. Facility Permit Contact Mailing Address	Street or P.O. Box: 11397 County Road 176											
	City, Town, or Village: Paulding											
	State: Ohio											
	Country: U.S.A.					Zip Code: 45879						
3. Operator Mailing Address and Telephone Number	Street or P.O. Box: P.O. Box 266											
	City, Town, or Village: Paulding											
	State: Ohio					Phone: (419) 399-4835						
	Country: U.S.A.					Zip Code: 45879						
4. Facility Existence Date	Facility Existence Date (mm/dd/yyyy): 11/1992											
5. Other Environmental Permits												
A. Facility Type (Enter code)	B. Permit Number										C. Description	
E. (Stormwater												
General Permit)	O	H	R	0	0	0	0	0	5			OEPA Facility Permit #2GR00294*CG
E. (Title V Permit)	P	0	1	0	9	0	6	8				Facility ID 0363000046
6. Nature of Business: Systech Environmental Corporation receives, blends, stores and transfers the liquid hazardous waste fuel to the cement kilns owned by Lafarge North America Inc., which are co-located at the site.												

7. Process Codes and Design Capacities – Enter Information in the Section on Form Page 3

A. PROCESS CODE – Enter the code from the list of process codes below that best describes each process to be used at the facility. If more lines are needed, attach a separate sheet of paper with the additional information. For "other" processes (i.e., D99, S99, T04 and X99), describe the process (including its design capacity) in the space provided in Item 8.

B. PROCESS DESIGN CAPACITY – For each code entered in Item 7.A; enter the capacity of the process.

- 1. AMOUNT** – Enter the amount. In a case where design capacity is not applicable (such as in a closure/post-closure or enforcement action) enter the total amount of waste for that process.
- 2. UNIT OF MEASURE** – For each amount entered in Item 7.B(1), enter the code in Item 7.B(2) from the list of unit of measure codes below that describes the unit of measure used. Select only from the units of measure in this list.

C. PROCESS TOTAL NUMBER OF UNITS – Enter the total number of units for each corresponding process code.

Process Code	Process	Appropriate Unit of Measure for Process Design Capacity	Process Code	Process	Appropriate Unit of Measure for Process Design Capacity
Disposal			Treatment (Continued) (for T81 – T94)		
D79	Underground Injection Well Disposal	Gallons; Liters; Gallons Per Day; or Liters Per Day	T81	Cement Kiln	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; BTU Per Hour; Liters Per Hour; Kilograms Per Hour; or Million BTU Per Hour
D80	Landfill	Acre-feet; Hectares-meter; Acres; Cubic Meters; Hectares; Cubic Yards	T82	Lime Kiln	
D81	Land Treatment	Acres or Hectares	T83	Aggregate Kiln	
D82	Ocean Disposal	Gallons Per Day or Liters Per Day	T84	Phosphate Kiln	
D83	Surface Impoundment Disposal	Gallons; Liters; Cubic Meters; or Cubic Yards	T85	Coke Oven	
D99	Other Disposal	Any Unit of Measure Listed Below	T86	Blast Furnace	
Storage			T87	Smelting, Melting, or Refining Furnace	
S01	Container	Gallons; Liters; Cubic Meters; or Cubic Yards	T88	Titanium Dioxide Chloride Oxidation Reactor	
S02	Tank Storage	Gallons; Liters; Cubic Meters; or Cubic Yards	T89	Methane Reforming Furnace	
S03	Waste Pile	Cubic Yards or Cubic Meters	T90	Pulping Liquor Recovery Furnace	
S04	Surface Impoundment	Gallons; Liters; Cubic Meters; or Cubic Yards	T91	Combustion Device Used in the Recovery of Sulfur Values from Spent Sulfuric Acid	
S05	Drip Pad	Gallons; Liters; Cubic Meters; Hectares; or Cubic Yards	T92	Halogen Acid Furnaces	
S08	Containment Building Storage	Cubic Yards or Cubic Meters	T93	Other Industrial Furnaces Listed in 40 CFR 260.10	
S99	Other Storage	Any Unit of Measure Listed Below	T94	Containment Building Treatment	Cubic Yards; Cubic Meters; Short Tons Per Hour; Gallons Per Hour; Liters Per Hour; BTU Per Hour; Pounds Per Hour; Short Tons Per Day; Kilograms Per Hour; Metric Tons Per Day; Gallons Per Day; Liters Per Day; Metric Tons Per Hour; or Million BTU Per Hour
Treatment			Miscellaneous (Subpart X)		
T01	Tank Treatment	Gallons Per Day; Liters Per Day	X01	Open Burning/Open Detonation	Any Unit of Measure Listed Below
T02	Surface Impoundment	Gallons Per Day; Liters Per Day	X02	Mechanical Processing	Short Tons Per Hour; Metric Tons Per Hour; Short Tons Per Day; Metric Tons Per Day; Pounds Per Hour; Kilograms Per Hour; Gallons Per Hour; Liters Per Hour; or Gallons Per Day
T03	Incinerator	Short Tons Per Hour; Metric Tons Per Hour; Gallons Per Hour; Liters Per Hour; BTUs Per Hour; Pounds Per Hour; Short Tons Per Day; Kilograms Per Hour; Gallons Per Day; Metric Tons Per Hour; or Million BTU Per Hour	X03	Thermal Unit	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; BTU Per Hour; or Million BTU Per Hour
T04	Other Treatment	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Short Tons Per Day; BTUs Per Hour; Gallons Per Day; Liters Per Hour; or Million BTU Per Hour	X04	Geologic Repository	Cubic Yards; Cubic Meters; Acre-feet; Hectare-meter; Gallons; or Liters
T80	Boiler	Gallons; Liters; Gallons Per Hour; Liters Per Hour; BTUs Per Hour; or Million BTU Per Hour	X99	Other Subpart X	Any Unit of Measure Listed Below

Unit of Measure	Unit of Measure Code	Unit of Measure	Unit of Measure Code	Unit of Measure	Unit of Measure Code
Gallons	G	Short Tons Per Hour	D	Cubic Yards	Y
Gallons Per Hour	E	Short Tons Per Day	N	Cubic Meters	C
Gallons Per Day	U	Metric Tons Per Hour	W	Acres	B
Liters	L	Metric Tons Per Day	S	Acre-feet	A
Liters Per Hour	H	Pounds Per Hour	J	Hectares	Q
Liters Per Day	V	Kilograms Per Hour	X	Hectare-meter	F
		Million BTU Per Hour	X	BTU Per Hour	I

9. Description of Hazardous Wastes - Enter Information in the Sections on Form Page 6

- A. EPA HAZARDOUS WASTE NUMBER** – Enter the four-digit number from 40 CFR, Part 261 Subpart D of each listed hazardous waste you will handle. For hazardous wastes which are not listed in 40 CFR, Part 261 Subpart D, enter the four-digit number(s) from 40 CFR Part 261, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.
- B. ESTIMATED ANNUAL QUANTITY** – For each listed waste entered in Item 9.A, estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in Item 9.A, estimate the total annual quantity of all the non-listed waste(s) that will be handled which possess that characteristic or contaminant.
- C. UNIT OF MEASURE** – For each quantity entered in Item 9.B, enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure, taking into account the appropriate density or specific gravity of the waste.

D. PROCESSES**1. PROCESS CODES:**

For listed hazardous waste: For each listed hazardous waste entered in Item 9.A, select the code(s) from the list of process codes contained in Items 7.A and 8.A on page 3 to indicate all the processes that will be used to store, treat, and/or dispose of all listed hazardous wastes.

For non-listed waste: For each characteristic or toxic contaminant entered in Item 9.A, select the code(s) from the list of process codes contained in Items 7.A and 8.A on page 3 to indicate all the processes that will be used to store, treat, and/or dispose of all the non-listed hazardous wastes that possess that characteristic or toxic contaminant.

NOTE: THREE SPACES ARE PROVIDED FOR ENTERING PROCESS CODES. IF MORE ARE NEEDED:

- Enter the first two as described above.
 - Enter "000" in the extreme right box of Item 9.D(1).
 - Use additional sheet, enter line number from previous sheet, and enter additional code(s) in Item 9.E.
- 2. PROCESS DESCRIPTION:** If code is not listed for a process that will be used, describe the process in Item 9.D(2) or in Item 9.E(2).

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER – Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

- Select one of the EPA Hazardous Waste Numbers and enter it in Item 9.A. On the same line complete Items 9.B, 9.C, and 9.D by estimating the total annual quantity of the waste and describing all the processes to be used to store, treat, and/or dispose of the waste.
- In Item 9.A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In Item 9.D.2 on that line enter "included with above" and make no other entries on that line.
- Repeat step 2 for each EPA Hazardous Waste Number that can be used to describe the hazardous waste.

EXAMPLE FOR COMPLETING Item 9 (shown in line numbers X-1, X-2, X-3, and X-4 below) – A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operations. In addition, the facility will treat and dispose of three non-listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

Line Number	A. EPA Hazardous Waste No. (Enter code)	B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
				(1) PROCESS CODES (Enter Code)					(2) PROCESS DESCRIPTION (If code is not entered in 9.D(1))				
X 1	K 0 5 4	900	P	T	0	3	D	8	0				
X 2	D 0 0 2	400	P	T	0	3	D	8	0				
X 3	D 0 0 1	100	P	T	0	3	D	8	0				
X 4	D 0 0 2												Included With Above

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)						(2) PROCESS DESCRIPTION (If code is not entered in 9.D(1))			
	1	D	0	0	1	40,000	T	S	0	1	S	0	2				
	2	D	0	0	2	40	T	S	0	1	S	0	2				
	3	D	0	0	3	<20	T	S	0	1	S	0	2				
	4	D	0	0	4	40	T	S	0	1	S	0	2				
	5	D	0	0	5	40	T	S	0	1	S	0	2				
	6	D	0	0	6	40	T	S	0	1	S	0	2				
	7	D	0	0	7	40	T	S	0	1	S	0	2				
	8	D	0	0	8	40	T	S	0	1	S	0	2				
	9	D	0	0	9	40	T	S	0	1	S	0	2				
1	0	D	0	1	0	40	T	S	0	1	S	0	2				
1	1	D	0	1	1	40	T	S	0	1	S	0	2				
1	2	D	0	1	2	40	T	S	0	1	S	0	2				
1	3	D	0	1	3	40	T	S	0	1	S	0	2				
1	4	D	0	1	4	40	T	S	0	1	S	0	2				
1	5	D	0	1	5	40	T	S	0	1	S	0	2				
1	6	D	0	1	6	40	T	S	0	1	S	0	2				
	7	D	0	1	7	40	T	S	0	1	S	0	2				
1	8	D	0	1	8	40	T	S	0	1	S	0	2				
1	9	D	0	1	9	40	T	S	0	1	S	0	2				
2	0	D	0	2	0	40	T	S	0	1	S	0	2				
2	1	D	0	2	1	40	T	S	0	1	S	0	2				
2	2	D	0	2	2	40	T	S	0	1	S	0	2				
2	3	D	0	2	3	40	T	S	0	1	S	0	2				
2	4	D	0	2	4	40	T	S	0	1	S	0	2				
2	5	D	0	2	5	40	T	S	0	1	S	0	2				
2	6	D	0	2	6	40	T	S	0	1	S	0	2				
2	7	D	0	2	7	40	T	S	0	1	S	0	2				
2	8	D	0	2	8	40	T	S	0	1	S	0	2				
2	9	D	0	2	9	40	T	S	0	1	S	0	2				
3	0	D	0	3	0	40	T	S	0	1	S	0	2				
3	1	D	0	3	1	40	T	S	0	1	S	0	2				
3	2	D	0	3	2	40	T	S	0	1	S	0	2				
3	3	D	0	3	3	40	T	S	0	1	S	0	2				
3	4	D	0	3	4	40	T	S	0	1	S	0	2				
3	5	D	0	3	5	40	T	S	0	1	S	0	2				
	6	D	0	3	6	40	T	S	0	1	S	0	2				

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)						(2) PROCESS DESCRIPTION (If code is not entered in 9.D(1))			
	1	D	0	0	1	40,000	T	T	0	1	T	0	4				
	2	D	0	0	2	40	T	T	0	1	T	0	4				
	3	D	0	0	3	<20	T	T	0	1	T	0	4				
	4	D	0	0	4	40	T	T	0	1	T	0	4				
	5	D	0	0	5	40	T	T	0	1	T	0	4				
	6	D	0	0	6	40	T	T	0	1	T	0	4				
	7	D	0	0	7	40	T	T	0	1	T	0	4				
	8	D	0	0	8	40	T	T	0	1	T	0	4				
	9	D	0	0	9	40	T	T	0	1	T	0	4				
1	0	D	0	1	0	40	T	T	0	1	T	0	4				
1	1	D	0	1	1	40	T	T	0	1	T	0	4				
1	2	D	0	1	2	40	T	T	0	1	T	0	4				
1	3	D	0	1	3	40	T	T	0	1	T	0	4				
1	4	D	0	1	4	40	T	T	0	1	T	0	4				
1	5	D	0	1	5	40	T	T	0	1	T	0	4				
1	6	D	0	1	6	40	T	T	0	1	T	0	4				
1	7	D	0	1	7	40	T	T	0	1	T	0	4				
1	8	D	0	1	8	40	T	T	0	1	T	0	4				
1	9	D	0	1	9	40	T	T	0	1	T	0	4				
2	0	D	0	2	0	40	T	T	0	1	T	0	4				
2	1	D	0	2	1	40	T	T	0	1	T	0	4				
2	2	D	0	2	2	40	T	T	0	1	T	0	4				
2	3	D	0	2	3	40	T	T	0	1	T	0	4				
2	4	D	0	2	4	40	T	T	0	1	T	0	4				
2	5	D	0	2	5	40	T	T	0	1	T	0	4				
2	6	D	0	2	6	40	T	T	0	1	T	0	4				
2	7	D	0	2	7	40	T	T	0	1	T	0	4				
2	8	D	0	2	8	40	T	T	0	1	T	0	4				
2	9	D	0	2	9	40	T	T	0	1	T	0	4				
3	0	D	0	3	0	40	T	T	0	1	T	0	4				
3	1	D	0	3	1	40	T	T	0	1	T	0	4				
3	2	D	0	3	2	40	T	T	0	1	T	0	4				
3	3	D	0	3	3	40	T	T	0	1	T	0	4				
3	4	D	0	3	4	40	T	T	0	1	T	0	4				
3	5	D	0	3	5	40	T	T	0	1	T	0	4				
3	6	D	0	3	6	40	T	T	0	1	T	0	4				

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Page Number	A. EPA Hazardous Waste No. (Enter code)					B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)						(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)			
3	7	D	0	3	7	40	T	S	0	1	S	0	2				
3	8	D	0	3	8	40	T	S	0	1	S	0	2				
3	9	D	0	3	9	40	T	S	0	1	S	0	2				
4	0	D	0	4	0	40	T	S	0	1	S	0	2				
4	1	D	0	4	1	40	T	S	0	1	S	0	2				
4	2	D	0	4	2	40	T	S	0	1	S	0	2				
4	3	D	0	4	3	<20	T	S	0	1	S	0	2				
4	4	F	0	0	1	<20	T	S	0	1	S	0	2				
4	5	F	0	0	2	<20	T	S	0	1	S	0	2				
4	6	F	0	0	3	40,000	T	S	0	1	S	0	2				
4	7	F	0	0	4	<20	T	S	0	1	S	0	2				
4	8	F	0	0	5	40,000	T	S	0	1	S	0	2				
4	9	F	0	0	6	<20	T	S	0	1	S	0	2				
5	0	F	0	0	7	<20	T	S	0	1	S	0	2				
5	1	F	0	0	8	<20	T	S	0	1	S	0	2				
5	2	F	0	0	9	<20	T	S	0	1	S	0	2				
5	3	F	0	1	0	<20	T	S	0	1	S	0	2				
5	4	F	0	1	1	<20	T	S	0	1	S	0	2				
5	5	F	0	1	2	<20	T	S	0	1	S	0	2				
5	6	F	0	1	9	<20	T	S	0	1	S	0	2				
5	7	F	0	2	4	<20	T	S	0	1	S	0	2				
5	8	F	0	2	5	<20	T	S	0	1	S	0	2				
5	9	F	0	3	4	<20	T	S	0	1	S	0	2				
6	0	F	0	3	5	<20	T	S	0	1	S	0	2				
6	1	F	0	3	7	<20	T	S	0	1	S	0	2				
6	2	F	0	3	8	<20	T	S	0	1	S	0	2				
6	3	F	0	3	9	<20	T	S	0	1	S	0	2				
6	4	K	0	0	1	<20	T	S	0	1	S	0	2				
6	5	K	0	0	2	<20	T	S	0	1	S	0	2				
6	6	K	0	0	3	<20	T	S	0	1	S	0	2				
6	7	K	0	0	4	<20	T	S	0	1	S	0	2				
6	8	K	0	0	5	<20	T	S	0	1	S	0	2				
6	9	K	0	0	6	<20	T	S	0	1	S	0	2				
7	0	K	0	0	7	<20	T	S	0	1	S	0	2				
7	1	K	0	0	8	<20	T	S	0	1	S	0	2				
7	2	K	0	0	9	<20	T	S	0	1	S	0	2				

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Site Number	A. EPA Hazardous Waste No. (Enter code)					B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)						(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)			
3	7	D	0	3	7	40	T	T	0	1	T	0	4				
3	8	D	0	3	8	40	T	T	0	1	T	0	4				
3	9	D	0	3	9	40	T	T	0	1	T	0	4				
4	0	D	0	4	0	40	T	T	0	1	T	0	4				
4	1	D	0	4	1	40	T	T	0	1	T	0	4				
4	2	D	0	4	2	40	T	T	0	1	T	0	4				
4	3	D	0	4	3	<20	T	T	0	1	T	0	4				
4	4	F	0	0	1	<20	T	T	0	1	T	0	4				
4	5	F	0	0	2	<20	T	T	0	1	T	0	4				
4	6	F	0	0	3	40,000	T	T	0	1	T	0	4				
4	7	F	0	0	4	<20	T	T	0	1	T	0	4				
4	8	F	0	0	5	40,000	T	T	0	1	T	0	4				
4	9	F	0	0	6	<20	T	T	0	1	T	0	4				
5	0	F	0	0	7	<20	T	T	0	1	T	0	4				
5	1	F	0	0	8	<20	T	T	0	1	T	0	4				
5	2	F	0	0	9	<20	T	T	0	1	T	0	4				
5	3	F	0	1	0	<20	T	T	0	1	T	0	4				
5	4	F	0	1	1	<20	T	T	0	1	T	0	4				
5	5	F	0	1	2	<20	T	T	0	1	T	0	4				
5	6	F	0	1	9	<20	T	T	0	1	T	0	4				
5	7	F	0	2	4	<20	T	T	0	1	T	0	4				
5	8	F	0	2	5	<20	T	T	0	1	T	0	4				
5	9	F	0	3	4	<20	T	T	0	1	T	0	4				
6	0	F	0	3	5	<20	T	T	0	1	T	0	4				
6	1	F	0	3	7	<20	T	T	0	1	T	0	4				
6	2	F	0	3	8	<20	T	T	0	1	T	0	4				
6	3	F	0	3	9	<20	T	T	0	1	T	0	4				
6	4	K	0	0	1	<20	T	T	0	1	T	0	4				
6	5	K	0	0	2	<20	T	T	0	1	T	0	4				
6	6	K	0	0	3	<20	T	T	0	1	T	0	4				
6	7	K	0	0	4	<20	T	T	0	1	T	0	4				
6	8	K	0	0	5	<20	T	T	0	1	T	0	4				
6	9	K	0	0	6	<20	T	T	0	1	T	0	4				
7	0	K	0	0	7	<20	T	T	0	1	T	0	4				
7	1	K	0	0	8	<20	T	T	0	1	T	0	4				
7	2	K	0	0	9	<20	T	T	0	1	T	0	4				

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)						(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)			
7	3	K	0	1	0	<20	T	S	0	1	S	0	2				
7	4	K	0	1	1	<20	T	S	0	1	S	0	2				
7	5	K	0	1	3	<20	T	S	0	1	S	0	2				
7	6	K	0	1	4	<20	T	S	0	1	S	0	2				
7	7	K	0	1	5	<20	T	S	0	1	S	0	2				
7	8	K	0	1	6	<20	T	S	0	1	S	0	2				
7	9	K	0	1	7	<20	T	S	0	1	S	0	2				
8	0	K	0	1	8	<20	T	S	0	1	S	0	2				
8	1	K	0	1	9	<20	T	S	0	1	S	0	2				
8	2	K	0	2	0	<20	T	S	0	1	S	0	2				
8	3	K	0	2	1	<20	T	S	0	1	S	0	2				
8	4	K	0	2	2	20,000	T	S	0	1	S	0	2				
8	5	K	0	2	3	<20	T	S	0	1	S	0	2				
8	6	K	0	2	4	<20	T	S	0	1	S	0	2				
8	7	K	0	2	5	<20	T	S	0	1	S	0	2				
8	8	K	0	2	6	<20	T	S	0	1	S	0	2				
8	9	K	0	2	7	<20	T	S	0	1	S	0	2				
9	0	K	0	2	8	<20	T	S	0	1	S	0	2				
9	1	K	0	2	9	<20	T	S	0	1	S	0	2				
9	2	K	0	3	0	<20	T	S	0	1	S	0	2				
9	3	K	0	3	1	<20	T	S	0	1	S	0	2				
9	4	K	0	3	2	<20	T	S	0	1	S	0	2				
9	5	K	0	3	3	<20	T	S	0	1	S	0	2				
9	6	K	0	3	4	<20	T	S	0	1	S	0	2				
9	7	K	0	3	5	<20	T	S	0	1	S	0	2				
9	8	K	0	3	6	<20	T	S	0	1	S	0	2				
9	9	K	0	3	7	<20	T	S	0	1	S	0	2				
0	0	K	0	3	8	<20	T	S	0	1	S	0	2				
0	1	K	0	3	9	<20	T	S	0	1	S	0	2				
0	2	K	0	4	0	<20	T	S	0	1	S	0	2				
0	3	K	0	4	1	<20	T	S	0	1	S	0	2				
0	4	K	0	4	2	<20	T	S	0	1	S	0	2				
0	5	K	0	4	3	<20	T	S	0	1	S	0	2				
0	6	K	0	4	4	<20	T	S	0	1	S	0	2				
0	7	K	0	4	5	<20	T	S	0	1	S	0	2				
0	8	K	0	4	6	<20	T	S	0	1	S	0	2				

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES										(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)
								(1) PROCESS CODES (Enter Code)										
7	3	K	0	1	0	<20	T	T	0	1	T	0	4					
7	4	K	0	1	1	<20	T	T	0	1	T	0	4					
7	5	K	0	1	3	<20	T	T	0	1	T	0	4					
7	6	K	0	1	4	<20	T	T	0	1	T	0	4					
7	7	K	0	1	5	<20	T	T	0	1	T	0	4					
7	8	K	0	1	6	<20	T	T	0	1	T	0	4					
7	9	K	0	1	7	<20	T	T	0	1	T	0	4					
8	0	K	0	1	8	<20	T	T	0	1	T	0	4					
8	1	K	0	1	9	<20	T	T	0	1	T	0	4					
8	2	K	0	2	0	<20	T	T	0	1	T	0	4					
8	3	K	0	2	1	<20	T	T	0	1	T	0	4					
8	4	K	0	2	2	20,000	T	T	0	1	T	0	4					
8	5	K	0	2	3	<20	T	T	0	1	T	0	4					
8	6	K	0	2	4	<20	T	T	0	1	T	0	4					
8	7	K	0	2	5	<20	T	T	0	1	T	0	4					
8	8	K	0	2	6	<20	T	T	0	1	T	0	4					
8	9	K	0	2	7	<20	T	T	0	1	T	0	4					
9	0	K	0	2	8	<20	T	T	0	1	T	0	4					
9	1	K	0	2	9	<20	T	T	0	1	T	0	4					
9	2	K	0	3	0	<20	T	T	0	1	T	0	4					
9	3	K	0	3	1	<20	T	T	0	1	T	0	4					
9	4	K	0	3	2	<20	T	T	0	1	T	0	4					
9	5	K	0	3	3	<20	T	T	0	1	T	0	4					
9	6	K	0	3	4	<20	T	T	0	1	T	0	4					
9	7	K	0	3	5	<20	T	T	0	1	T	0	4					
9	8	K	0	3	6	<20	T	T	0	1	T	0	4					
9	9	K	0	3	7	<20	T	T	0	1	T	0	4					
0	0	K	0	3	8	<20	T	T	0	1	T	0	4					
0	1	K	0	3	9	<20	T	T	0	1	T	0	4					
0	2	K	0	4	0	<20	T	T	0	1	T	0	4					
0	3	K	0	4	1	<20	T	T	0	1	T	0	4					
0	4	K	0	4	2	<20	T	T	0	1	T	0	4					
0	5	K	0	4	3	<20	T	T	0	1	T	0	4					
0	6	K	0	4	4	<20	T	T	0	1	T	0	4					
0	7	K	0	4	5	<20	T	T	0	1	T	0	4					
0	8	K	0	4	6	<20	T	T	0	1	T	0	4					

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)							(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)		
0	9	K	0	4	7	<20	T	S	0	1	S	0	2				
1	0	K	0	4	8	20,000	T	S	0	1	S	0	2				
1	1	K	0	4	9	20,000	T	S	0	1	S	0	2				
1	2	K	0	5	0	<20	T	S	0	1	S	0	2				
1	3	K	0	5	1	20,000	T	S	0	1	S	0	2				
1	4	K	0	5	2	<20	T	S	0	1	S	0	2				
1	5	K	0	6	0	<20	T	S	0	1	S	0	2				
1	6	K	0	6	1	<20	T	S	0	1	S	0	2				
1	7	K	0	6	2	<20	T	S	0	1	S	0	2				
1	8	K	0	6	9	<20	T	S	0	1	S	0	2				
1	9	K	0	7	1	<20	T	S	0	1	S	0	2				
2	0	K	0	7	3	<20	T	S	0	1	S	0	2				
2	1	K	0	8	3	<20	T	S	0	1	S	0	2				
2	2	K	0	8	4	<20	T	S	0	1	S	0	2				
2	3	K	0	8	5	<20	T	S	0	1	S	0	2				
2	4	K	0	8	6	36,000	T	S	0	1	S	0	2				
2	5	K	0	8	7	<20	T	S	0	1	S	0	2				
2	6	K	0	8	8	<20	T	S	0	1	S	0	2				
2	7	K	0	9	3	<20	T	S	0	1	S	0	2				
2	8	K	0	9	4	<20	T	S	0	1	S	0	2				
2	9	K	0	9	5	<20	T	S	0	1	S	0	2				
3	0	K	0	9	6	<20	T	S	0	1	S	0	2				
3	1	K	0	9	7	<20	T	S	0	1	S	0	2				
3	2	K	0	9	8	<20	T	S	0	1	S	0	2				
3	3	K	0	9	9	<20	T	S	0	1	S	0	2				
3	4	K	1	0	0	<20	T	S	0	1	S	0	2				
3	5	K	1	0	1	<20	T	S	0	1	S	0	2				
3	6	K	1	0	2	<20	T	S	0	1	S	0	2				
3	7	K	1	0	3	<20	T	S	0	1	S	0	2				
3	8	K	1	0	4	<20	T	S	0	1	S	0	2				
3	9	K	1	0	5	<20	T	S	0	1	S	0	2				
4	0	K	1	0	6	<20	T	S	0	1	S	0	2				
4	1	K	1	0	7	<20	T	S	0	1	S	0	2				
4	2	K	1	0	8	<20	T	S	0	1	S	0	2				
4	3	K	1	0	9	<20	T	S	0	1	S	0	2				
4	4	K	1	1	0	<20	T	S	0	1	S	0	2				

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)						(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)			
0	9	K	0	4	7	<20	T	T	0	1	T	0	4				
1	0	K	0	4	8	20,000	T	T	0	1	T	0	4				
1	1	K	0	4	9	20,000	T	T	0	1	T	0	4				
1	2	K	0	5	0	<20	T	T	0	1	T	0	4				
1	3	K	0	5	1	20,000	T	T	0	1	T	0	4				
1	4	K	0	5	2	<20	T	T	0	1	T	0	4				
1	5	K	0	6	0	<20	T	T	0	1	T	0	4				
1	6	K	0	6	1	<20	T	T	0	1	T	0	4				
1	7	K	0	6	2	<20	T	T	0	1	T	0	4				
1	8	K	0	6	9	<20	T	T	0	1	T	0	4				
1	9	K	0	7	1	<20	T	T	0	1	T	0	4				
2	0	K	0	7	3	<20	T	T	0	1	T	0	4				
2	1	K	0	8	3	<20	T	T	0	1	T	0	4				
2	2	K	0	8	4	<20	T	T	0	1	T	0	4				
2	3	K	0	8	5	<20	T	T	0	1	T	0	4				
2	4	K	0	8	6	36,000	T	T	0	1	T	0	4				
2	5	K	0	8	7	<20	T	T	0	1	T	0	4				
2	6	K	0	8	8	<20	T	T	0	1	T	0	4				
2	7	K	0	9	3	<20	T	T	0	1	T	0	4				
2	8	K	0	9	4	<20	T	T	0	1	T	0	4				
2	9	K	0	9	5	<20	T	T	0	1	T	0	4				
3	0	K	0	9	6	<20	T	T	0	1	T	0	4				
3	1	K	0	9	7	<20	T	T	0	1	T	0	4				
3	2	K	0	9	8	<20	T	T	0	1	T	0	4				
3	3	K	0	9	9	<20	T	T	0	1	T	0	4				
3	4	K	1	0	0	<20	T	T	0	1	T	0	4				
3	5	K	1	0	1	<20	T	T	0	1	T	0	4				
3	6	K	1	0	2	<20	T	T	0	1	T	0	4				
3	7	K	1	0	3	<20	T	T	0	1	T	0	4				
3	8	K	1	0	4	<20	T	T	0	1	T	0	4				
3	9	K	1	0	5	<20	T	T	0	1	T	0	4				
4	0	K	1	0	6	<20	T	T	0	1	T	0	4				
4	1	K	1	0	7	<20	T	T	0	1	T	0	4				
4	2	K	1	0	8	<20	T	T	0	1	T	0	4				
4	3	K	1	0	9	<20	T	T	0	1	T	0	4				
4	4	K	1	1	0	<20	T	T	0	1	T	0	4				

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Number		A. EPA Hazardous Waste No. (Enter code)					B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
									(1) PROCESS CODES (Enter Code)						(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)			
4	5	K	1	1	1	<20	T		S	0	1	S	0	2				
4	6	K	1	1	2	<20	T		S	0	1	S	0	2				
4	7	K	1	1	3	<20	T		S	0	1	S	0	2				
4	8	K	1	1	4	<20	T		S	0	1	S	0	2				
4	9	K	1	1	5	<20	T		S	0	1	S	0	2				
5	0	K	1	1	6	<20	T		S	0	1	S	0	2				
5	1	K	1	1	7	<20	T		S	0	1	S	0	2				
5	2	K	1	1	8	<20	T		S	0	1	S	0	2				
5	3	K	1	2	3	<20	T		S	0	1	S	0	2				
5	4	K	1	2	4	<20	T		S	0	1	S	0	2				
5	5	K	1	2	5	<20	T		S	0	1	S	0	2				
5	6	K	1	2	6	<20	T		S	0	1	S	0	2				
5	7	K	1	3	1	<20	T		S	0	1	S	0	2				
5	8	K	1	3	2	<20	T		S	0	1	S	0	2				
5	9	K	1	3	6	<20	T		S	0	1	S	0	2				
6	0	K	1	4	1	<20	T		S	0	1	S	0	2				
6	1	K	1	4	2	<20	T		S	0	1	S	0	2				
6	2	K	1	4	3	<20	T		S	0	1	S	0	2				
6	3	K	1	4	4	<20	T		S	0	1	S	0	2				
6	4	K	1	4	5	<20	T		S	0	1	S	0	2				
6	5	K	1	4	7	<20	T		S	0	1	S	0	2				
6	6	K	1	4	8	<20	T		S	0	1	S	0	2				
6	7	K	1	4	9	<20	T		S	0	1	S	0	2				
6	8	K	1	5	0	<20	T		S	0	1	S	0	2				
6	9	K	1	5	1	<20	T		S	0	1	S	0	2				
7	0	K	1	5	6	<20	T		S	0	1	S	0	2				
7	1	K	1	5	7	<20	T		S	0	1	S	0	2				
7	2	K	1	5	8	<20	T		S	0	1	S	0	2				
7	3	K	1	5	9	<20	T		S	0	1	S	0	2				
7	4	K	1	6	1	<20	T		S	0	1	S	0	2				
7	5	K	1	6	9	20,000	T		S	0	1	S	0	2				
7	6	K	1	7	0	20,000	T		S	0	1	S	0	2				
7	7	K	1	7	1	<20	T		S	0	1	S	0	2				
7	8	K	1	7	2	<20	T		S	0	1	S	0	2				
7	9	K	1	7	4	<20	T		S	0	1	S	0	2				
7	0	K	1	7	5	<20	T		S	0	1	S	0	2				

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Number		A. EPA Hazardous Waste No. (Enter code)	B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
					(1) PROCESS CODES (Enter Code)						(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)			
4	5	K 1 1 1	<20	T	T	0	1	T	0	4				
4	6	K 1 1 2	<20	T	T	0	1	T	0	4				
4	7	K 1 1 3	<20	T	T	0	1	T	0	4				
4	8	K 1 1 4	<20	T	T	0	1	T	0	4				
4	9	K 1 1 5	<20	T	T	0	1	T	0	4				
5	0	K 1 1 6	<20	T	T	0	1	T	0	4				
5	1	K 1 1 7	<20	T	T	0	1	T	0	4				
5	2	K 1 1 8	<20	T	T	0	1	T	0	4				
5	3	K 1 2 3	<20	T	T	0	1	T	0	4				
5	4	K 1 2 4	<20	T	T	0	1	T	0	4				
5	5	K 1 2 5	<20	T	T	0	1	T	0	4				
5	6	K 1 2 6	<20	T	T	0	1	T	0	4				
5	7	K 1 3 1	<20	T	T	0	1	T	0	4				
5	8	K 1 3 2	<20	T	T	0	1	T	0	4				
5	9	K 1 3 6	<20	T	T	0	1	T	0	4				
6	0	K 1 4 1	<20	T	T	0	1	T	0	4				
6	1	K 1 4 2	<20	T	T	0	1	T	0	4				
6	2	K 1 4 3	<20	T	T	0	1	T	0	4				
6	3	K 1 4 4	<20	T	T	0	1	T	0	4				
6	4	K 1 4 5	<20	T	T	0	1	T	0	4				
6	5	K 1 4 7	<20	T	T	0	1	T	0	4				
6	6	K 1 4 8	<20	T	T	0	1	T	0	4				
6	7	K 1 4 9	<20	T	T	0	1	T	0	4				
6	8	K 1 5 0	<20	T	T	0	1	T	0	4				
6	9	K 1 5 1	<20	T	T	0	1	T	0	4				
7	0	K 1 5 6	<20	T	T	0	1	T	0	4				
7	1	K 1 5 7	<20	T	T	0	1	T	0	4				
7	2	K 1 5 8	<20	T	T	0	1	T	0	4				
7	3	K 1 5 9	<20	T	T	0	1	T	0	4				
7	4	K 1 6 1	<20	T	T	0	1	T	0	4				
7	5	K 1 6 9	20,000	T	T	0	1	T	0	4				
7	6	K 1 7 0	20,000	T	T	0	1	T	0	4				
7	7	K 1 7 1	<20	T	T	0	1	T	0	4				
7	8	K 1 7 2	<20	T	T	0	1	T	0	4				
7	9	K 1 7 4	<20	T	T	0	1	T	0	4				
7	0	K 1 7 5	<20	T	T	0	1	T	0	4				

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Number	A. EPA Hazardous Waste No. (Enter code)					B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)						(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)			
8	1	K	1	7	6	<20	T	S	0	1	S	0	2				
8	2	K	1	7	7	<20	T	S	0	1	S	0	2				
8	3	K	1	7	8	<20	T	S	0	1	S	0	2				
8	4	K	1	8	1	<20	T	S	0	1	S	0	2				
8	5	U	0	0	1	<20	T	S	0	1	S	0	2				
8	6	U	0	0	2	<20	T	S	0	1	S	0	2				
8	7	U	0	0	3	<20	T	S	0	1	S	0	2				
8	8	U	0	0	4	<20	T	S	0	1	S	0	2				
8	9	U	0	0	5	<20	T	S	0	1	S	0	2				
9	0	U	0	0	6	<20	T	S	0	1	S	0	2				
9	1	U	0	0	7	<20	T	S	0	1	S	0	2				
9	2	U	0	0	8	<20	T	S	0	1	S	0	2				
9	3	U	0	0	9	<20	T	S	0	1	S	0	2				
9	4	U	0	1	0	<20	T	S	0	1	S	0	2				
9	5	U	0	1	1	<20	T	S	0	1	S	0	2				
9	6	U	0	1	2	<20	T	S	0	1	S	0	2				
9	7	U	0	1	4	<20	T	S	0	1	S	0	2				
9	8	U	0	1	5	<20	T	S	0	1	S	0	2				
9	9	U	0	1	6	<20	T	S	0	1	S	0	2				
0	0	U	0	1	7	<20	T	S	0	1	S	0	2				
0	1	U	0	1	8	<20	T	S	0	1	S	0	2				
0	2	U	0	1	9	<20	T	S	0	1	S	0	2				
0	3	U	0	2	0	<20	T	S	0	1	S	0	2				
0	4	U	0	2	1	<20	T	S	0	1	S	0	2				
0	5	U	0	2	2	<20	T	S	0	1	S	0	2				
0	6	U	0	2	3	<20	T	S	0	1	S	0	2				
0	7	U	0	2	4	<20	T	S	0	1	S	0	2				
0	8	U	0	2	5	<20	T	S	0	1	S	0	2				
0	9	U	0	2	6	<20	T	S	0	1	S	0	2				
1	0	U	0	2	7	<20	T	S	0	1	S	0	2				
1	1	U	0	2	8	<20	T	S	0	1	S	0	2				
1	2	U	0	2	9	<20	T	S	0	1	S	0	2				
1	3	U	0	3	0	<20	T	S	0	1	S	0	2				
1	4	U	0	3	1	<20	T	S	0	1	S	0	2				
1	5	U	0	3	2	<20	T	S	0	1	S	0	2				
1	6	U	0	3	3	<20	T	S	0	1	S	0	2				

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Number		A. EPA Hazardous Waste No. (Enter code)					B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
									(1) PROCESS CODES (Enter Code)						(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)			
8	1	K	1	7	6		<20	T	T	0	1	T	0	4				
8	2	K	1	7	7		<20	T	T	0	1	T	0	4				
8	3	K	1	7	8		<20	T	T	0	1	T	0	4				
8	4	K	1	8	1		<20	T	T	0	1	T	0	4				
8	5	U	0	0	1		<20	T	T	0	1	T	0	4				
8	6	U	0	0	2		<20	T	T	0	1	T	0	4				
8	7	U	0	0	3		<20	T	T	0	1	T	0	4				
8	8	U	0	0	4		<20	T	T	0	1	T	0	4				
8	9	U	0	0	5		<20	T	T	0	1	T	0	4				
9	0	U	0	0	6		<20	T	T	0	1	T	0	4				
9	1	U	0	0	7		<20	T	T	0	1	T	0	4				
9	2	U	0	0	8		<20	T	T	0	1	T	0	4				
9	3	U	0	0	9		<20	T	T	0	1	T	0	4				
9	4	U	0	1	0		<20	T	T	0	1	T	0	4				
9	5	U	0	1	1		<20	T	T	0	1	T	0	4				
9	6	U	0	1	2		<20	T	T	0	1	T	0	4				
9	7	U	0	1	4		<20	T	T	0	1	T	0	4				
9	8	U	0	1	5		<20	T	T	0	1	T	0	4				
9	9	U	0	1	6		<20	T	T	0	1	T	0	4				
0	0	U	0	1	7		<20	T	T	0	1	T	0	4				
0	1	U	0	1	8		<20	T	T	0	1	T	0	4				
0	2	U	0	1	9		<20	T	T	0	1	T	0	4				
0	3	U	0	2	0		<20	T	T	0	1	T	0	4				
0	4	U	0	2	1		<20	T	T	0	1	T	0	4				
0	5	U	0	2	2		<20	T	T	0	1	T	0	4				
0	6	U	0	2	3		<20	T	T	0	1	T	0	4				
0	7	U	0	2	4		<20	T	T	0	1	T	0	4				
0	8	U	0	2	5		<20	T	T	0	1	T	0	4				
0	9	U	0	2	6		<20	T	T	0	1	T	0	4				
1	0	U	0	2	7		<20	T	T	0	1	T	0	4				
1	1	U	0	2	8		<20	T	T	0	1	T	0	4				
1	2	U	0	2	9		<20	T	T	0	1	T	0	4				
1	3	U	0	3	0		<20	T	T	0	1	T	0	4				
1	4	U	0	3	1		<20	T	T	0	1	T	0	4				
1	5	U	0	3	2		<20	T	T	0	1	T	0	4				
1	6	U	0	3	3		<20	T	T	0	1	T	0	4				

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Number	A. EPA Hazardous Waste No. (Enter code)					B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)						(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)			
1	7	U	0	3	4	<20	T	S	0	1	S	0	2				
1	8	U	0	3	5	<20	T	S	0	1	S	0	2				
1	9	U	0	3	6	<20	T	S	0	1	S	0	2				
2	0	U	0	3	7	<20	T	S	0	1	S	0	2				
2	1	U	0	3	8	<20	T	S	0	1	S	0	2				
2	2	U	0	3	9	<20	T	S	0	1	S	0	2				
2	3	U	0	4	1	<20	T	S	0	1	S	0	2				
2	4	U	0	4	2	<20	T	S	0	1	S	0	2				
2	5	U	0	4	3	<20	T	S	0	1	S	0	2				
2	6	U	0	4	4	<20	T	S	0	1	S	0	2				
2	7	U	0	4	5	<20	T	S	0	1	S	0	2				
2	8	U	0	4	6	<20	T	S	0	1	S	0	2				
2	9	U	0	4	7	<20	T	S	0	1	S	0	2				
3	0	U	0	4	8	<20	T	S	0	1	S	0	2				
3	1	U	0	4	9	<20	T	S	0	1	S	0	2				
3	2	U	0	5	0	<20	T	S	0	1	S	0	2				
3	3	U	0	5	1	<20	T	S	0	1	S	0	2				
3	4	U	0	5	2	<20	T	S	0	1	S	0	2				
3	5	U	0	5	3	<20	T	S	0	1	S	0	2				
3	6	U	0	5	5	<20	T	S	0	1	S	0	2				
3	7	U	0	5	6	<20	T	S	0	1	S	0	2				
3	8	U	0	5	7	<20	T	S	0	1	S	0	2				
3	9	U	0	5	8	<20	T	S	0	1	S	0	2				
4	0	U	0	5	9	<20	T	S	0	1	S	0	2				
4	1	U	0	6	0	<20	T	S	0	1	S	0	2				
4	2	U	0	6	1	<20	T	S	0	1	S	0	2				
4	3	U	0	6	2	<20	T	S	0	1	S	0	2				
4	4	U	0	6	3	<20	T	S	0	1	S	0	2				
4	5	U	0	6	4	<20	T	S	0	1	S	0	2				
4	6	U	0	6	6	<20	T	S	0	1	S	0	2				
4	7	U	0	6	7	<20	T	S	0	1	S	0	2				
4	8	U	0	6	8	<20	T	S	0	1	S	0	2				
4	9	U	0	6	9	<20	T	S	0	1	S	0	2				
5	0	U	0	7	0	<20	T	S	0	1	S	0	2				
5	1	U	0	7	1	<20	T	S	0	1	S	0	2				
5	2	U	0	7	2	<20	T	S	0	1	S	0	2				

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES										(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)
								(1) PROCESS CODES (Enter Code)										
1	7	U	0	3	4	<20	T	T	0	1	T	0	4					
1	8	U	0	3	5	<20	T	T	0	1	T	0	4					
1	9	U	0	3	6	<20	T	T	0	1	T	0	4					
2	0	U	0	3	7	<20	T	T	0	1	T	0	4					
2	1	U	0	3	8	<20	T	T	0	1	T	0	4					
2	2	U	0	3	9	<20	T	T	0	1	T	0	4					
2	3	U	0	4	1	<20	T	T	0	1	T	0	4					
2	4	U	0	4	2	<20	T	T	0	1	T	0	4					
2	5	U	0	4	3	<20	T	T	0	1	T	0	4					
2	6	U	0	4	4	<20	T	T	0	1	T	0	4					
2	7	U	0	4	5	<20	T	T	0	1	T	0	4					
2	8	U	0	4	6	<20	T	T	0	1	T	0	4					
2	9	U	0	4	7	<20	T	T	0	1	T	0	4					
3	0	U	0	4	8	<20	T	T	0	1	T	0	4					
3	1	U	0	4	9	<20	T	T	0	1	T	0	4					
3	2	U	0	5	0	<20	T	T	0	1	T	0	4					
3	3	U	0	5	1	<20	T	T	0	1	T	0	4					
3	4	U	0	5	2	<20	T	T	0	1	T	0	4					
3	5	U	0	5	3	<20	T	T	0	1	T	0	4					
3	6	U	0	5	5	<20	T	T	0	1	T	0	4					
3	7	U	0	5	6	<20	T	T	0	1	T	0	4					
3	8	U	0	5	7	<20	T	T	0	1	T	0	4					
3	9	U	0	5	8	<20	T	T	0	1	T	0	4					
4	0	U	0	5	9	<20	T	T	0	1	T	0	4					
4	1	U	0	6	0	<20	T	T	0	1	T	0	4					
4	2	U	0	6	1	<20	T	T	0	1	T	0	4					
4	3	U	0	6	2	<20	T	T	0	1	T	0	4					
4	4	U	0	6	3	<20	T	T	0	1	T	0	4					
4	5	U	0	6	4	<20	T	T	0	1	T	0	4					
4	6	U	0	6	6	<20	T	T	0	1	T	0	4					
4	7	U	0	6	7	<20	T	T	0	1	T	0	4					
4	8	U	0	6	8	<20	T	T	0	1	T	0	4					
4	9	U	0	6	9	<20	T	T	0	1	T	0	4					
5	0	U	0	7	0	<20	T	T	0	1	T	0	4					
5	1	U	0	7	1	<20	T	T	0	1	T	0	4					
5	2	U	0	7	2	<20	T	T	0	1	T	0	4					

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Number	A. EPA Hazardous Waste No. (Enter code)					B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)						(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)			
1	5	3	U	0	7	3	<20	T	S	0	1	S	0	2			
2	5	4	U	0	7	4	<20	T	S	0	1	S	0	2			
3	5	5	U	0	7	5	<20	T	S	0	1	S	0	2			
4	5	6	U	0	7	6	<20	T	S	0	1	S	0	2			
5	5	7	U	0	7	7	<20	T	S	0	1	S	0	2			
6	5	8	U	0	7	8	<20	T	S	0	1	S	0	2			
7	5	9	U	0	7	9	<20	T	S	0	1	S	0	2			
8	6	0	U	0	8	0	<20	T	S	0	1	S	0	2			
9	6	1	U	0	8	1	<20	T	S	0	1	S	0	2			
10	6	2	U	0	8	2	<20	T	S	0	1	S	0	2			
11	6	3	U	0	8	3	<20	T	S	0	1	S	0	2			
12	6	4	U	0	8	4	<20	T	S	0	1	S	0	2			
13	6	5	U	0	8	5	<20	T	S	0	1	S	0	2			
14	6	6	U	0	8	6	<20	T	S	0	1	S	0	2			
15	6	7	U	0	8	7	<20	T	S	0	1	S	0	2			
16	6	8	U	0	8	8	<20	T	S	0	1	S	0	2			
17	6	9	U	0	8	9	<20	T	S	0	1	S	0	2			
18	6	0	U	0	9	0	<20	T	S	0	1	S	0	2			
19	7	1	U	0	9	1	<20	T	S	0	1	S	0	2			
20	7	2	U	0	9	2	<20	T	S	0	1	S	0	2			
21	7	3	U	0	9	3	<20	T	S	0	1	S	0	2			
22	7	4	U	0	9	4	<20	T	S	0	1	S	0	2			
23	7	5	U	0	9	5	<20	T	S	0	1	S	0	2			
24	7	6	U	0	9	6	<20	T	S	0	1	S	0	2			
25	7	7	U	0	9	7	<20	T	S	0	1	S	0	2			
26	7	8	U	0	9	8	<20	T	S	0	1	S	0	2			
27	7	9	U	0	9	9	<20	T	S	0	1	S	0	2			
28	8	0	U	1	0	1	<20	T	S	0	1	S	0	2			
29	8	1	U	1	0	2	<20	T	S	0	1	S	0	2			
30	8	2	U	1	0	3	<20	T	S	0	1	S	0	2			
31	8	3	U	1	0	5	<20	T	S	0	1	S	0	2			
32	8	4	U	1	0	6	<20	T	S	0	1	S	0	2			
33	8	5	U	1	0	7	<20	T	S	0	1	S	0	2			
34	8	6	U	1	0	8	<20	T	S	0	1	S	0	2			
35	8	7	U	1	0	9	<20	T	S	0	1	S	0	2			
36	8	8	U	1	1	0	<20	T	S	0	1	S	0	2			

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Number	A. EPA Hazardous Waste No. (Enter code)					B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)						(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)			
2	5	3	U	0	7	3	<20	T	T	0	1	T	0	4			
2	5	4	U	0	7	4	<20	T	T	0	1	T	0	4			
2	5	5	U	0	7	5	<20	T	T	0	1	T	0	4			
2	5	6	U	0	7	6	<20	T	T	0	1	T	0	4			
2	5	7	U	0	7	7	<20	T	T	0	1	T	0	4			
2	5	8	U	0	7	8	<20	T	T	0	1	T	0	4			
2	5	9	U	0	7	9	<20	T	T	0	1	T	0	4			
2	6	0	U	0	8	0	<20	T	T	0	1	T	0	4			
2	6	1	U	0	8	1	<20	T	T	0	1	T	0	4			
2	6	2	U	0	8	2	<20	T	T	0	1	T	0	4			
2	6	3	U	0	8	3	<20	T	T	0	1	T	0	4			
2	6	4	U	0	8	4	<20	T	T	0	1	T	0	4			
2	6	5	U	0	8	5	<20	T	T	0	1	T	0	4			
2	6	6	U	0	8	6	<20	T	T	0	1	T	0	4			
2	6	7	U	0	8	7	<20	T	T	0	1	T	0	4			
2	6	8	U	0	8	8	<20	T	T	0	1	T	0	4			
2	6	9	U	0	8	9	<20	T	T	0	1	T	0	4			
2	7	0	U	0	9	0	<20	T	T	0	1	T	0	4			
2	7	1	U	0	9	1	<20	T	T	0	1	T	0	4			
2	7	2	U	0	9	2	<20	T	T	0	1	T	0	4			
2	7	3	U	0	9	3	<20	T	T	0	1	T	0	4			
2	7	4	U	0	9	4	<20	T	T	0	1	T	0	4			
2	7	5	U	0	9	5	<20	T	T	0	1	T	0	4			
2	7	6	U	0	9	6	<20	T	T	0	1	T	0	4			
2	7	7	U	0	9	7	<20	T	T	0	1	T	0	4			
2	7	8	U	0	9	8	<20	T	T	0	1	T	0	4			
2	7	9	U	0	9	9	<20	T	T	0	1	T	0	4			
2	8	0	U	1	0	1	<20	T	T	0	1	T	0	4			
2	8	1	U	1	0	2	<20	T	T	0	1	T	0	4			
2	8	2	U	1	0	3	<20	T	T	0	1	T	0	4			
2	8	3	U	1	0	5	<20	T	T	0	1	T	0	4			
2	8	4	U	1	0	6	<20	T	T	0	1	T	0	4			
2	8	5	U	1	0	7	<20	T	T	0	1	T	0	4			
2	8	6	U	1	0	8	<20	T	T	0	1	T	0	4			
2	8	7	U	1	0	9	<20	T	T	0	1	T	0	4			
2	8	8	U	1	1	0	<20	T	T	0	1	T	0	4			

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Number	A. EPA Hazardous Waste No. (Enter code)					B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)						(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)			
1	8	9	U	1	1	1	<20	T	S	0	1	S	0	2			
2	9	0	U	1	1	2	<20	T	S	0	1	S	0	2			
2	9	1	U	1	1	3	<20	T	S	0	1	S	0	2			
2	9	2	U	1	1	4	<20	T	S	0	1	S	0	2			
2	9	3	U	1	1	5	<20	T	S	0	1	S	0	2			
2	9	4	U	1	1	6	<20	T	S	0	1	S	0	2			
2	9	5	U	1	1	7	<20	T	S	0	1	S	0	2			
2	9	6	U	1	1	8	<20	T	S	0	1	S	0	2			
2	9	7	U	1	1	9	<20	T	S	0	1	S	0	2			
2	9	8	U	1	2	0	<20	T	S	0	1	S	0	2			
2	9	9	U	1	2	1	<20	T	S	0	1	S	0	2			
3	0	0	U	1	2	2	<20	T	S	0	1	S	0	2			
3	0	1	U	1	2	3	<20	T	S	0	1	S	0	2			
3	0	2	U	1	2	4	<20	T	S	0	1	S	0	2			
3	0	3	U	1	2	5	<20	T	S	0	1	S	0	2			
3	0	4	U	1	2	6	<20	T	S	0	1	S	0	2			
3	0	5	U	1	2	7	<20	T	S	0	1	S	0	2			
3	0	6	U	1	2	8	<20	T	S	0	1	S	0	2			
3	0	7	U	1	2	9	<20	T	S	0	1	S	0	2			
3	0	8	U	1	3	0	<20	T	S	0	1	S	0	2			
3	0	9	U	1	3	1	<20	T	S	0	1	S	0	2			
3	1	0	U	1	3	2	<20	T	S	0	1	S	0	2			
3	1	1	U	1	3	3	<20	T	S	0	1	S	0	2			
3	1	2	U	1	3	4	<20	T	S	0	1	S	0	2			
3	1	3	U	1	3	5	<20	T	S	0	1	S	0	2			
3	1	4	U	1	3	6	<20	T	S	0	1	S	0	2			
3	1	5	U	1	3	7	<20	T	S	0	1	S	0	2			
3	1	6	U	1	3	8	<20	T	S	0	1	S	0	2			
3	1	7	U	1	4	0	<20	T	S	0	1	S	0	2			
3	1	8	U	1	4	1	<20	T	S	0	1	S	0	2			
3	1	9	U	1	4	2	<20	T	S	0	1	S	0	2			
3	2	0	U	1	4	3	<20	T	S	0	1	S	0	2			
3	2	1	U	1	4	4	<20	T	S	0	1	S	0	2			
3	2	2	U	1	4	5	<20	T	S	0	1	S	0	2			
3	2	3	U	1	4	6	<20	T	S	0	1	S	0	2			
3	2	4	U	1	4	7	<20	T	S	0	1	S	0	2			

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Number	A. EPA Hazardous Waste No. (Enter code)						B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
									(1) PROCESS CODES (Enter Code)						(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)			
2	8	9	U	1	1	1	<20	T	T	0	1	T	0	4				
2	9	0	U	1	1	2	<20	T	T	0	1	T	0	4				
2	9	1	U	1	1	3	<20	T	T	0	1	T	0	4				
2	9	2	U	1	1	4	<20	T	T	0	1	T	0	4				
2	9	3	U	1	1	5	<20	T	T	0	1	T	0	4				
2	9	4	U	1	1	6	<20	T	T	0	1	T	0	4				
2	9	5	U	1	1	7	<20	T	T	0	1	T	0	4				
2	9	6	U	1	1	8	<20	T	T	0	1	T	0	4				
2	9	7	U	1	1	9	<20	T	T	0	1	T	0	4				
2	9	8	U	1	2	0	<20	T	T	0	1	T	0	4				
2	9	9	U	1	2	1	<20	T	T	0	1	T	0	4				
3	0	0	U	1	2	2	<20	T	T	0	1	T	0	4				
3	0	1	U	1	2	3	<20	T	T	0	1	T	0	4				
3	0	2	U	1	2	4	<20	T	T	0	1	T	0	4				
3	0	3	U	1	2	5	<20	T	T	0	1	T	0	4				
3	0	4	U	1	2	6	<20	T	T	0	1	T	0	4				
3	0	5	U	1	2	7	<20	T	T	0	1	T	0	4				
3	0	6	U	1	2	8	<20	T	T	0	1	T	0	4				
3	0	7	U	1	2	9	<20	T	T	0	1	T	0	4				
3	0	8	U	1	3	0	<20	T	T	0	1	T	0	4				
3	0	9	U	1	3	1	<20	T	T	0	1	T	0	4				
3	1	0	U	1	3	2	<20	T	T	0	1	T	0	4				
3	1	1	U	1	3	3	<20	T	T	0	1	T	0	4				
3	1	2	U	1	3	4	<20	T	T	0	1	T	0	4				
3	1	3	U	1	3	5	<20	T	T	0	1	T	0	4				
3	1	4	U	1	3	6	<20	T	T	0	1	T	0	4				
3	1	5	U	1	3	7	<20	T	T	0	1	T	0	4				
3	1	6	U	1	3	8	<20	T	T	0	1	T	0	4				
3	1	7	U	1	4	0	<20	T	T	0	1	T	0	4				
3	1	8	U	1	4	1	<20	T	T	0	1	T	0	4				
3	1	9	U	1	4	2	<20	T	T	0	1	T	0	4				
3	2	0	U	1	4	3	<20	T	T	0	1	T	0	4				
3	2	1	U	1	4	4	<20	T	T	0	1	T	0	4				
3	2	2	U	1	4	5	<20	T	T	0	1	T	0	4				
3	2	3	U	1	4	6	<20	T	T	0	1	T	0	4				
3	2	4	U	1	4	7	<20	T	T	0	1	T	0	4				

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Line Number	A. EPA Hazardous Waste No. (Enter code)						B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES										(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)
									(1) PROCESS CODES (Enter Code)										
3 2	5	U	1	4	8		<20	T	T	0	1	T	0	4					
3 2	6	U	1	4	9		<20	T	T	0	1	T	0	4					
3 2	7	U	1	5	0		<20	T	T	0	1	T	0	4					
3 2	8	U	1	5	1		<20	T	T	0	1	T	0	4					
3 2	9	U	1	5	2		<20	T	T	0	1	T	0	4					
3 3	0	U	1	5	3		<20	T	T	0	1	T	0	4					
3 3	1	U	1	5	4		<20	T	T	0	1	T	0	4					
3 3	2	U	1	5	5		<20	T	T	0	1	T	0	4					
3 3	3	U	1	5	6		<20	T	T	0	1	T	0	4					
3 3	4	U	1	5	7		<20	T	T	0	1	T	0	4					
3 3	5	U	1	5	8		<20	T	T	0	1	T	0	4					
3 3	6	U	1	5	9		<20	T	T	0	1	T	0	4					
3 3	7	U	1	6	0		<20	T	T	0	1	T	0	4					
3 3	8	U	1	6	1		<20	T	T	0	1	T	0	4					
3 3	9	U	1	6	2		<20	T	T	0	1	T	0	4					
3 4	0	U	1	6	3		<20	T	T	0	1	T	0	4					
3 4	1	U	1	6	4		<20	T	T	0	1	T	0	4					
3 4	2	U	1	6	5		<20	T	T	0	1	T	0	4					
3 4	3	U	1	6	6		<20	T	T	0	1	T	0	4					
3 4	4	U	1	6	7		<20	T	T	0	1	T	0	4					
3 4	5	U	1	6	8		<20	T	T	0	1	T	0	4					
3 4	6	U	1	6	9		<20	T	T	0	1	T	0	4					
3 4	7	U	1	7	0		<20	T	T	0	1	T	0	4					
3 4	8	U	1	7	1		<20	T	T	0	1	T	0	4					
3 4	9	U	1	7	2		<20	T	T	0	1	T	0	4					
3 5	0	U	1	7	3		<20	T	T	0	1	T	0	4					
3 5	1	U	1	7	4		<20	T	T	0	1	T	0	4					
3 5	2	U	1	7	6		<20	T	T	0	1	T	0	4					
3 5	3	U	1	7	7		<20	T	T	0	1	T	0	4					
3 5	4	U	1	7	8		<20	T	T	0	1	T	0	4					
3 5	5	U	1	7	9		<20	T	T	0	1	T	0	4					
3 5	6	U	1	8	0		<20	T	T	0	1	T	0	4					
3 5	7	U	1	8	1		<20	T	T	0	1	T	0	4					
3 5	8	U	1	8	2		<20	T	T	0	1	T	0	4					
3 5	9	U	1	8	3		<20	T	T	0	1	T	0	4					
3 6	0	U	1	8	4		<20	T	T	0	1	T	0	4					

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES										(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)
								(1) PROCESS CODES (Enter Code)										
2	5	U	1	4	8	<20	T	S	0	1	S	0	2					
2	6	U	1	4	9	<20	T	S	0	1	S	0	2					
2	7	U	1	5	0	<20	T	S	0	1	S	0	2					
2	8	U	1	5	1	<20	T	S	0	1	S	0	2					
2	9	U	1	5	2	<20	T	S	0	1	S	0	2					
3	0	U	1	5	3	<20	T	S	0	1	S	0	2					
3	1	U	1	5	4	<20	T	S	0	1	S	0	2					
3	2	U	1	5	5	<20	T	S	0	1	S	0	2					
3	3	U	1	5	6	<20	T	S	0	1	S	0	2					
3	4	U	1	5	7	<20	T	S	0	1	S	0	2					
3	5	U	1	5	8	<20	T	S	0	1	S	0	2					
3	6	U	1	5	9	<20	T	S	0	1	S	0	2					
3	7	U	1	6	0	<20	T	S	0	1	S	0	2					
3	8	U	1	6	1	<20	T	S	0	1	S	0	2					
3	9	U	1	6	2	<20	T	S	0	1	S	0	2					
4	0	U	1	6	3	<20	T	S	0	1	S	0	2					
4	1	U	1	6	4	<20	T	S	0	1	S	0	2					
4	2	U	1	6	5	<20	T	S	0	1	S	0	2					
4	3	U	1	6	6	<20	T	S	0	1	S	0	2					
4	4	U	1	6	7	<20	T	S	0	1	S	0	2					
4	5	U	1	6	8	<20	T	S	0	1	S	0	2					
4	6	U	1	6	9	<20	T	S	0	1	S	0	2					
4	7	U	1	7	0	<20	T	S	0	1	S	0	2					
4	8	U	1	7	1	<20	T	S	0	1	S	0	2					
4	9	U	1	7	2	<20	T	S	0	1	S	0	2					
5	0	U	1	7	3	<20	T	S	0	1	S	0	2					
5	1	U	1	7	4	<20	T	S	0	1	S	0	2					
5	2	U	1	7	6	<20	T	S	0	1	S	0	2					
5	3	U	1	7	7	<20	T	S	0	1	S	0	2					
5	4	U	1	7	8	<20	T	S	0	1	S	0	2					
5	5	U	1	7	9	<20	T	S	0	1	S	0	2					
5	6	U	1	8	0	<20	T	S	0	1	S	0	2					
5	7	U	1	8	1	<20	T	S	0	1	S	0	2					
5	8	U	1	8	2	<20	T	S	0	1	S	0	2					
5	9	U	1	8	3	<20	T	S	0	1	S	0	2					
6	0	U	1	8	4	<20	T	S	0	1	S	0	2					

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Line Number	A. EPA Hazardous Waste No. (Enter code)					B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES										(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)
								(1) PROCESS CODES (Enter Code)										
3 6 1	U	1	8	5	<20	T	S	0	1	S	0	2						
3 6 2	U	1	8	6	<20	T	S	0	1	S	0	2						
3 6 3	U	1	8	7	<20	T	S	0	1	S	0	2						
3 6 4	U	1	8	8	<20	T	S	0	1	S	0	2						
3 6 5	U	1	8	9	<20	T	S	0	1	S	0	2						
3 6 6	U	1	9	0	<20	T	S	0	1	S	0	2						
3 6 7	U	1	9	1	<20	T	S	0	1	S	0	2						
3 6 8	U	1	9	2	<20	T	S	0	1	S	0	2						
3 6 9	U	1	9	3	<20	T	S	0	1	S	0	2						
3 7 0	U	1	9	4	<20	T	S	0	1	S	0	2						
3 7 1	U	1	9	6	<20	T	S	0	1	S	0	2						
3 7 2	U	1	9	7	<20	T	S	0	1	S	0	2						
3 7 3	U	2	0	0	<20	T	S	0	1	S	0	2						
3 7 4	U	2	0	1	<20	T	S	0	1	S	0	2						
3 7 5	U	2	0	2	<20	T	S	0	1	S	0	2						
3 7 6	U	2	0	3	<20	T	S	0	1	S	0	2						
3 7 7	U	2	0	4	<20	T	S	0	1	S	0	2						
3 7 8	U	2	0	5	<20	T	S	0	1	S	0	2						
3 7 9	U	2	0	6	<20	T	S	0	1	S	0	2						
3 8 0	U	2	0	7	<20	T	S	0	1	S	0	2						
3 8 1	U	2	0	8	<20	T	S	0	1	S	0	2						
3 8 2	U	2	0	9	<20	T	S	0	1	S	0	2						
3 8 3	U	2	1	0	<20	T	S	0	1	S	0	2						
3 8 4	U	2	1	1	<20	T	S	0	1	S	0	2						
3 8 5	U	2	1	3	<20	T	S	0	1	S	0	2						
3 8 6	U	2	1	4	<20	T	S	0	1	S	0	2						
3 8 7	U	2	1	5	<20	T	S	0	1	S	0	2						
3 8 8	U	2	1	6	<20	T	S	0	1	S	0	2						
3 8 9	U	2	1	7	<20	T	S	0	1	S	0	2						
3 9 0	U	2	1	8	<20	T	S	0	1	S	0	2						
3 9 1	U	2	1	9	<20	T	S	0	1	S	0	2						
3 9 2	U	2	2	0	<20	T	S	0	1	S	0	2						
3 9 3	U	2	2	1	<20	T	S	0	1	S	0	2						
3 9 4	U	2	2	2	<20	T	S	0	1	S	0	2						
3 9 5	U	2	2	3	<20	T	S	0	1	S	0	2						
3 9 6	U	2	2	5	<20	T	S	0	1	S	0	2						

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Line Number	A. EPA Hazardous Waste No. (Enter code)					B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES										(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)
								(1) PROCESS CODES (Enter Code)										
3 6 1	U	1	8	5	<20	T	T	0	1	T	0	4						
3 6 2	U	1	8	6	<20	T	T	0	1	T	0	4						
3 6 3	U	1	8	7	<20	T	T	0	1	T	0	4						
3 6 4	U	1	8	8	<20	T	T	0	1	T	0	4						
3 6 5	U	1	8	9	<20	T	T	0	1	T	0	4						
3 6 6	U	1	9	0	<20	T	T	0	1	T	0	4						
3 6 7	U	1	9	1	<20	T	T	0	1	T	0	4						
3 6 8	U	1	9	2	<20	T	T	0	1	T	0	4						
3 6 9	U	1	9	3	<20	T	T	0	1	T	0	4						
3 7 0	U	1	9	4	<20	T	T	0	1	T	0	4						
3 7 1	U	1	9	6	<20	T	T	0	1	T	0	4						
3 7 2	U	1	9	7	<20	T	T	0	1	T	0	4						
3 7 3	U	2	0	0	<20	T	T	0	1	T	0	4						
3 7 4	U	2	0	1	<20	T	T	0	1	T	0	4						
3 7 5	U	2	0	2	<20	T	T	0	1	T	0	4						
3 7 6	U	2	0	3	<20	T	T	0	1	T	0	4						
3 7 7	U	2	0	4	<20	T	T	0	1	T	0	4						
3 7 8	U	2	0	5	<20	T	T	0	1	T	0	4						
3 7 9	U	2	0	6	<20	T	T	0	1	T	0	4						
3 8 0	U	2	0	7	<20	T	T	0	1	T	0	4						
3 8 1	U	2	0	8	<20	T	T	0	1	T	0	4						
3 8 2	U	2	0	9	<20	T	T	0	1	T	0	4						
3 8 3	U	2	1	0	<20	T	T	0	1	T	0	4						
3 8 4	U	2	1	1	<20	T	T	0	1	T	0	4						
3 8 5	U	2	1	3	<20	T	T	0	1	T	0	4						
3 8 6	U	2	1	4	<20	T	T	0	1	T	0	4						
3 8 7	U	2	1	5	<20	T	T	0	1	T	0	4						
3 8 8	U	2	1	6	<20	T	T	0	1	T	0	4						
3 8 9	U	2	1	7	<20	T	T	0	1	T	0	4						
3 9 0	U	2	1	8	<20	T	T	0	1	T	0	4						
3 9 1	U	2	1	9	<20	T	T	0	1	T	0	4						
3 9 2	U	2	2	0	<20	T	T	0	1	T	0	4						
3 9 3	U	2	2	1	<20	T	T	0	1	T	0	4						
3 9 4	U	2	2	2	<20	T	T	0	1	T	0	4						
3 9 5	U	2	2	3	<20	T	T	0	1	T	0	4						
3 9 6	U	2	2	5	<20	T	T	0	1	T	0	4						

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

9. Description of Hazardous Waste (Continued)								D. PROCESSES									
Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	(1) PROCESS CODES (Enter Code)						(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)			
								S	0	1	S	0	2				
9	7	U	2	2	6	<20	T	S	0	1	S	0	2				
9	8	U	2	2	7	<20	T	S	0	1	S	0	2				
9	9	U	2	2	8	<20	T	S	0	1	S	0	2				
0	0	U	2	3	4	<20	T	S	0	1	S	0	2				
0	1	U	2	3	5	<20	T	S	0	1	S	0	2				
0	2	U	2	3	6	<20	T	S	0	1	S	0	2				
0	3	U	2	3	7	<20	T	S	0	1	S	0	2				
0	4	U	2	3	8	<20	T	S	0	1	S	0	2				
0	5	U	2	3	9	<20	T	S	0	1	S	0	2				
0	6	U	2	4	0	<20	T	S	0	1	S	0	2				
0	7	U	2	4	3	<20	T	S	0	1	S	0	2				
0	8	U	2	4	4	<20	T	S	0	1	S	0	2				
0	9	U	2	4	6	<20	T	S	0	1	S	0	2				
1	0	U	2	4	7	<20	T	S	0	1	S	0	2				
1	1	U	2	4	8	<20	T	S	0	1	S	0	2				
1	2	U	2	4	9	<20	T	S	0	1	S	0	2				
1	3	U	2	7	1	<20	T	S	0	1	S	0	2				
1	4	U	2	7	8	<20	T	S	0	1	S	0	2				
1	5	U	2	7	9	<20	T	S	0	1	S	0	2				
1	6	U	2	8	0	<20	T	S	0	1	S	0	2				
1	7	U	3	2	8	<20	T	S	0	1	S	0	2				
1	8	U	3	5	3	<20	T	S	0	1	S	0	2				
1	9	U	3	5	9	<20	T	S	0	1	S	0	2				
2	0	U	3	6	4	<20	T	S	0	1	S	0	2				
2	1	U	3	6	7	<20	T	S	0	1	S	0	2				
2	2	U	3	7	2	<20	T	S	0	1	S	0	2				
2	3	U	3	7	3	<20	T	S	0	1	S	0	2				
2	4	U	3	8	7	<20	T	S	0	1	S	0	2				
2	5	U	3	8	9	<20	T	S	0	1	S	0	2				
2	6	U	3	9	4	<20	T	S	0	1	S	0	2				
2	7	U	3	9	5	<20	T	S	0	1	S	0	2				
2	8	U	4	0	4	<20	T	S	0	1	S	0	2				
2	9	U	4	0	9	<20	T	S	0	1	S	0	2				
3	0	U	4	1	0	<20	T	S	0	1	S	0	2				
3	1	U	4	1	1	<20	T	S	0	1	S	0	2				
3	2	P	0	0	1	<20	T	S	0	1	S	0	2				

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES										
								(1) PROCESS CODES (Enter Code)							(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)			
9	7	U	2	2	6	<20	T	T	0	1	T	0	4					
9	8	U	2	2	7	<20	T	T	0	1	T	0	4					
9	9	U	2	2	8	<20	T	T	0	1	T	0	4					
0	0	U	2	3	4	<20	T	T	0	1	T	0	4					
0	1	U	2	3	5	<20	T	T	0	1	T	0	4					
0	2	U	2	3	6	<20	T	T	0	1	T	0	4					
0	3	U	2	3	7	<20	T	T	0	1	T	0	4					
0	4	U	2	3	8	<20	T	T	0	1	T	0	4					
0	5	U	2	3	9	<20	T	T	0	1	T	0	4					
0	6	U	2	4	0	<20	T	T	0	1	T	0	4					
0	7	U	2	4	3	<20	T	T	0	1	T	0	4					
0	8	U	2	4	4	<20	T	T	0	1	T	0	4					
0	9	U	2	4	6	<20	T	T	0	1	T	0	4					
1	0	U	2	4	7	<20	T	T	0	1	T	0	4					
1	1	U	2	4	8	<20	T	T	0	1	T	0	4					
1	2	U	2	4	9	<20	T	T	0	1	T	0	4					
1	3	U	2	7	1	<20	T	T	0	1	T	0	4					
1	4	U	2	7	8	<20	T	T	0	1	T	0	4					
1	5	U	2	7	9	<20	T	T	0	1	T	0	4					
1	6	U	2	8	0	<20	T	T	0	1	T	0	4					
1	7	U	3	2	8	<20	T	T	0	1	T	0	4					
1	8	U	3	5	3	<20	T	T	0	1	T	0	4					
1	9	U	3	5	9	<20	T	T	0	1	T	0	4					
2	0	U	3	6	4	<20	T	T	0	1	T	0	4					
2	1	U	3	6	7	<20	T	T	0	1	T	0	4					
2	2	U	3	7	2	<20	T	T	0	1	T	0	4					
2	3	U	3	7	3	<20	T	T	0	1	T	0	4					
2	4	U	3	8	7	<20	T	T	0	1	T	0	4					
2	5	U	3	8	9	<20	T	T	0	1	T	0	4					
2	6	U	3	9	4	<20	T	T	0	1	T	0	4					
2	7	U	3	9	5	<20	T	T	0	1	T	0	4					
2	8	U	4	0	4	<20	T	T	0	1	T	0	4					
2	9	U	4	0	9	<20	T	T	0	1	T	0	4					
3	0	U	4	1	0	<20	T	T	0	1	T	0	4					
3	1	U	4	1	1	<20	T	T	0	1	T	0	4					
3	2	P	0	0	1	<20	T	T	0	1	T	0	4					

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

9. Description of Hazardous Waste								D. PROCESSES										
Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	(1) PROCESS CODES (Enter Code)										(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)
3	3	P	0	0	2	<20	T	S	0	1	S	0	2					
3	4	P	0	0	3	<20	T	S	0	1	S	0	2					
3	5	P	0	0	4	<20	T	S	0	1	S	0	2					
3	6	P	0	0	5	<20	T	S	0	1	S	0	2					
3	7	P	0	0	6	<20	T	S	0	1	S	0	2					
3	8	P	0	0	7	<20	T	S	0	1	S	0	2					
3	9	P	0	0	8	<20	T	S	0	1	S	0	2					
4	0	P	0	0	9	<20	T	S	0	1	S	0	2					
4	1	P	0	1	0	<20	T	S	0	1	S	0	2					
4	2	P	0	1	1	<20	T	S	0	1	S	0	2					
4	3	P	0	1	2	<20	T	S	0	1	S	0	2					
4	4	P	0	1	3	<20	T	S	0	1	S	0	2					
4	5	P	0	1	4	<20	T	S	0	1	S	0	2					
4	6	P	0	1	5	<20	T	S	0	1	S	0	2					
4	7	P	0	1	6	<20	T	S	0	1	S	0	2					
4	8	P	0	1	7	<20	T	S	0	1	S	0	2					
4	9	P	0	1	8	<20	T	S	0	1	S	0	2					
4	0	P	0	2	0	<20	T	S	0	1	S	0	2					
5	1	P	0	2	1	<20	T	S	0	1	S	0	2					
5	2	P	0	2	2	<20	T	S	0	1	S	0	2					
5	3	P	0	2	3	<20	T	S	0	1	S	0	2					
5	4	P	0	2	4	<20	T	S	0	1	S	0	2					
5	5	P	0	2	6	<20	T	S	0	1	S	0	2					
5	6	P	0	2	7	<20	T	S	0	1	S	0	2					
5	7	P	0	2	8	<20	T	S	0	1	S	0	2					
5	8	P	0	2	9	<20	T	S	0	1	S	0	2					
5	9	P	0	3	0	<20	T	S	0	1	S	0	2					
6	0	P	0	3	1	<20	T	S	0	1	S	0	2					
6	1	P	0	3	3	<20	T	S	0	1	S	0	2					
6	2	P	0	3	4	<20	T	S	0	1	S	0	2					
6	3	P	0	3	6	<20	T	S	0	1	S	0	2					
6	4	P	0	3	7	<20	T	S	0	1	S	0	2					
6	5	P	0	3	8	<20	T	S	0	1	S	0	2					
6	6	P	0	3	9	<20	T	S	0	1	S	0	2					
6	7	P	0	4	0	<20	T	S	0	1	S	0	2					
6	8	P	0	4	1	<20	T	S	0	1	S	0	2					

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

9. Description of Hazardous Wastes (Continued) See additional sheets for hazardous waste codes.																	
Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)						(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)			
3	3	P	0	0	2	<20	T	T	0	1	T	0	4				
3	4	P	0	0	3	<20	T	T	0	1	T	0	4				
3	5	P	0	0	4	<20	T	T	0	1	T	0	4				
3	6	P	0	0	5	<20	T	T	0	1	T	0	4				
3	7	P	0	0	6	<20	T	T	0	1	T	0	4				
3	8	P	0	0	7	<20	T	T	0	1	T	0	4				
3	9	P	0	0	8	<20	T	T	0	1	T	0	4				
4	0	P	0	0	9	<20	T	T	0	1	T	0	4				
4	1	P	0	1	0	<20	T	T	0	1	T	0	4				
4	2	P	0	1	1	<20	T	T	0	1	T	0	4				
4	3	P	0	1	2	<20	T	T	0	1	T	0	4				
4	4	P	0	1	3	<20	T	T	0	1	T	0	4				
4	5	P	0	1	4	<20	T	T	0	1	T	0	4				
4	6	P	0	1	5	<20	T	T	0	1	T	0	4				
4	7	P	0	1	6	<20	T	T	0	1	T	0	4				
4	8	P	0	1	7	<20	T	T	0	1	T	0	4				
4	9	P	0	1	8	<20	T	T	0	1	T	0	4				
4	0	P	0	2	0	<20	T	T	0	1	T	0	4				
5	1	P	0	2	1	<20	T	T	0	1	T	0	4				
5	2	P	0	2	2	<20	T	T	0	1	T	0	4				
5	3	P	0	2	3	<20	T	T	0	1	T	0	4				
5	4	P	0	2	4	<20	T	T	0	1	T	0	4				
5	5	P	0	2	6	<20	T	T	0	1	T	0	4				
5	6	P	0	2	7	<20	T	T	0	1	T	0	4				
5	7	P	0	2	8	<20	T	T	0	1	T	0	4				
5	8	P	0	2	9	<20	T	T	0	1	T	0	4				
5	9	P	0	3	0	<20	T	T	0	1	T	0	4				
6	0	P	0	3	1	<20	T	T	0	1	T	0	4				
6	1	P	0	3	3	<20	T	T	0	1	T	0	4				
6	2	P	0	3	4	<20	T	T	0	1	T	0	4				
6	3	P	0	3	6	<20	T	T	0	1	T	0	4				
6	4	P	0	3	7	<20	T	T	0	1	T	0	4				
6	5	P	0	3	8	<20	T	T	0	1	T	0	4				
6	6	P	0	3	9	<20	T	T	0	1	T	0	4				
6	7	P	0	4	0	<20	T	T	0	1	T	0	4				
6	8	P	0	4	1	<20	T	T	0	1	T	0	4				

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES										(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)
								(1) PROCESS CODES (Enter Code)										
6	9	P	0	4	2	<20	T	S	0	1	S	0	2					
7	0	P	0	4	3	<20	T	S	0	1	S	0	2					
7	1	P	0	4	4	<20	T	S	0	1	S	0	2					
7	2	P	0	4	5	<20	T	S	0	1	S	0	2					
7	3	P	0	4	6	<20	T	S	0	1	S	0	2					
7	4	P	0	4	7	<20	T	S	0	1	S	0	2					
7	5	P	0	4	8	<20	T	S	0	1	S	0	2					
7	6	P	0	4	9	<20	T	S	0	1	S	0	2					
7	7	P	0	5	0	<20	T	S	0	1	S	0	2					
7	8	P	0	5	1	<20	T	S	0	1	S	0	2					
7	9	P	0	5	4	<20	T	S	0	1	S	0	2					
8	0	P	0	5	6	<20	T	S	0	1	S	0	2					
8	1	P	0	5	7	<20	T	S	0	1	S	0	2					
8	2	P	0	5	8	<20	T	S	0	1	S	0	2					
8	3	P	0	5	9	<20	T	S	0	1	S	0	2					
8	4	P	0	6	0	<20	T	S	0	1	S	0	2					
8	5	P	0	6	2	<20	T	S	0	1	S	0	2					
8	6	P	0	6	3	<20	T	S	0	1	S	0	2					
8	7	P	0	6	4	<20	T	S	0	1	S	0	2					
8	8	P	0	6	5	<20	T	S	0	1	S	0	2					
8	9	P	0	6	6	<20	T	S	0	1	S	0	2					
9	0	P	0	6	7	<20	T	S	0	1	S	0	2					
9	1	P	0	6	8	<20	T	S	0	1	S	0	2					
9	2	P	0	6	9	<20	T	S	0	1	S	0	2					
9	3	P	0	7	0	<20	T	S	0	1	S	0	2					
9	4	P	0	7	1	<20	T	S	0	1	S	0	2					
9	5	P	0	7	2	<20	T	S	0	1	S	0	2					
9	6	P	0	7	3	<20	T	S	0	1	S	0	2					
9	7	P	0	7	4	<20	T	S	0	1	S	0	2					
9	8	P	0	7	5	<20	T	S	0	1	S	0	2					
9	9	P	0	7	6	<20	T	S	0	1	S	0	2					
0	0	P	0	7	7	<20	T	S	0	1	S	0	2					
0	1	P	0	7	8	<20	T	S	0	1	S	0	2					
0	2	P	0	8	1	<20	T	S	0	1	S	0	2					
0	3	P	0	8	2	<20	T	S	0	1	S	0	2					
0	4	P	0	8	4	<20	T	S	0	1	S	0	2					

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES										(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)
								(1) PROCESS CODES (Enter Code)										
6	9	P	0	4	2	<20	T	T	0	1	T	0	4					
7	0	P	0	4	3	<20	T	T	0	1	T	0	4					
7	1	P	0	4	4	<20	T	T	0	1	T	0	4					
7	2	P	0	4	5	<20	T	T	0	1	T	0	4					
7	3	P	0	4	6	<20	T	T	0	1	T	0	4					
7	4	P	0	4	7	<20	T	T	0	1	T	0	4					
7	5	P	0	4	8	<20	T	T	0	1	T	0	4					
7	6	P	0	4	9	<20	T	T	0	1	T	0	4					
7	7	P	0	5	0	<20	T	T	0	1	T	0	4					
7	8	P	0	5	1	<20	T	T	0	1	T	0	4					
7	9	P	0	5	4	<20	T	T	0	1	T	0	4					
8	0	P	0	5	6	<20	T	T	0	1	T	0	4					
8	1	P	0	5	7	<20	T	T	0	1	T	0	4					
8	2	P	0	5	8	<20	T	T	0	1	T	0	4					
8	3	P	0	5	9	<20	T	T	0	1	T	0	4					
8	4	P	0	6	0	<20	T	T	0	1	T	0	4					
8	5	P	0	6	2	<20	T	T	0	1	T	0	4					
8	6	P	0	6	3	<20	T	T	0	1	T	0	4					
8	7	P	0	6	4	<20	T	T	0	1	T	0	4					
8	8	P	0	6	5	<20	T	T	0	1	T	0	4					
8	9	P	0	6	6	<20	T	T	0	1	T	0	4					
9	0	P	0	6	7	<20	T	T	0	1	T	0	4					
9	1	P	0	6	8	<20	T	T	0	1	T	0	4					
9	2	P	0	6	9	<20	T	T	0	1	T	0	4					
9	3	P	0	7	0	<20	T	T	0	1	T	0	4					
9	4	P	0	7	1	<20	T	T	0	1	T	0	4					
9	5	P	0	7	2	<20	T	T	0	1	T	0	4					
9	6	P	0	7	3	<20	T	T	0	1	T	0	4					
9	7	P	0	7	4	<20	T	T	0	1	T	0	4					
9	8	P	0	7	5	<20	T	T	0	1	T	0	4					
9	9	P	0	7	6	<20	T	T	0	1	T	0	4					
0	0	P	0	7	7	<20	T	T	0	1	T	0	4					
0	1	P	0	7	8	<20	T	T	0	1	T	0	4					
0	2	P	0	8	1	<20	T	T	0	1	T	0	4					
0	3	P	0	8	2	<20	T	T	0	1	T	0	4					
0	4	P	0	8	4	<20	T	T	0	1	T	0	4					

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

D. PROCESSES																
Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	(1) PROCESS CODES (Enter Code)						(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)		
0	5	P	0	8	5	<20	T	S	0	1	S	0	2			
0	6	P	0	8	7	<20	T	S	0	1	S	0	2			
0	7	P	0	8	8	<20	T	S	0	1	S	0	2			
0	8	P	0	8	9	<20	T	S	0	1	S	0	2			
0	9	P	0	9	2	<20	T	S	0	1	S	0	2			
1	0	P	0	9	3	<20	T	S	0	1	S	0	2			
1	1	P	0	9	4	<20	T	S	0	1	S	0	2			
1	2	P	0	9	5	<20	T	S	0	1	S	0	2			
1	3	P	0	9	6	<20	T	S	0	1	S	0	2			
1	4	P	0	9	7	<20	T	S	0	1	S	0	2			
1	5	P	0	9	8	<20	T	S	0	1	S	0	2			
1	6	P	0	9	9	<20	T	S	0	1	S	0	2			
1	7	P	1	0	1	<20	T	S	0	1	S	0	2			
1	8	P	1	0	2	<20	T	S	0	1	S	0	2			
1	9	P	1	0	3	<20	T	S	0	1	S	0	2			
2	0	P	1	0	4	<20	T	S	0	1	S	0	2			
2	1	P	1	0	5	<20	T	S	0	1	S	0	2			
2	2	P	1	0	6	<20	T	S	0	1	S	0	2			
2	3	P	1	0	8	<20	T	S	0	1	S	0	2			
2	4	P	1	0	9	<20	T	S	0	1	S	0	2			
2	5	P	1	1	0	<20	T	S	0	1	S	0	2			
2	6	P	1	1	1	<20	T	S	0	1	S	0	2			
2	7	P	1	1	2	<20	T	S	0	1	S	0	2			
2	8	P	1	1	3	<20	T	S	0	1	S	0	2			
2	9	P	1	1	4	<20	T	S	0	1	S	0	2			
3	0	P	1	1	5	<20	T	S	0	1	S	0	2			
3	1	P	1	1	6	<20	T	S	0	1	S	0	2			
3	2	P	1	1	8	<20	T	S	0	1	S	0	2			
3	3	P	1	1	9	<20	T	S	0	1	S	0	2			
3	4	P	1	2	0	<20	T	S	0	1	S	0	2			
3	5	P	1	2	1	<20	T	S	0	1	S	0	2			
3	6	P	1	2	2	<20	T	S	0	1	S	0	2			
3	7	P	1	2	3	<20	T	S	0	1	S	0	2			
3	8	P	1	2	7	<20	T	S	0	1	S	0	2			
3	9	P	1	2	8	<20	T	S	0	1	S	0	2			
4	0	P	1	8	5	<20	T	S	0	1	S	0	2			

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES										(2) PROCESS DESCRIPTION (If code is not entered in 9.D.1)
								(1) PROCESS CODES (Enter Code)										
0	5	P	0	8	5	<20	T	T	0	1	T	0	4					
0	6	P	0	8	7	<20	T	T	0	1	T	0	4					
0	7	P	0	8	8	<20	T	T	0	1	T	0	4					
0	8	P	0	8	9	<20	T	T	0	1	T	0	4					
0	9	P	0	9	2	<20	T	T	0	1	T	0	4					
1	0	P	0	9	3	<20	T	T	0	1	T	0	4					
1	1	P	0	9	4	<20	T	T	0	1	T	0	4					
1	2	P	0	9	5	<20	T	T	0	1	T	0	4					
1	3	P	0	9	6	<20	T	T	0	1	T	0	4					
1	4	P	0	9	7	<20	T	T	0	1	T	0	4					
1	5	P	0	9	8	<20	T	T	0	1	T	0	4					
1	6	P	0	9	9	<20	T	T	0	1	T	0	4					
1	7	P	1	0	1	<20	T	T	0	1	T	0	4					
1	8	P	1	0	2	<20	T	T	0	1	T	0	4					
1	9	P	1	0	3	<20	T	T	0	1	T	0	4					
2	0	P	1	0	4	<20	T	T	0	1	T	0	4					
5.2	1	P	1	0	5	<20	T	T	0	1	T	0	4					
2	2	P	1	0	6	<20	T	T	0	1	T	0	4					
2	3	P	1	0	8	<20	T	T	0	1	T	0	4					
2	4	P	1	0	9	<20	T	T	0	1	T	0	4					
2	5	P	1	1	0	<20	T	T	0	1	T	0	4					
2	6	P	1	1	1	<20	T	T	0	1	T	0	4					
2	7	P	1	1	2	<20	T	T	0	1	T	0	4					
2	8	P	1	1	3	<20	T	T	0	1	T	0	4					
2	9	P	1	1	4	<20	T	T	0	1	T	0	4					
3	0	P	1	1	5	<20	T	T	0	1	T	0	4					
3	1	P	1	1	6	<20	T	T	0	1	T	0	4					
3	2	P	1	1	8	<20	T	T	0	1	T	0	4					
3	3	P	1	1	9	<20	T	T	0	1	T	0	4					
3	4	P	1	2	0	<20	T	T	0	1	T	0	4					
3	5	P	1	2	1	<20	T	T	0	1	T	0	4					
3	6	P	1	2	2	<20	T	T	0	1	T	0	4					
3	7	P	1	2	3	<20	T	T	0	1	T	0	4					
3	8	P	1	2	7	<20	T	T	0	1	T	0	4					
3	9	P	1	2	8	<20	T	T	0	1	T	0	4					
4	0	P	1	8	5	<20	T	T	0	1	T	0	4					

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

[illegible]

9. Description of Hazardous Wastes (Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)

[illegible]

10. Map

Attach to this application a topographical map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all spring, rivers, and other surface water bodies in this map area. See instructions for precise requirements.

11. Facility Drawing

All existing facilities must include a scale drawing of the facility (see instructions for more detail).

12. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment, and disposal areas; and sites of future storage, treatment, or disposal areas (see instructions for more detail).

13. Comments

Items 10-12 are all contained in Systech's part B permit renewal application. The addition of these waste codes does not change what has already been submitted.



Used Oil Tanks

Container
Building

Lab/Office

OL 1-6

OL 7-9

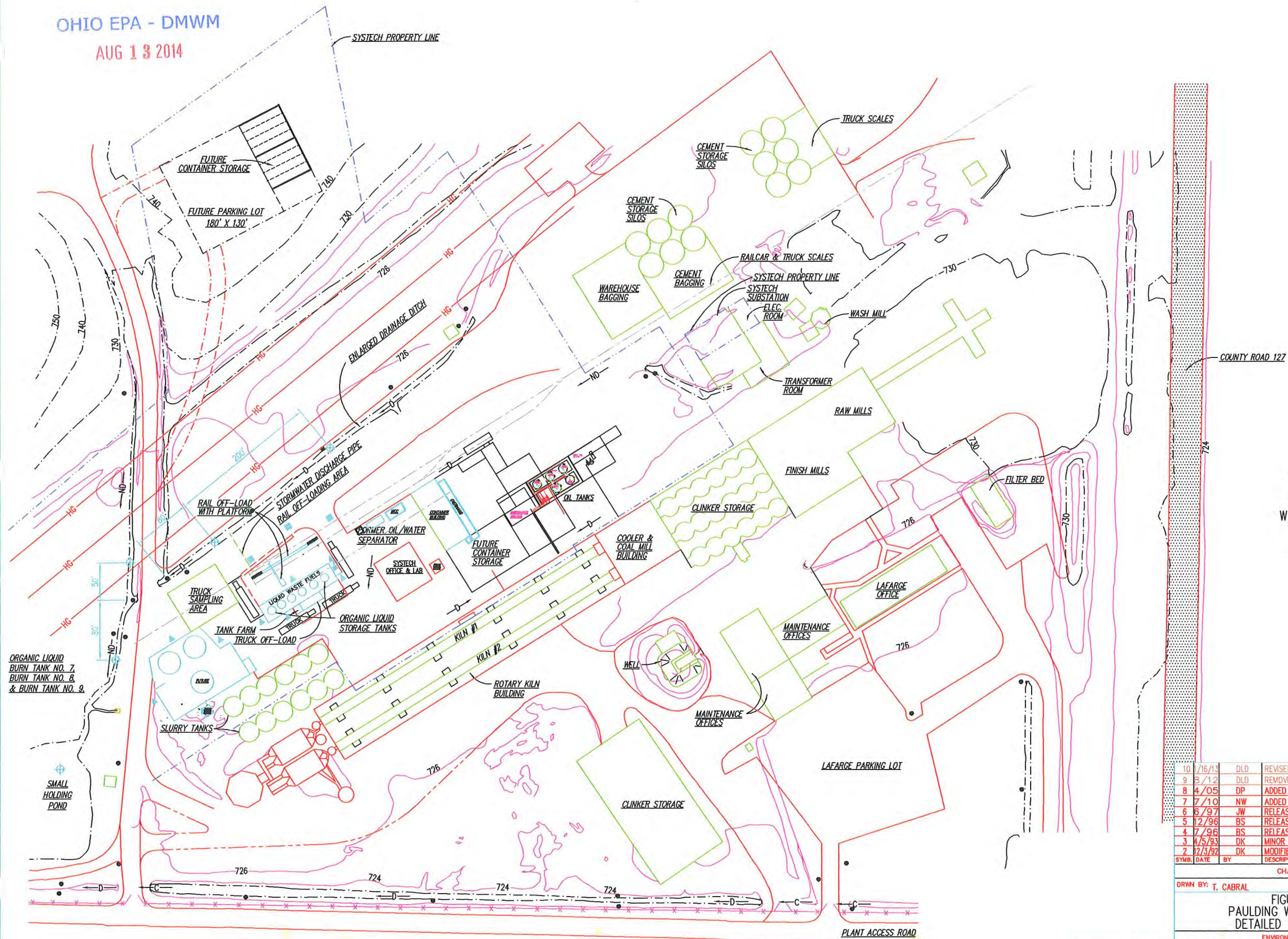
OHIO EPA - DMWM

AUG 13 2014

00580

OHIO EPA - DMWM

AUG 13 2014



LEGEND	
	= PROPERTY LINE
	= GRID MATCHLINE
	= GRAVEL
	= 10' CONTOURS
	= 2' CONTOURS
	= APPROVED CAPITAL TANK FARM
	= CONTAINER PROCESSING
	= DRY WASTE FUELS
	= PYROLYZER
	= SYSTECH FACILITY BOUNDARY
	= NATURAL DRAINAGE
	= STORM CULVERT
	= STORM DITCH
	= CITY WATER SUPPLY
	= PROCESS WATER SUPPLY
	= FENCE
	= POWER POLE
	= PROPOSED SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS
	= PROPOSED SOIL BORINGS
	= PROPOSED GEOTECHNICAL SOIL BORING LOCATION
	= PROPOSED SOIL BORING AT PERIMETER OF RAIL OFF-LOADING AREA



00581

SCALE: 100 ft.

SYMB.	DATE	BY	DESCRIPTION
10	1/16/13	DLD	REVISED COLORS ON DRAWING FOR PERMIT
9	3/12	DLD	REMOVED HELL REMOVAL SYSTEM, ADDED MCC, OFFICE, FOAM ROOM.
8	4/05	DP	ADDED SWMUs
7	7/10	NW	ADDED DIRECT BURN AND CONTAINER STORAGE
6	6/97	JW	RELEASED FOR PERMIT
5	12/96	BS	RELEASED
4	7/96	BS	RELEASED
3	1/5/93	DK	MINOR REVISION PER G.H.
2	12/3/92	DK	MODIFIED ROAD LOCATION

CHANGES			
DRWN BY: T. CABRAL	DATE 10/16/91	CHKD. BY:	DATE
FIGURE NO. 8.1 PAULDING WASTE MANAGEMENT DETAILED TOPOGRAPHIC MAP			
ENVIRONMENT AND ENERGY			
SYSTECH ENVIRONMENTAL CORPORATION			
3085 WOODMAN DRIVE, DAYTON, OHIO 45420 937-643-1240			
SHEET OF	DWG. NO. 11-06G10	REV. NO. 10	

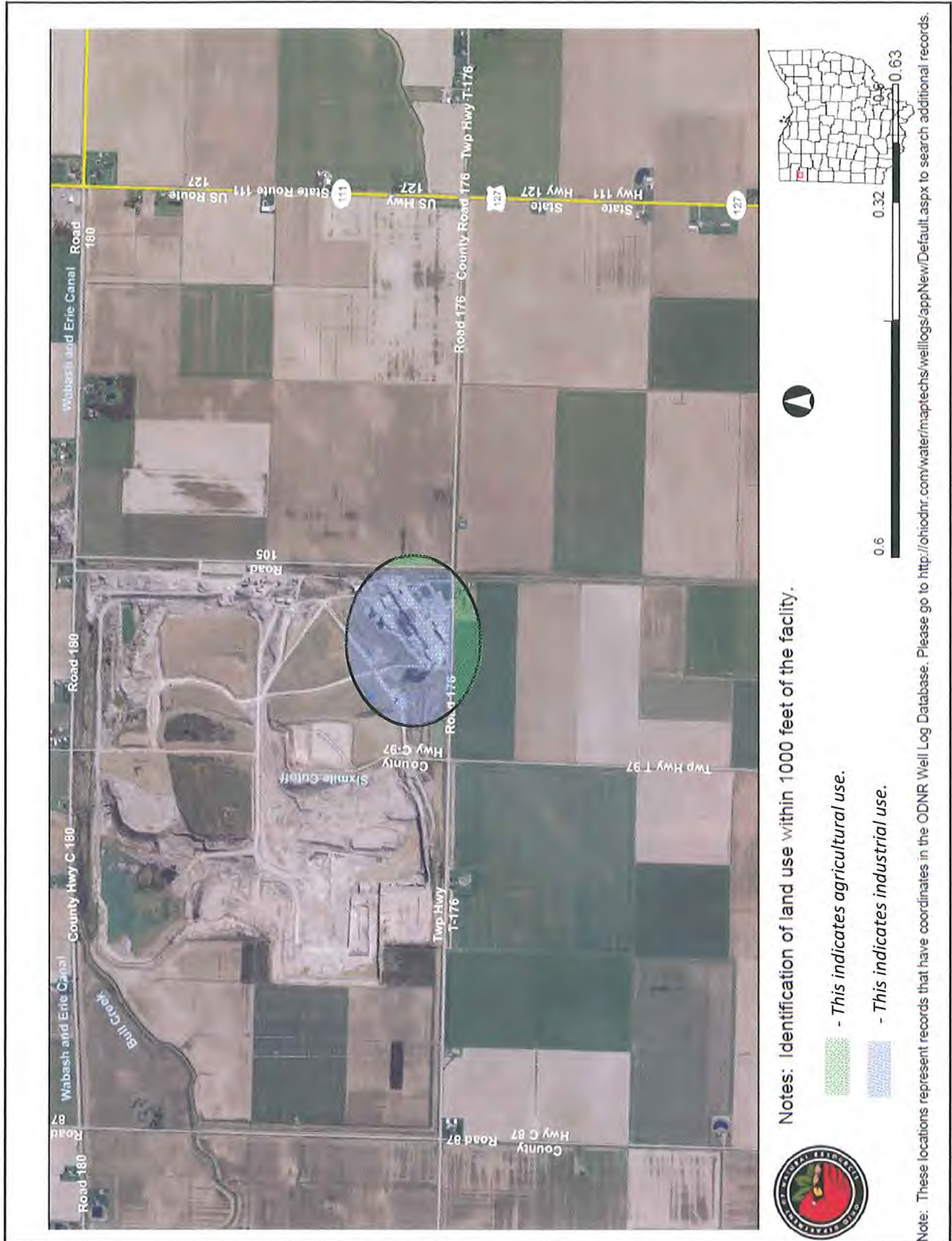
Unless Otherwise Specified all units are in feet and inches (12"-0").
Tolerances are: feet inches
Foot 63 inches 4 6.1
Ft-Inch 61/2 inch 4 4.03
Fraction 61/4 inch 4 4.0'

SYSTECH®

Systech's Paulding, OH Facility Wells



AUG 13 2014



00583