RESPONSE ACTION WORK PLAN
CLASS 2 NON-HAZARDOUS WASTE LANDFILL

EXIDE TECHNOLOGIES
NORTH LANDFILL
7471 SOUTH 5TH STREET
FRISCO, COLLIN COUNTY, TEXAS

December 7, 2012

Prepared For:

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ATTACHMENTS

LIST OF APPENDICES

1.0 INTRODUCTION

W&M Environmental Group, Inc. (W&M) in conjunction with Remediation Services, Inc. (RSI) has prepared this Response Action Work Plan (RAWP) detailing the proposed response activities at Exide Technologies, Inc. (Exide) active Class 2 Non-Hazardous Waste Landfill (landfill) located at the far north end of the Exide Technologies property at 7471 South 5th Street in Frisco, Texas (Site). The RAWP relates to the active cells of the landfill, namely cells 10, 11, and 12. The landfill operates pursuant to 30 Texas Administrative Code (TAC) Chapter 335 as an on-site Class 2 Non-Hazardous Industrial Waste Landfill.

The goal of the response action is to remove the treated slag material within the cells that exceeds the Universal Treatment Standard (UTS) for lead and/or cadmium, re-treat the excavated material within the confines of the landfill, collect confirmation samples to ensure that the UTS is met, and return the re-treated materials meeting the UTS to the active cells of the landfill. This document addresses input received from TCEQ and details the proposed response actions, including specific material handling procedures, re-treatment chemistry and processes, dust suppression and control, air sampling, confirmation sampling, safety consideration, and laboratory quality assurance procedures.

All of the documents and plans associated with the response action have been incorporated into this RAWP. We have included separate detailed plans prepared by RSI for waste stabilization, dust suppression/control and air monitoring in appendices. These appendices are part of the RAWP.

Exide may propose revisions to this RAWP to implement alternative or supplemental measures which, at a minimum, shall be as protective of human health and the environment as the measures set forth in this RAWP. Any alternative or supplemental measure proposed by Exide must be approved by the Executive Director prior to implementation.

1.1 Site Background

The Texas Commission on Environmental Quality (TCEQ) conducted investigation inspections at Exide's Class 2 Non-Hazardous Landfill on May 6, 12, 17-19, and June 28-29, 2011. During the investigations on May 19, 2011, two surface samples were collected within the landfill. TCEQ's sampling results indicated that the samples failed applicable UTS for lead and/or cadmium constituents in the treated waste using the TCLP analysis. Exide conducted a review of analytical data and operational performance over a 3-year time period and determined that further evaluation of the *in-situ* treated slag material in the active cells was warranted.

Between June 2011 and December 2011, Exide and W&M collected 195 additional samples of the *in-situ* waste. The investigations identified UTS exceedances of lead and cadmium concentrations, primarily in the upper 2 feet of the waste material. W&M's investigation also identified isolated areas in the active cells of the landfill at a depth greater than 2 feet with TCLP lead concentrations greater than the UTS. A summary of the landfill investigations is provided in the "*Results of Class 2 Non-Hazardous Waste Landfill Investigation*" Report dated March 13, 2012.

Figures 2 and 3 identify areas of the landfill where samples exceeded the lead and/or cadmium UTS from the surface to a depth of 2 feet. **Figure 4** identifies samples that exceeded the lead

UTS that were collected at a depth greater than 2 feet. A conceptual profile summarizing the analytical results of the investigations is provided in **Attachment 1**.

Based on its review of the data, Exide concluded that the exceedances in the shallow zone are most likely attributable to deviations from previous and current operating procedures (such as adjustments to the ratio of treatment ingredients used) and more rigorous truck wash-out procedures employed in 2010-2011 that could have resulted in the separation of treatment chemicals before the treated slag has set up. The active cells 10-12 were constructed in the first half of 2009 and thereafter put in use. Since only the currently active cells were in use during the 2010-2011 period and the analytical data and operating procedures for prior periods shows compliance with the UTS, the findings being addressed by this RAWP do not involve the closed cells of the landfill.

2.0 RESPONSE ACTIONS

This Section of the RAWP details the proposed response actions to be conducted at the landfill.

2.1 Response Action Objectives

The objective of the proposed response action is to remove discrete areas of waste containing concentrations of lead and/or cadmium that exceed the UTS, re-treat the excavated material until laboratory analysis indicates regulatory compliance (below the UTS), and collect confirmation samples of the *in-situ* treated slag to ensure that excavation has removed all wastes that exceed the UTS and no land ban or hazardous wastes remain in the cells. The response action has been designed to minimize the generation of dust that could contain lead from the treated slag, and incorporates components to control and monitor dust levels during its implementation.

2.2 Response Action Design

Various alternatives were considered before selecting the response action. In-place treatment of the slag that exceeds the UTS is not feasible or practical due to the physical properties of much of the *in-situ* treated slag. Excavation and off-Site disposal to a licensed facility would result in the transportation of large volumes of material over public roads for treatment and land disposal (an estimated 300 truckloads of material would be required for an off-Site land disposal option) and was not considered cost-effective. Treatment at Exide's on-site Slag Treatment Building was not a preferred option since it would result in the loading and transportation of the slag in trucks across the plant property and the treatment capacity at the Slag Treatment Building is being fully utilized for site wind down activities. It was judged that the most protective response action would minimize handling and movement of the slag from the landfill footprint and re-treat the material in-place using methods that reduce the addition of water.

The selected *conceptual* response action at the landfill will consist of the following steps. Details regarding the response action sequencing are provided in Section 2.3 and described more fully in RSI's *Waste Stabilization Plan* included as **Appendix A** and incorporated herein.

- Remove the upper 12 inches of *in-situ* treated slag material throughout the active landfill (area identified in **Figure 2**).
- Demarcate the estimated horizontal extent of the remaining in-situ material that contains lead and/or cadmium above the UTS to a depth of 2 feet, as well as areas that contain lead above the UTS deeper than 2 feet (areas identified in **Figures 3 and 4**).
- Discretely excavate each of the delineated areas of treated slag that contain lead and/or cadmium concentrations above the UTS. The lateral extent of excavation will extend two-thirds of the distance to the nearest sample point with acceptable results.
- Below 2 feet, remove the delineated areas within the intervals identified on **Figure 4** from the landfill for re-treatment. Any zones of materials previously identified as acceptable as a result of the site investigation results that are excavated will be placed into discrete stockpiles on the landfill and returned without re-treatment.
- At the conclusion of each phase of excavation, collect confirmation samples from the floors and sidewalls of the excavated areas to confirm that all materials exceeding the UTS have

been removed and ensure that the waste remaining in the landfill meets the disposal criteria for treated slag material and for Class 2 landfills.

- Continue the excavation until acceptable confirmation results are received, the protective soil liner is encountered, or the excavation adjoins an area previously sampled and shown to contain material that is in compliance with the UTS.
- All excavated material will be stockpiled and re-treated within the boundaries of the active landfill.
- The re-treated slag material will be segregated, sampled and analyzed in accordance with the protocols outlined in Section 2.3 and the detailed procedures in the project *Sampling & Analysis Plan/Quality Assurance Project Plan (SAP/QAPP)* included as **Appendix D** and incorporated herein.
- All re-treated material will be deposited in areas of the landfill where it has been demonstrated that the existing material satisfies land disposal criteria.
- If on-Site re-treatment and placement in the landfill is not practical or cost-effective, off-Site treatment and disposal may be considered. Such treatment and disposal will be completed in accordance with all federal and State regulations.
- Residual material generated from equipment decontamination at project completion will be accumulated, transported to the main plant and re-treated in Exide's existing slag treatment process.

Areas outlined in **Figures 2**, **3**, and **4** will be excavated to the prescribed depths to remove the waste material that contains concentrations of lead and/or cadmium above the UTS acceptable levels (TCLP concentrations of 0.75 mg/L and 0.11 mg/L, respectively). The proposed approach is outlined below.

Excavation Activities

Due to space constraints, the response action will be implemented in sections, with the removal of slag to be re-treated starting at the western end of the active landfill, placement in 1-foot lifts for re-treatment in a second portion of the landfill, and stockpiling for confirmation sampling in a third area. All re-treatment will occur by mixing the slag and reagent within controlled areas of specific dimensions to determine the volumes of treatment chemicals required.

Excavated slag will be segregated and placed in designated areas and clearly flagged as to whether they are un-treated or have been re-treated and await backfilling pending confirmatory testing. All re-treated slag will be covered and secured as outlined in the *Waste Stabilization Plan.*

The details of the excavation and re-treatment process are described in the *Waste Stabilization Plan* in **Appendix A.** The re-treatment will be principally a dry process, with water added only as required to control dust and particulates during handling of the slag and reagents. No excess water will be used.

Dust Control and Air Monitoring

Dust suppression will be available at all times and implemented during excavation activities to minimize and monitor emissions associated with remediation activities at the Site. Best management practices will be implemented throughout the project, including wetting active remediation areas, minimizing or ceasing activity during periods of high wind (greater than 20 miles per hour), sweeping or wetting paved areas, wetting unpaved areas, application of dust suppressant materials as well as covering stockpiles at all times they are not in active use.

A detailed description of the methods and procedures to be employed for dust control are described in RSI's *Dust Control Plan*, provided in **Appendix B** and incorporated herein. The use of water during dust suppression activities will be monitored to avoid application of excess water that could result in runoff from the work areas.

In order to monitor dust levels at or near the property boundaries during remediation activities that could generate dust, the *Perimeter Air Monitoring Plan*, prepared by RSI and included in **Appendix C** and incorporated herein, will be implemented. This plan details the requirements and methods for monitoring ambient air quality during slag excavation and treatment activities for particulate matter (dust), lead and cadmium.

The air monitoring program that has been developed for the Site is composed of exposure monitoring of on-Site workers as well as ambient air monitoring.

The primary objectives of the perimeter air monitoring are to:

- Develop a relationship between particulate (dust) levels and concentrations of lead and cadmium, so that the particulate measurements can be used as a surrogate;
- Determine if concentrations of lead and cadmium and particulate emissions are in excess of air Take Action or Stop Work Levels established for the Site; and
- Ensure that engineering controls and work practices help minimize potential off-site impacts. The monitoring plan will help ensure that RSI reacts quickly and makes appropriate changes to dust control measures as needed.

Confirmation Sampling

Confirmation samples will be collected from the sidewalls and floor of each excavation area at the locations identified.

Confirmation samples will be collected at a minimum frequency of one sample per 30 linear feet of the excavation sidewall, and one sample per 1,000 square feet of excavation base. Each confirmation sample will be a discrete sample from a representative location and depth and collected in a large plastic bag. A sub-sample will then be placed in laboratory-supplied four-ounce sample jars, labeled with the sample location, depth of sample, date, and time of collection. The soil samples will be hand delivered to Oxidor Laboratories for TCLP analysis of lead and cadmium on a rush turnaround basis.

In view of the high relative percent differences (RPDs) observed during the investigation phase, blind duplicate samples will be collected at a frequency of 10%, and third party duplicates also at a frequency of 10%; therefore, the overall project will involve duplicates at a rate of 20%.

Details regarding confirmation sampling procedures, analytical protocols, and quality assurance goals and procedures are described in detail in the SAP/QAPP provided in **Appendix D**. All sampling procedures and chemical analyses will be performed in accordance with the latest versions of SW-846 "*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*".

If any analytical results (from confirmation samples or any associated duplicates) indicate concentrations of lead above 0.75 mg/L and/or concentrations of cadmium above 0.11 mg/L, those areas will be over excavated and additional confirmation samples will be collected as described above. The process will continue until concentrations remaining on the sidewalls or floors of the excavation area are below the applicable UTS limits, the protective soil clay liner is encountered, or until the excavation reaches an area previously sampled and determined to contain acceptable waste materials.

Backfilling and Landfill Restoration

Lastly, once the re-treatment of slag excavated from the landfill is completed in accordance with this RAWP, all treated slag meeting UTS criteria from ongoing operations that has been stockpiled at the Site will also be backfilled in the landfill, and landfilling operations will resume in accordance with the Site's Landfill Operations Plan.

3.0 QUALITY ASSURANCE/QUALITY CONTROL

The quality assurance/quality control (QA/QC) procedures for the proposed response action are outlined in the *SAP/QAPP* in **Appendix D** and include:

- Following written procedures for all sampling, sample handling and preservation.
- Recording all sampling and other field activities conducted at the Site in a field logbook.
- Collecting blind and third-party duplicate samples of confirmation samples.
- Completing chain-of-custody documentation for all samples collected at the landfill.
- Ensure that all sampling procedures and chemical analyses are performed in accordance with the latest versions of SW-846 "*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*".
- Reviewing QA/QC data package from the analytical laboratory.

As outlined in the *SAP/QAPP*, blind duplicate soil samples and third party duplicate samples will be collected at a frequency of 10 percent each, resulting in a combined frequency of 20%. The duplicate samples will be collected following the sample collection procedures discussed in Section 2.2.

In addition, W&M will review laboratory control samples (LCS) and LCS duplicate (LCSD) results, matrix spike (MS), and MS duplicate (MSD) results to assess the validity of the results (e. g. the laboratory QA/QC data package).

4.0 COMPLETION OF RESPONSE ACTION

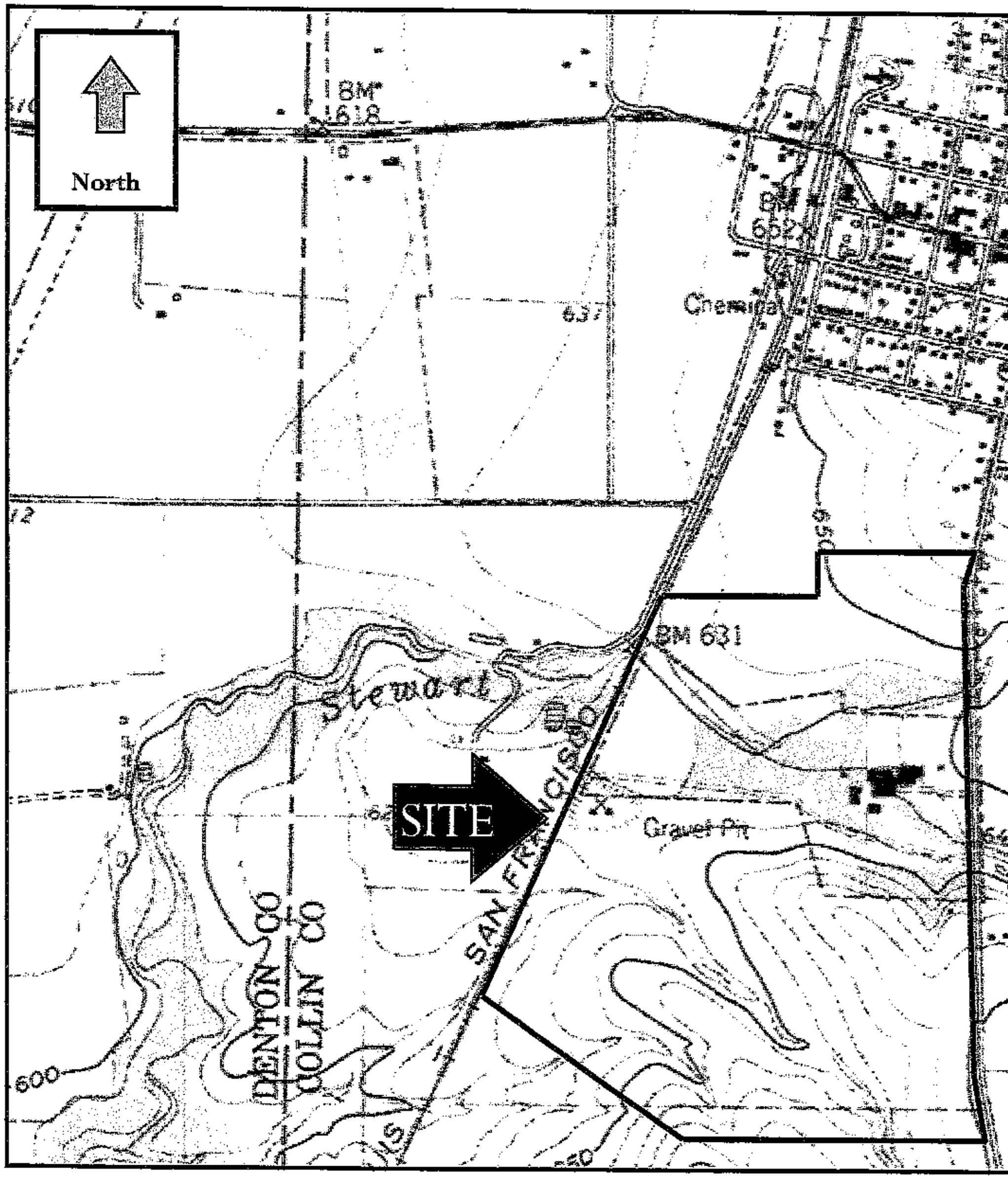
4.1 Response Action Completion Report

Following completion of the remedial activities, a report will be prepared and submitted to TCEQ detailing the remediation activities conducted under this RAWP and the results of the confirmation sampling. This report will include a summary of completed activities, photographic log, confirmation sampling results, and review of QA/QC data.

4.2 Future Land Use of Landfill Area

The landfill area is currently permitted as a Class 2 Industrial Non-Hazardous Waste Landfill. Exide will continue use of the active cells of the landfill until they reach their capacity. At that time, the cells will be closed with a composite clay/membrane liner and vegetative soil cover. Future use of the Site will remain industrial.

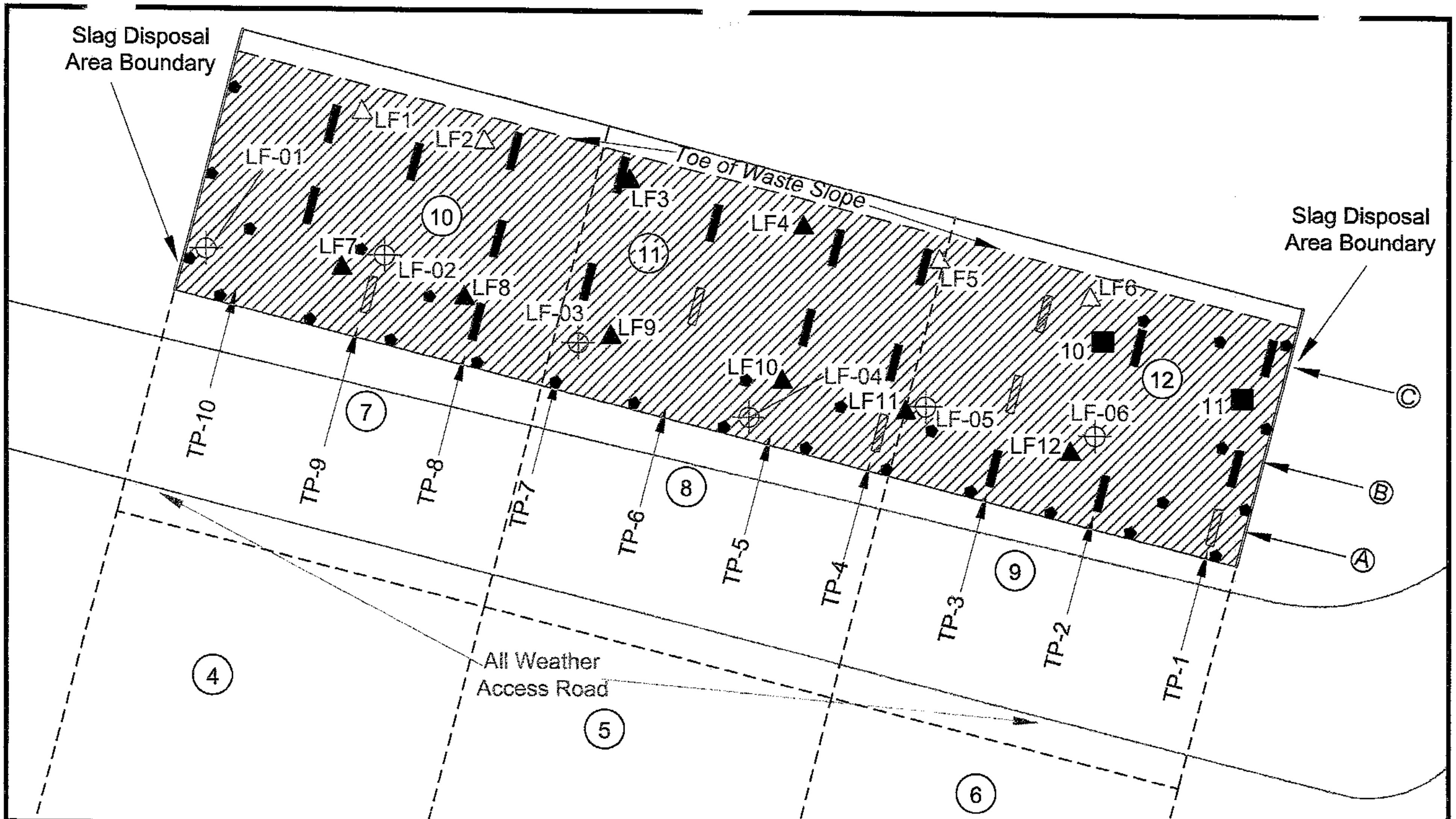
FIGURES



W&M

Figure 1
Site Location
7471 South 5th Street
Frisco, Texas

2-15-12	RAWP	W&M Project No.: 112.059



Legend

□10	Surface Sample Location - TCEQ
△LF1	Surface Sample Location - Exide
⊕LF-01	Soil Boring
	Test Pit Location
-------	Landfill Cell Boundaries
#	Landfill Cell Numbers
	Area to be Excavated to 1 Foot
	Confirmation Sample Location

0' 50' 100'
APPROXIMATE SCALE

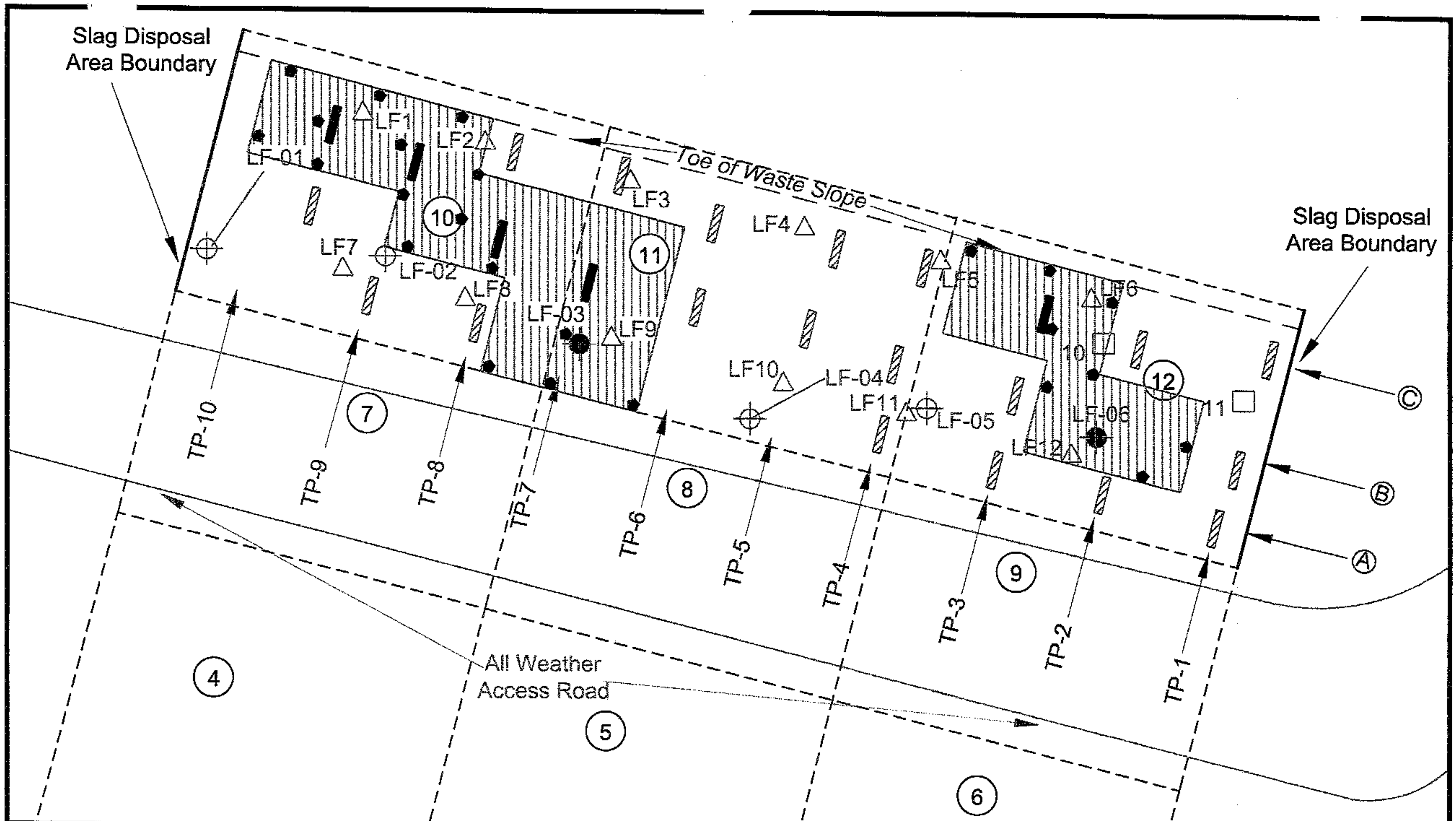
N

Note: All Completed Locations Marked in **Solid Red** Contain at Least One Sample That Exceeds UTS for Lead and/or Cadmium at the 0 - 0.5 foot interval

Figure 2
Area of Excavation
0' - 1'
7471 South 5th Street
Frisco, Texas

W&M Environmental Group, Inc.
www.wh-m.com

12/21/11	W&M Project No. 112.059	Drawn by: SF	Revision: 2/10/12, 7/20/12



Legend

Symbol	Description
□10	Surface Sample Location - TCEQ
△LF1	Surface Sample Location - Exide
⊕LF-01	Soil Boring
▨	Test Pit Location
- - - -	Landfill Cell Boundaries
(#)	Landfill Cell Numbers
▨	Area to be Excavated to 2 Feet
⬟	Confirmation Sample Location

0' 50' 100'
APPROXIMATE SCALE

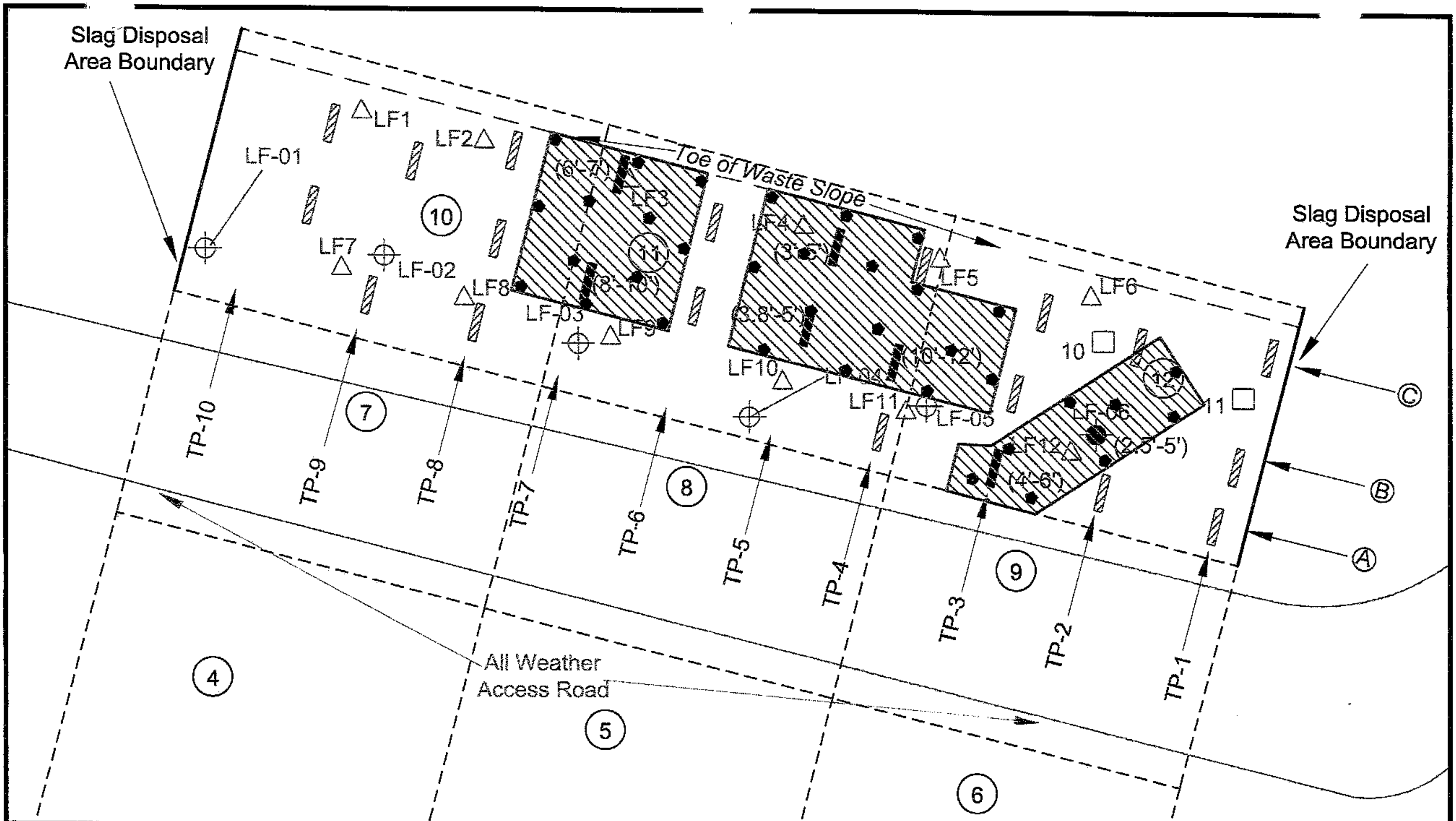
N

Note: All Completed Locations Marked in **Solid Red** Contain at Least One Sample That Exceeds UTS for Lead and/or Cadmium at the 0 - 2 foot interval

Figure 3
Area of Excavation
0' - 2'
7471 South 5th Street
Frisco, Texas

W&M ENVIRONMENTAL GROUP, INC.
www.wh-m.com

12/21/11 | W&M Project No. 112.059 | Drawn by: SF | Revision: 2/10/12, 7/20/12



Legend

□10	Surface Sample Location - TCEQ
△LF1	Surface Sample Location - Exide
⊕LF-01	Soil Boring
▨	Test Pit Location
- - - -	Landfill Cell Boundaries
#	Landfill Cell Numbers
▨	Area to be Excavated
⬟	Confirmation Sample Location

0' 50' 100'
APPROXIMATE SCALE

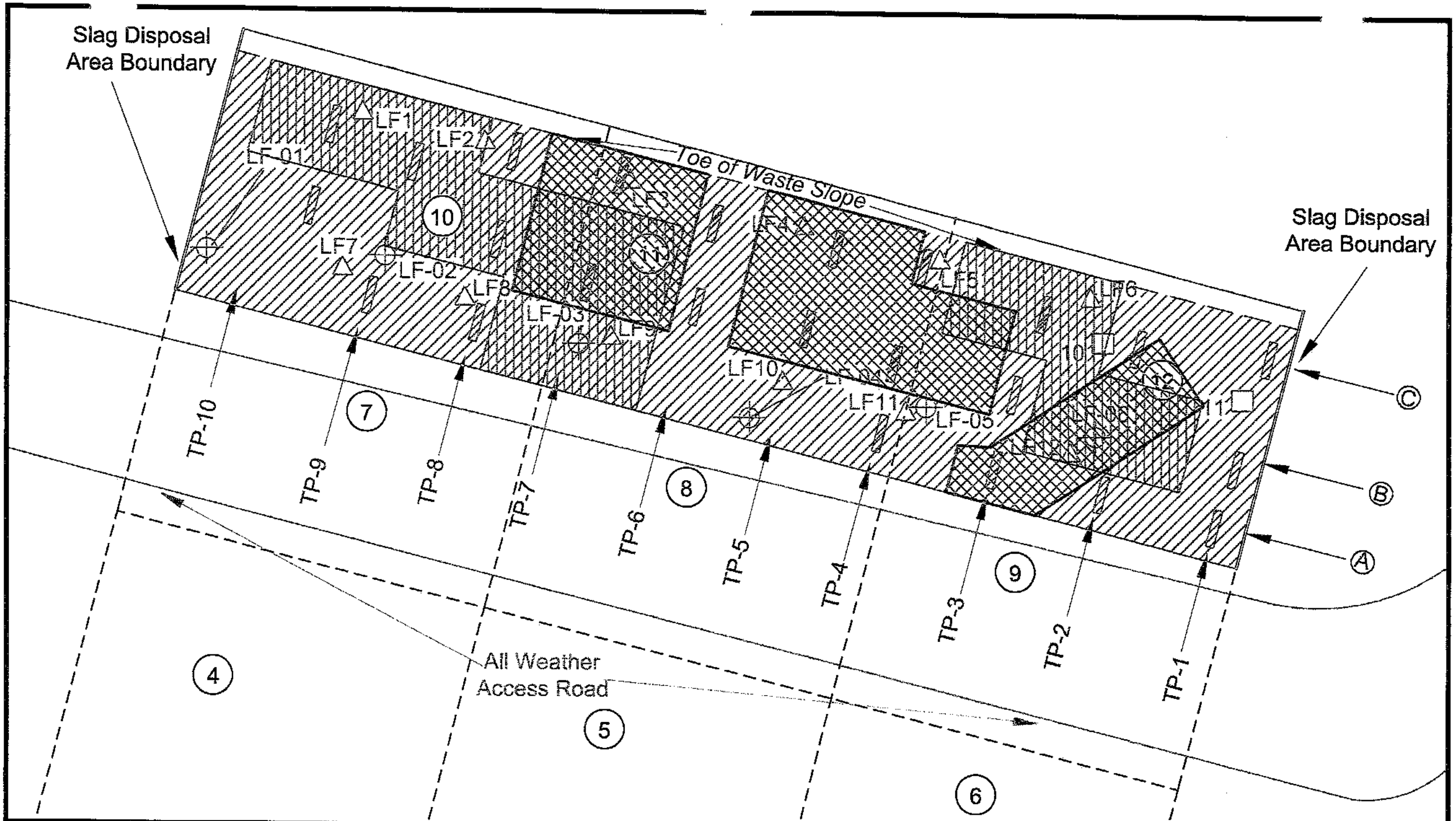
N

Note: All Completed Locations Marked in **Solid Red** Contain at Least One Sample That Exceeds UTS for Lead at an interval >2 feet

Figure 4
Area of Excavation
> 2'
7471 South 5th Street
Frisco, Texas

W&M Environmental Group, Inc.
www.wh-m.com

12/21/11	W&M Project No. 112.059		Drawn by: SF	Revision: 1/31/12



Legend

$\square_{10}$	Surface Sample Location - TCEQ
$\triangle_{LF1}$	Surface Sample Location - Exide
$\oplus_{LF-01}$	Soil Boring
▨	Test Pit Location
-------	Landfill Cell Boundaries
(#)	Landfill Cell Numbers

0' 50' 100'
APPROXIMATE SCALE

N

Figure 5
Area of Excavation

7471 South 5th Street
Frisco, Texas

W&M ENVIRONMENTAL GROUP, INC.
www.wh-m.com

12/21/11	W&M Project No. 112.059		Drawn by: SF	Revision: 1/31/12

CONCEPTUAL SUBSURFACE PROFILE OF ANALYTICAL RESULTS

ATTACHMENT 1

CONCEPTUAL PROFILE
TEST PIT ROWS A, B and C

ROW A

Location	TP-1A		TP-2A		TP-3A		TP-4A		LF-04		TP-6A		LF-03		TP-8A		TP-9A		LF-01	
Depth (ft)	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb
0 - 0.5																				
0 - 2																				
2 - 4																				
4 - 6																				
6 - 8																				
8 - 10																				
10 - 12																				
12 - 14																				

ROW B

Location	TP-1B		LF-06		TP-3B		TP-4B		TP-5B		TP-6B		TP-7B		TP-8B		LF-02		TP-10B	
Depth (ft)	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb
0 - 0.5																				
0 - 2																				
2 - 4																				
4 - 6																				
6 - 8																				
8 - 10																				
10 - 12																				
12 - 14																				

ROW C

Location	TP-1C		TP-2C		TP-3C		TP-4C		TP-5C		TP-6C		TP-7C		TP-8C		TP-9C		TP-10C	
Depth (ft)	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb	Cd	Pb
0 - 0.5																				
0 - 2																				
2 - 4																				
4 - 6																				
6 - 8																				
8 - 10																				
10 - 12																				
12 - 14																				

- Sample above UTS
- Sample below UTS
- Protective Soil Layer (Clay)

Note: Where actual sampling depths spanned the typical intervals depicted, both cells have been highlighted (e.g. 3'-5' sample at TP-5C includes cells for 2'-4' and 4'-6').

WASTE STABILIZATION PLAN
(REMEDIATION SERVICES, INC.)

APPENDIX A

WASTE STABILIZATION PLAN

For

Response Actions
at
Class 2 Non-Hazardous Waste Landfill
Exide Technologies, Inc.
Frisco, Texas

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620-331-1200

December 7, 2012

Reviewed By:

W&M Environmental Group, Inc.

TABLE OF CONTENTS

FIGURES

APPENDICES

1.0 INTRODUCTION

Remediation Services, Incorporated (RSI), an environmental remediation firm located in Independence, Kansas, has been contracted by Exide Technologies Inc., to develop a Waste Stabilization Plan (WSP) for the treated slag remediation project to be conducted at the Exide Technologies facility located at 7471 South 5th Street, Frisco, Texas (Facility or Site). This document outlines the procedures that will be used to implement stabilization of slag that exceeds the Universal Treatment Standard (UTS) for lead and/or cadmium. This document also includes a detailed description of the stabilization process proposed for the Site. Implementation of the stabilization activities will be conducted by RSI.

The objective of this WSP is to provide a detailed overview of the proposed stabilization methodology, including the equipment and reagent to be used during the re-treatment process. A *Site Safety & Health Plan (SSHP)* developed for the work has been prepared and is attached.

Separate plans developed for the response actions are described below:

- *Dust Control Plan* describing methods and procedures to control dust associated with the slag handling and re-treatment activities;

- *Sampling and Analysis Plan (SAP)* that includes a *Quality Assurance Project Plan (QAPP)* discussing overall sampling and laboratory quality assurance issues; and,

- *Perimeter Air Monitoring Plan* to monitor dust levels at or near the property boundaries during remediation activities.

Upon completion of this project a *Response Action Completion Report (RACR)* will be prepared by W&M Environmental Group, Inc., (W&M), documenting the remediation activities.

2.0 IDENTIFICATION OF MATERIAL TO BE TREATED

The material to be stabilized is treated slag placed within the Class 2 non-hazardous waste landfill located in the northeastern portion of the Site. Areas of concern were identified during extensive investigations completed in the landfill and are described in the March 2012 report titled "*Results of Non-Hazardous Waste Landfill Investigation, Exide Technologies, Inc. North Landfill*", prepared by W&M.

Based on the landfill investigations, the chemicals of concern (COCs) are lead and cadmium. These investigations identified levels of lead and cadmium in the slag which exceeds the UTS of 0.75 mg/L for lead and 0.11 mg/L for cadmium when subjected to the Toxicity Characteristic Leaching Procedure (TCLP). The *Response Action Work Plan (RAWP)* dated December 7, 2012 describes the location of the material requiring re-treatment as being located principally within the upper two (2) feet of the active cells of the landfill, with three (3) discrete areas requiring removal at greater depths.

3.0 PROPOSED REMEDIATION PROCEDURE

3.1 Overview

Previous Site investigations indicate approximately 4,000 cubic yards of treated slag placed within the on-Site Class 2 non-hazardous waste landfill may exceed the UTS for lead and/or cadmium and will require on-Site re-treatment. The proposed re-treatment process will treat the excavated slag waste material to below the UTS for both lead and cadmium. Post re-treatment to levels meeting the UTS, the stabilized material will be placed back into the landfill.

If confirmation sampling within the landfill indicates that additional areas of slag require re-treatment, provisions will be made to have the capacity (i.e. equipment and treatment chemicals) to treat this additional material.

The proposed on-Site re- treatment of slag that exceeds the UTS for lead and cadmium will consist of permanent stabilization of the slag using Free Flow 100®. This is the same material that is currently used by Exide on a daily basis to treat slag generated at this facility. With careful mixing and adequate confirmation sampling, RSI can ensure the re-treated material will satisfy the land disposal criteria. Information regarding Free Flow 100® is included in Appendix A.

Portions of lined, active landfill will be used for staging the temporary storage and processing of the excavated materials. At the onset of the excavation activities, all slag materials in the western end of the landfill that require re-treatment will be removed and placed on the eastern end of the active cells pending re-treatment in order to accommodate space constraints and response action sequencing (the Initial Excavation). Materials from the Initial Excavation will be re-treated and will be sampled to demonstrate that land ban criteria are met, and returned to the disposal area within a period of less than 90 days from the date of the Initial Excavation. Materials that are excavated following the Initial Excavation are expected to be re-treated on the same day they are excavated, and are expected to be sampled and demonstrate that land ban criteria are met and returned to the disposal area within seven days of excavation. Dust suppression measures detailed in **Appendices B** and **C** to the RAWP will be implemented to prevent fugitive dust emissions associated with the storage and re-treatment activities. Stockpiles of the re-treated slag material will be placed directly on 6 mil polyethylene sheeting and weighted down by sandbags when not in active use and at the end of each day. Conducting these temporary activities within the confines of the landfill is intended to facilitate a reliable, effective and protective response by eliminating the potential generation of dust associated with transportation of the material for storage and re-treatment. Areas where any re-treatment activities occur will undergo confirmation sampling to confirm that the material in place meets the land ban criteria. The temporary staging stockpiles and the re-treatment activities have been designed to prevent releases of hazardous constituents or wastes into the environment, and to minimize and adequately control cross-media transfer, as necessary to protect human health and the environment. The design of the re-treatment activities and the temporary staging stockpiles is described in Section 3.3.3.

As previously noted, it is expected that storage, processing and re-disposal of excavated materials will occur within seven days of excavation, with the exception of materials from the Initial Excavation, for which such storage, processing and re-disposal activities will occur within less than 90 days of excavation. Exide will maintain documentation of the date upon which accumulation of any excavated material begins and the date the material is re-disposed of in the landfill following re-treatment. In no event shall the accumulation period of excavated materials exceed 30 days, other than materials from the Initial Excavation, which shall have an accumulation period of less than 90 days.

3.1.1 Equipment

The equipment will be mobilized from the RSI yard in Independence, Kansas or obtained from local equipment vendors. Specification sheets/descriptive literature for the proposed equipment are included in Appendix B.

The equipment to be utilized during the treatment process includes the following:

Excavation	Caterpillar 324EL Excavator Caterpillar 950H Loader Caterpillar 938H Loader Box Type Low Noise Demolition Hammer Caterpillar 25 ton Off Road Haul Truck
Stabilization	Bomag MPH 364R Reclaimer or equivalent
Dust Control	Ford F 750 - 2,000 Gallon Water Truck(s) Dust Boss Model DB 60, or equivalent
Particle Sizing	Antraquip Hydraulic Cutter
Placement of Stabilized Slag	Caterpillar 950H Loader Caterpillar 25 Ton Off-Road Haul Truck or equivalent John Deere 550 Dozer or equivalent

3.1.2 Equipment Decontamination

An equipment decontamination area will be constructed within the active landfill at the southwest corner in the stabilized slag staging area. The decontamination area will be constructed after the slag in this area has been removed and samples collected confirm the results are less than the UTS for lead and cadmium. Berms will be constructed around the perimeter utilizing stabilized slag that meets the treatment standards. The decontamination area will be large enough to accommodate the largest piece of equipment that will be used during the stabilization process. The area will be graded to drain to one corner to allow the fluids generated during decontamination to be removed. A 40-mil high density polyethylene (HDPE) liner will be placed over the graded area extending over the berms. The HDPE liner will be anchored in at the bottom of the berms to prevent it from becoming windblown. Timbers will be installed over the HDPE liner to protect it from the tracks and tires of the heavy equipment during the decontamination activities.

The equipment will be decontaminated using potable water and high pressure washers. The decontamination fluids will be pumped out of the lined decontamination area into a tank and transferred to the Facility on-Site wastewater treatment facility for treatment and discharge in compliance with the Facility's Industrial User

Wastewater Discharge (IUWWD) Permit. The decontamination pad will be covered during periods of inactivity and during storm events with poly sheeting weighted with sandbags.

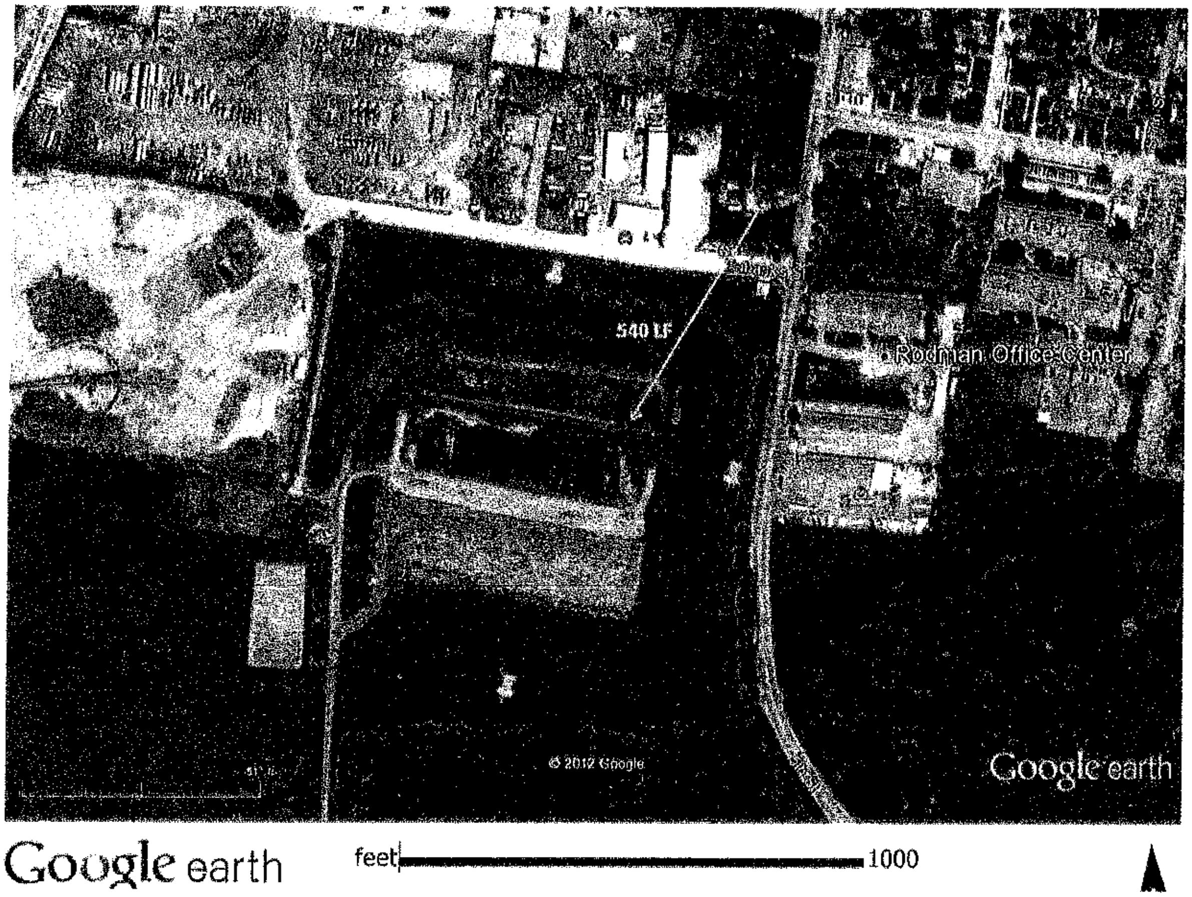
During the stabilization activities, decontamination residue will be placed with material requiring treatment. At the completion of the work, the sediments will be removed and transferred to the existing slag treatment area at the Facility for treatment. The liner will be decontaminated using high pressure water which will subsequently be collected and transferred to the Facility's on-Site wastewater treatment facility for treatment and discharge in compliance with the Facility's IUWWD Permit. Once decontamination is complete, the liner will be transferred to the Facility's operational area for characterization, storage and disposal in accordance with local, state and federal requirements.

Three grab samples will be collected from beneath the decontamination area and analyzed for TCLP lead and cadmium. Should any of the results exceed the UTS for either metal, six (6) inches of material underlying the decontamination area will be removed and transferred to Exide for treatment and additional grab samples will be collected and analyzed. This process will be repeated as required until the grab samples exhibits less than the UTS for lead and cadmium.

3.1.3 Noise Levels

All of the equipment to be utilized will be late model or new equipment used on general construction and earthmoving projects on a daily basis. The specification sheets for the equipment that will be utilized are included in Appendix B. The closest occupied properties to the landfill are commercial properties, an aggregate supplier located northwest of the landfill and Rodman located northeast of the landfill. The noise levels expected with the stabilization activities are consistent with the noise levels associated with the neighboring operations and are not expected to increase the current noise level. The closest residence is approximately 540 feet NNE of the North landfill (see Figure 1). Background noise monitoring will be performed during the background air sampling phase of work.

Figure 1
Residence Location Map



3.1.4 Noise Mitigation

Although not expected to be necessary, if the noise monitoring between the Site boundaries and the residences or businesses to the north and east exceeds 85 decibels (dba) during the initial Site activities, a noise abatement barrier will be installed prior to continuing work. The noise barrier will be constructed by installing an eight (8) ounce fabric on the inside of temporary 6' chain link fence. Additional noise monitoring will be performed on the next working day. If the additional noise monitoring continues to exceed 85 dba between the Site boundaries and the residences or businesses, additional noise mitigation measures will be undertaken including the consideration of the construction of an earthen berm inside of the boundary fence.

3.1.5 Schedule for Site Activities

A project schedule will be prepared prior to the start of work. The schedule will be based upon working six (6) days per week beginning approximately one (1) to two (2) weeks from approval of the *Response Action Work Plan* and receipt of any other authorizations required for the proposed activities. Site operations will be conducted from 7AM until 5PM.

3.2 Summary of Free Flow 100® Chemistry

Free Flow 100® is a proprietary blend of stabilizing reagents manufactured by Free Flow Technologies, Ltd. of Machesney Park, Illinois that ensures long term stability of heavy metals in waste across a wide range of pH values (www.freeflowtech.com). Free Flow 100® uses a combination of phosphate, carbonate and hydroxide fixation chemistry. Although the addition of water is not required at the time of treatment, when free water in the soil matrix or percolating rain water comes into contact with waste or soil stabilized with Free Flow 100®, phosphates are immediately released to initiate fixation reactions with elevated concentrations of lead by forming insoluble lead phosphates, for example:

$$Pb^{+2}_{(aq)} + HPO_4{}^{-2}_{(aq)} \rightarrow PbHPO_{4\,(s)} \quad K_{sp} = 3.7 \times 10^{-12}$$

Over time, lead will be further converted into the mineral hydroxypyromorphite [$Pb_5(PO_4)_3OH$] (K_{sp}~ $5x10^{-77}$) where the lead is completely locked within the insoluble matrix of the mineral.

Other metals will be converted into stable carbonate or hydroxide compounds, depending on the least soluble form of the metal. For example, cadmium is stabilized as a phosphate.

$$Cd^{+2}_{(aq)} + HPO_4{}^{-2}_{(aq)} \rightarrow CdHPO_{4\,(s)} \quad K_{sp} \sim 4 \times 10^{-13}$$

Two (2) representative samples of the slag that requires treatment were submitted to Free Flow Technologies, Ltd. for a treatability study to determine the dosage required to properly stabilize the slag. Testing was carried out using the treatment formula currently used by the facility Exide facility, i.e., 6% Free Flow 100®, as well as using different combinations of Free Flow 300®. Based upon this treatability study, 6 % Free Flow 100® by weight of slag will be used in the treatment process. The results of the treatability study are included in Appendix A.

Additional information relative to the Free Flow 100® is included in Appendix A.

3.3 Material Handling Plan

Descriptive brochures of the heavy equipment to be utilized during the project are included in Appendix B.

3.3.1 Storm Water Management

The north landfill is constructed with perimeter berms to prevent stormwater from surrounding areas from flowing into the active landfill. The only water that enters the landfill is from precipitation that falls directly into the landfill footprint. Waste materials are placed in the landfill to provide positive flow of storm water into a collection point at the northwest corner end of the active landfill and above the landfill liner. Storm water from this collection area is captured and pumped to the lined solar evaporation pond directly west of the landfill. The water is allowed to either evaporate in this pond or is pumped to the on-Site wastewater treatment plant for treatment and discharge in compliance with Exide's IUWWD Permit. These methods are consistent with existing practices for stormwater management associated with landfill operation and are in accordance with the Facility's Multi-Sector General (MSG) Permit and Best Management Practice (BMP) Plan.

3.3.2 Grade Control

The landfill surface will be profiled on 25-foot centers to establish the baseline grades of the landfill using a GPS or laser based survey system. The base line survey will be used to verify and control the depth of excavation of each treated lift.

3.3.3 Stockpile Areas

The upper two (2) feet of the slag beginning at the west boundary and proceeding east approximately 75 feet will be removed and spread in a one-foot lift over the top of the slag to the east. Based upon previous samples collected, this should remove all of the contaminated slag from this area. Confirmation samples will be collected and analyzed after the material has been removed as described in the SAP/ QAPP to confirm that the remaining material meets the UTS. This remediation will allow stabilized material to be stockpiled in this area and loaded out without the possibility of removing material which does not meet the UTS.

Excavated slag in stockpile areas will be placed in temporary piles following re-treatment. The height of the temporary piles will be kept to a minimum (no greater than 10 feet), with a maximum volume of 50 cubic yards each. The excavated slag in the temporary piles will be placed on 6 mil polyethylene sheeting and will be covered with 6 mil polyethylene sheeting and weighted down by sandbags at the end of each day or when not in active use. No temporary pile of treated slag will remain in the stockpile areas more than 30 days other than temporary piles for the Initial Excavation, which will remain in the stockpile areas no more than 90 days.

3.3.4 Stabilization

RSI proposes to perform stabilization of the slag within the confines of the active landfill. The slag will be mixed with Free Flow 100 ® by use of a pulvimixer, temporarily stored, and analyzed to ensure the stabilization has been successful and the re-treated slag meets the UTS. The resulting stabilized slag will then be placed back into the landfill.

The required stabilization reagent, as a percentage of waste by weight, will be known based upon the treatability study. The weight of the raw slag will be verified in the field by weighing a container with a known volume.

The stabilization reagent will be delivered to the site in one ton bags. Grids will be established and marked in the field to represent a treatment grid. The treatment grid will be broken down into sub grids to represent the area that each bag of reagent will cover.

An example of a treatment grid follows:

110 ft. x 110 ft. x 1 ft. Thick Grid =	448 cubic yards
Assuming a slag density of 4,000 lbs. per cubic yard =	896 tons
Assuming reagent required at 6% by weight of slag =	54 tons
Each one ton bag of reagent will cover an area of	224 square feet

A clean loader/forklift will be used to transfer the reagent from the storage area to the landfill area. Another loader/forklift, which is dedicated for use inside of the active landfill, will be used to spread the reagent. The bags that the reagent is delivered in are manufactured with bottom opening chutes which allow the reagent to be spread close to the surface which minimizes the generation of dust and allows the material to be spread evenly over the grid. The empty bags will be placed in a roll off container for off-Site transportation and disposal as a non-hazardous waste.

Once the reagent has been spread over the grid, the pulvimixer will be used to mix the reagent and the slag. A descriptive brochure of the pulvimixer is included in Appendix B. The pulvimixer is a large industrial tiller that is used daily in the road construction industry to mix lime and other stabilization materials for soil stabilization of roads, parking lots and building slabs. The depth of the mixing is set by lowering the mixing drum upon which the mixing teeth are mounted. The drum is attached to an indicator that allows the operator to gauge the mixing depth. The mixing depth behind the machine will be verified by measuring the depth of mixing after the machine has made the first pass. Two passes will be completed over each treatment grid. The second treatment pass will be completed parallel to the first.

Once the stabilization activities described above have been completed for a grid, the stabilized waste will be excavated using a hydraulic excavator equipped with a smooth edge bucket. Excavation depth will be controlled as described above. The stabilized material will be placed into a haul truck and transported to the stockpile area. The haul truck will dump near the area designated for each stockpile onto 6-mil polyethylene sheeting. A loader equipped with electronic totalizing bucket scale will be used to construct the 50 cubic yard stockpiles based upon the weight of the slag. Each stockpile will be sampled and covered with 6-mil plastic sheeting which will be weighted with sandbags. The stockpiles will be identified by marking the sample number on the stockpile cover and a pin flag inserted into the stockpile below the cover. The sampling and analysis for the stabilized slag is provided in the QAPP and SAP.

3.3.5 Milling and Sizing of Hard Slag

A milling head attachment mounted on a hydraulic excavator will be used to remove approximately 450 cubic yards of hard, cement-like slag that is located greater than 2 feet below the surface and requires re-treatment. This type of machine is used to remove rock and other hard materials in the construction and mining industries. A descriptive brochure for this piece of equipment is included in Appendix B. The operation of the milling attachment will reduce the size of the hard slag as it is being removed. The milled material will be immediately transported to the stabilization area for retreatment as described above. Hard slag material overlying the slag that requires retreatment will be broken utilizing a demolition hammer, removed with the excavator and stockpiled adjacent to the excavation.

All milling and breaking of hardened slag material will be completed using appropriate dust suppression techniques as described in the *Dust Control Plan*. All stockpiles will be covered with 6-mil poly sheeting when material is not being actively added to or removed from the stockpile.

3.3.6 Stabilized Slag Placement

Analysis for each stockpile will be reviewed by Exide, RSI and W&M prior to removal from the stockpile area or bulking to insure that it meets the treatment standards and the quality assurance/quality control (QA/QC). It is anticipated that approximately 1,000 – 1,500 cubic yards of stabilized waste will be bulked together in several stockpiles within the stockpile area until enough waste has been removed and stabilized to allow placement. These stockpiles will also be no greater than ten (10) feet high and will be covered with 6-mil poly sheeting when material is not being actively added to or removed from the stockpiles.

Stabilized slag which meets the land disposal criteria for lead and cadmium (i.e., <0.75 mg/L lead and / or 0.11 mg/L cadmium) will be placed back into the active landfill. The stockpile cover poly sheeting will be removed and staged for reuse or placed into a rolloff container for offsite disposal. Stabilized slag, that has been previously approved for replacement will be loaded into an off road haul truck, transported to the placement area, dumped and spread with a bull dozer. The material will be compacted with the tracks of the bulldozer. Active dust suppression will be completed during these activities as described in the *Dust Control Plan.* Used poly sheeting will be sampled and analyzed for TCLP lead and cadmium to insure it meets the UTS prior to off-Site disposal.

Overburden materials will be replaced using the same methodology.

3.4 Health and Safety

The health and safety of our employees is paramount to RSI and Exide. The personnel protective measures and air monitoring to be used during the work at this Site are detailed in the SSHP included as Appendix C.

APPENDIX A

FREE FLOW 100®

& TREATABILITY STUDY RESULTS

Free Flow Technologies, Ltd.

866-677-0166

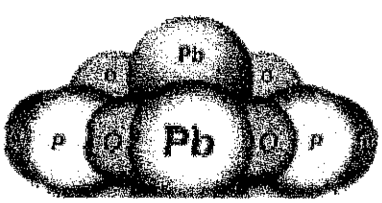
Heavy Metals Treatment Products

We offer stabilization reagent products for permanent treatment of heavy metals contaminants. Our products have been successfully used by municipal, state, federal and private sector clients for more than a decade to treat heavy metals contamination.

Free Flow Chemistry

Free Flow Technologies, Ltd. offers a variety of reagent blends that are specially developed to reduce the mobility of heavy metals in contaminated materials.

The Free Flow family of reagents utilize reactive anions to fixate metals by converting them into insoluble minerals. Special additives further bind and lock the metals within an oxide lattice structure that is stable across a variety of adverse chemical conditions.



The Free Flow chemistry has been utilized throughout the United States and has proved to be effective on RCRA metals. The combined additives form a blend that prevents leaching in all types of environments. The blends pass the SPLP, TCLP and MEP, which is the EPA approved method for determining the long term stability of treated waste.

The Free Flow blends have been approved for use in remediation projects directed by the U.S. Army Corps of Engineers, USEPA, DOD, U.S. Navy, and various state agencies.

Free Flow 100®

Nonreversible chemical fixation chemistry for effective RCRA heavy metals stabilization.

Free Flow 100-FS

An alternative to the standard Free Flow 100 blend. Nonreversible chemical fixation chemistry for effective RCRA heavy metals stabilization.

Free Flow 200

Non-phosphate chemistry for effective stabilization of lead in soil and sludges. Free Flow 200 is also effective for stabilization of acidic waste materials cleanups.

Free Flow 300

New!

A new blend that provides a broader range of effective treatment for RCRA metals under a variety of onsite conditions.

Custom Blends

Custom blended heavy metals treatment reagents for...

Site Map | **Privacy Policy**

Free Flow Technologies, Ltd.

9918 N. Alpine Road
Machesney Park, IL 61115
Toll Free: 866-677-0166
Tel: 815-636-0166
Fax: 815-636-0560
www.freeflowtech.com

Summary of Free Flow 100® Chemistry

Free Flow 100® is a proprietary blend of stabilizing reagents that fixates heavy metals in waste across of wide range of pH values using a combination of phosphate, carbonate, and hydroxide fixation chemistry. When water comes into contact with waste or soil stabilized with Free Flow 100®, phosphates are immediately released to initiate fixation reactions with elevated concentrations of lead by forming insoluble lead phosphates, for example:

$$Pb^{+2}_{(aq)} + HPO_4{}^{-2}_{(aq)} \rightarrow PbHPO_{4\,(s)} \quad K_{sp} = 3.7 \times 10^{-12}$$

Other metals will be converted into stable carbonate or hydroxide compounds, depending on the least soluble form of the metal. For example, cadmium is stabilized as a phosphate.

$$Cd^{+2}_{(aq)} + HPO_4{}^{-2}_{(aq)} \rightarrow CdHPO_{4\,(s)} \quad K_{sp} \sim 4 \times 10^{-13}$$

FF-100®

Free Flow 100 (FF-100®) chemistry is utilized throughout the United States in both fixed-based applications and remediation projects for the stabilization of heavy metals in contaminated waste materials and soils. The chemistry is effective on a variety of RCRA metals and most frequently used to stabilize lead, cadmium, barium and chromium. The chemistry is capable of achieving results below the universal treatment standard and produces a stabilized material with long-term stabilization characteristics.

Physical Properties

- **Molecular Formula:** Mixture
- **Appearance:** Brown granular material
- **Density:** 80—85 lbs. per cubic foot
- **pH:** 6.0—12.0
- **Flashpoint:** Noncombustible
- **Odor:** None

Typical Sieve Analysis %

Passing 20 Mesh	90%
Passing 40 Mesh	65%
Passing 100 Mesh	27%
Passing 200 Mesh	5%

Advantages

- **Custom Blending / Packaging**
- **User Friendly Chemistries**
- **Cost Effectiveness**
- **Reduced Application Rate**

Free Flow - Rockford, L.L.C.
A Free Flow Technologies, Ltd. Company

MATERIAL SAFETY DATA SHEET

SECTION 1 – CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MSDS Name:	**Free Flow 100®** **Free Flow 300**
Product CAS:	None

Company Identification:

Free Flow Technologies, Inc.
9918 N. Alpine Road
Machesney Park, Illinois 61115

For information call: (815) 636-0166 or (866) 677-0166
Emergency Contact: Mike Slattery
Fax: (815) 636-0560

MSDS Effective: 12/28/11
Supersedes: NA

SECTION 2 – COMPOSITION, INFORMATION ON INGREDIENTS

Chemical Name	CAS	Approximate % (w/w)
Phosphate Compounds	7758-23-8	5 - 80
Magnesium Oxide	1309-48-4	5 - 80
Calcium Oxide	1305-78-8	10 - 60
Sulfur	7704-34-9	10 - 25
Silicon Dioxide	60676-86-0	5 - 10
Aluminum Oxide - Non- fibrous	1344-28-1	1 - 5
Iron Oxide	1309-37-1	1 - 5

SECTION 3 – HAZARDS IDENTIFICATION

Hazards Ratings	HMIS
Health	1
Fire	0
Reactivity	1
Special Protection	E

POTENTIAL HEALTH EFFECTS

Target Organs: Eyes, respiratory passages, skin, digestive tract. Pre-existing respiratory diseases including asthma and emphysema may also be aggravated.

Eye: May cause irritation/inflammation and tissue damage.

Skin: May cause irritation and alkaline burns to moist skin.

SECTION 3 – HAZARDS IDENTIFICATION (CONT.)

Ingestion: May cause ulceration to the digestive tract.

Inhalation: May cause irritation/inflammation to nasal and upper respiratory passages. Inhalation of magnesium oxide fumes may cause metal fume fever, however no evidence of metal fume fever resulting from industrial exposure to magnesium oxide fume has been found. Symptoms of metal fume fever include; cough, tightness of chest, sweating, headache, fever, muscle aches, nausea, vomiting and tiredness.

SECTION 4 – FIRST AID MEASURES

Eye: Flush eyes with water while lifting lids for at least 10 minutes. Seek medical attention.

Skin: Wash skin with soap and water, remove contaminated clothing and shoes. If irritation develops, seek medical attention.

Ingestion: Dilute with water, fruit juice or vinegar. Seek medical attention.

Inhalation: Remove to fresh air, if irritation develops, seek medical attention.

SECTION 5 – FIRE FIGHTING MEASURES

Unusual Fire and Explosion Hazards: Noncombustible

Special Fire Fighting Procedures: Do not use water on adjacent fires. Extinguish adjacent fires with dry chemical or CO_2. Water reacts exothermically with magnesium oxide to produce magnesium hydroxide and heat/steam. Avoid water contact in closed or restricted storage vessels as heat, swelling, and rupture of storage vessel may occur.

Extinguishing Media:	N/A	Flammable Limits		
Auto ignition Temperature:	N/A		Lower Limit:	N/A
Flash Point:	N/A		Upper Limit:	N/A

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Disposal: Dispose as a non-hazardous solid waste in accordance with all Local, State and Federal regulations.

Spills/Leaks: Use appropriate protective equipment while using dry cleanup methods (sweep/shovel) which minimize dusting. Reclaim in watertight containers for disposal. Use personal protective equipment as required.

SECTION 7 – HANDLING AND STORAGE

Handling: Avoid inhalation of dust. Clean area frequently to avoid dust build-up. Wear applicable personal protective equipment when handling.

Storage: Store in a dry area in sealed containers. Keep away from incompatible materials such as interhalogens and strong acids. Avoid contact with water – product reacts exothermically with water to form magnesium hydroxide and heat/steam. Water contact in closed or restricted storage vessels may cause heat swelling and possible rupture of storage vessel.

SECTION 8 – EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls: Use general and local exhaust to keep dust levels within acceptable limits. Local exhaust ventilation with or without process enclosure is important where large quantities are handled, as in bagging operations.

Eyes: Wear safety goggles in high dust concentrations, unless full face-piece respiratory protection is worn.

Skin: Wear long sleeves, gloves, and pant cuffs over shoes to minimize skin contact.

Respirators: Use NIOSH approved dust respirator when exposure limits exceeded. If magnesium oxide fume is likely to be produced then ensure that a NIOSH/MSHA respirator approved for fumes is used. In conditions of oxygen deficiency, or where airborne concentrations exceed 100 mg/m^3, wear positive pressure or pressure demand supplied air respiratory protection or SCBA.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	White-gray-tan powder.	Boiling Point:	N/A
Odor:	No odor.	Freezing Point:	N/A
Physical State:	Solid	Melting Point:	Approx. 2800^{0}C
pH:	11.0 – 12.0	Decomposition Temp.:	N/A
Vapor Pressure:	N/A	Specific Gravity:	3.09
Vapor Density:	N/A	Molecular Formula:	Mixture
Evaporation Rate:	N/A	Available Lime:	30.0 percent
Viscosity:	N/A		
Water Solubility (@20^{0}C):	0.0006 g/100m		

SECTION 10 – STABILITY AND REACTIVITY

Chemical Stability: Stable, keep dry.

Incompatibility: Avoid contact with water. Contains calcium oxide and magnesium oxide and may react with water, strong acids, interhalogens, or phosphorous pentachloride to produce sufficient heat to ignite combustible materials.

Hazardous Decomposition Products: Magnesium fume may be generated if heated to volatilization. Heat and steam may be generated upon contact with water. Could possibly release minor amounts of irritating fluoride if heated to extreme temperatures.

Hazardous Polymerization: Does not occur.

Conditions to Avoid: Extreme temperatures and contact with water.

SECTION 11 – TOXICOLOGICAL INFORMATION

Toxicological Information:

Component	Formula	% Wt.	CAS	PEL	TLV
Phosphate Compounds	$Ca(H_2PO_4)_2H_2O$	5 – 80	7758-23-8	Not established	Not established
Magnesium Oxide	MgO	5 – 80	1309-48-4	15 mg/m^3	10 mg/m^3
Calcium Oxide	CaO	10 – 60	1305-78-8	5 mg/m^3	2 mg/m^3
Sulfur	SO_3	10 – 25	7704-34-9	15 mg/m^3	10 mg/m^3
Silicon Dioxide	SiO_2	5 – 10	60676-86-0	0.1 mg/m^3*	0.1 mg/m^3*
Aluminum Oxide	Al_2O_3	1 - 5	1344-28-1	10 mg/m^3+	10 mg/m^3+
Iron Oxide	Fe_2O_3	1 - 5	1309-37-1	15 mg/m^3	5 mg/m^3

* Respirable Dust
+ 5 mg/M^3 as Respirable Fraction

Silicon Dioxide and Iron Oxide are listed by IARC as potential carcinogens.

SECTION 12 – ECOLOGICAL INFORMATION

Ecological Information: None available

SECTION 13 – OTHER PRECAUTIONS

Other Precautions: None

SECTION 14 – TRANSPORT INFORMATION

DOT Label No: N/A

SECTION 15 – REGULATORY INFORMATION

SARA Title III - Section 302 Extremely Hazardous Material - None

SARA Title III – Section 31/312 – Hazard Categories:
Fire Hazard – No
Sudden Release of Pressure – No
Reactivity Hazard – Yes
Immediate Health Hazard – Yes
Delayed Health Hazard - Yes

SARA Title III – Section 313 - This material is not subject to the toxic chemical reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Toxic Substance Control Act (TSCA) Inventory List 8(b) – Yes
Magnesium Oxide
Calcium Oxide
Aluminum Oxide
Iron Oxide

SECTION 16 – ADDITIONAL INFORMATION

Information herein is based on data believed to be accurate at the time of the preparation. No warranty or representation, express or implied, is made to the accuracy or completeness of the MSDS. No responsibility can be assumed by vendor for any damage or injury resulting from misuse, failure to follow recommended practices, or from any hazards inherent in the nature of the product.

Bench Scale Testing Results
Free Flow Technologies, Ltd.
Exide Treated Slag
Frisco, Texas

Chemical Name	Regulatory	12/9/2011		6/19/2012		6/19/2012 [3]		6/26/2012				7/5/2012
	UTS Criteria	Raw Samples [1]		TP - 5C +	TP - 7C +	TP - 5C +	TP - 7C +	TP - 5C +	TP - 5C +	TP - 5C +	TP - 5C +	TP - 7C +
		TP - 5C (0-0.5')	TP - 7C (0-0.5')	10% FF-300	10% FF-300	10% FF-100 (Modified 50/50)	10% FF-100 (Modified 50/50)	6% FF-300	8% FF-300	8% FF-100 60/40	8% FF-100	6% FF-100
	(mg/l unless othewise noted)	(mg/l unless othewise noted)	(mg/l unless othewise noted)	(mg/l unless otherwise noted)	(mg/l unless otherwise noted)	(mg/l unless othewise noted)	(mg/l unless othewise noted)	(mg/l unless othewise noted)	(mg/l unless othewise noted)	(mg/l unless othewise noted)	(mg/l unless othewise noted)	(mg/l unless othewise noted)
TCLP Metals												
Cadmium	0.11	1.92	1.27	0.036	0.002	0.072	[illegible]	<0.001	<0.001	<0.001	0.013	0.033
Lead	0.75	48	7.76	<0.002	<0.002	0.062	0.124	0.022	0.279	<0.002	<0.002	<0.002
Initial pH (unitless)				5.51	9.43	2.84	2.72	2.76	3.19	3.70	2.40	2.65
Extraction fluid				Fluid 2	Fluid 2	Fluid 1	Fluid 1	Fluid 1	Fluid 1	Fluid 1	Fluid 1	Fluid 1
Final pH (unitless)				8.32	9.51	7.33	7.06	10.22	10.97	10.77	8.20	8.10

NOTES:

1 Samples of treated slag from test pits excavated by W&M Environmental Group in Exide North Landfill in December 2011; analytical results from testing by Oxidor Laboratories in Plano, Texas.

2 FF-100 is Free Flow 100 proprietary stabilizing agent, FF-300 is Free Flow 300

3 Tests of 6/19/12 were completed using an experimental mixture of 50/50 ash/phosphate to stabilize the metals. This trial was unsuccessful for this material.

Passing Result

Failing Result

APPENDIX B

REMEDIATION EQUIPMENT SPECIFICATIONS

APPENDIX B

REMEDIATION EQUIPMENT SPECIFICATIONS

BOMF , 364 F

2011 Bomag MPH364R

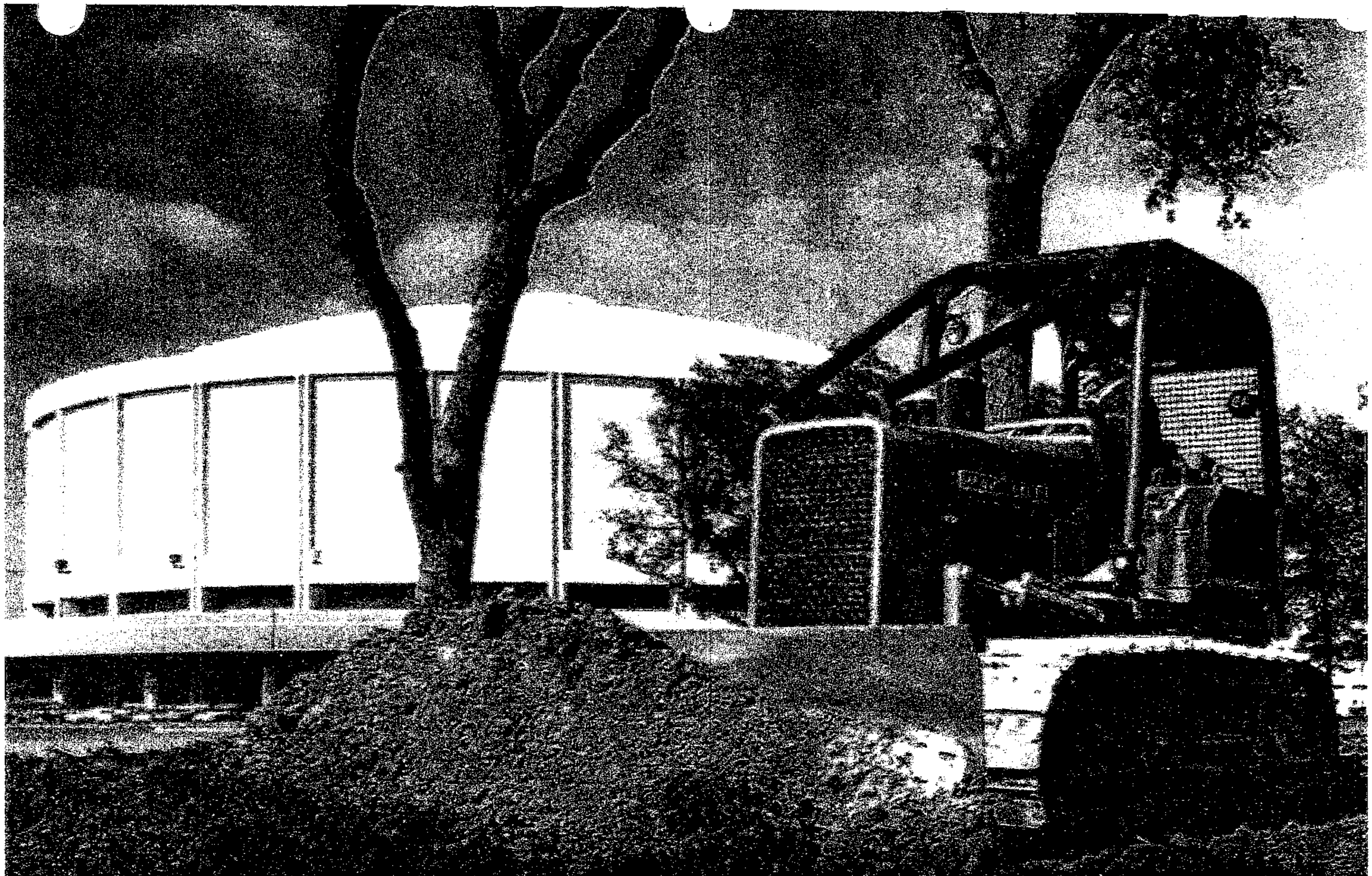
Cummins Qsm11-360 Hp Diesel Engine Hydrostatic Rear & Front Wheel Drive Recycling Rotor (upcut) 44" Dia X 79" 12 Cutting Depth With Replaceable Carbide Tip Bullet Te Rops And Fops, Seat Belts W10-water Injection

Standard Features:

- Tier 3 / stage III electronic controlled engine
- Hydrostatic rotor drive with Automatic Power Adjustment (APA)
- Hydrostatic travel system with ASC traction control system
- Rear drive system with double reduction planetary gearbox drive and SAHR brakes
- Selectable hydrostatic front drive axle
- Hydraulic power steering
- Single lever control for travel and steer assist braking
- 24V electrical system with manual battery disconnect
- Dual element engine air filter
- Engine warning and shut down system
- Vehicle hydraulic system monitoring and warning system
- Warning horn, emergency stop and back-up alarm
- Visual Display(s) for
  - Fuel level
  - Hour meter
  - Voltmeter
  - Engine coolant temperature
  - Engine oil pressure
  - Hydraulic oil temperature
  - Rotor drive pressure
  - Forward travel pressure
  - Speedometer
  - Engine tachometer
- Visual Warning Indicators for:
  - Low rotor charge pressure
  - Engine air filter service
  - Hydraulic filter service
  - Brakes applied
  - Speed range
  - High engine coolant temperature
  - High hydraulic oil temperature
  - Low engine oil pressure
- ROPS with seat belt
- Adjustable operator's seat
- Tiltable steering wheel

Rotor

- Rotor Width: 79 in. (2,005 mm)
- Rotor Diameter, Outer: 44 in. (1.118 mm)
- Maximum Cutting Depth: 12 in. (305 mm)
- Rotor Speed: 135, 150 rpm
- Type of Cutting Teeth: Bullet
- Number of Cutting Teeth: 168
- Direction of Cutting: Upward



JOHN DEERE

JD550 BULLDOZER

Transport Height .... **10 ft 11 in (3.32 m)**
Transport Length .... **12 ft 4.5 in. (3.77 m)**
Machine Width .... **8 ft (2.44 m)**

ENGINE .... **John Deere 300 Series**

Number of Cylinders and Displacement	4 cylinders, 276 cu in. (4.5 L)
Air Intake System	Turbocharged
Bore and Stroke	4.19 x 5.00 in. (106 x 127 mm)
Net hp at 2200 rpm	72 SAE hp (54 kW) DIN 54 kW
Maximum Torque at 1200 rpm	230 lb-ft (313 N•m)
Nozzle Opening Pressure:	
New	3700 ± 50 psi (25 510 ± 345 kPa)
Used	3500 ± 50 psi (24 135 ± 345 kPa)
Valve Clearance (Cold):	
Intake	0.014 in. (0.36 mm)
Exhaust	0.018 in. (0.46 mm)
Oil Pressure at Fast Idle	50 ± 15 psi (345 ± 105 kPa)
Static Injection Pump Timing	Timing lines aligned w/ flywheel located at TDC
Dynamic Injection Pump Timing at Rated Load rpm*	16 + 0 - 1° BTDC
Speeds:	
Slow Idle	800 + 25 - 0 rpm
Fast Idle	2375—2400 rpm
Full Load Rating	2200 rpm
Cylinder Pressure Hot (Min)	350 psi (2415 kPa) cranking with injectors removed
Turbo Boost Pressure (at Full Load)	10—12 psi (69—83 kPa)
Flywheel Teeth	115

*Note: *For latest information, see Dealer Technical Assistance Center (DTAC) Solution K000413.*

TRANSMISSION

Model and Speeds	Powershift: 3 forward, 3 reverse
Cooler Flow in Range (Min)	15 gpm (57 L/min)
Transmission Pump Flow (Min)	22 gpm (83 L/min) used at 250—280 psi (1725—1930 kPa) and 2375 rpm
Lube Pressure (Steering Clutches Engaged)	30 psi (207 kPa) at 2375 rpm
Converter-Out Pressure in Range	60—110 psi (415—760 kPa)
Transmission Main Pressure in Range	255 ± 12 psi (1760 ± 83 kPa)

HYDRAULIC SYSTEM—Open-Center

Pump:	
Size	1.72 cu in. (28.2 cm^3)
Flow (Min)	15 gpm (0.96 L/s) new at 1750 psi (12 065 kPa) and 2200 rpm
Pump:	
Size	2.29 cu in. (37.4 cm^3)
Flow (Min)	20.8 gpm (1.31 L/s) new at 1750 psi (12 065 kPa) and 2200 rpm
Pump:	
Size	2.98 cu in. (48.8 cm^3)
Flow (Min)	28 gpm (104.6 L/min) new at 2250 psi (15 515 kPa) and 2200 rpm

Continued on next page

RELIEF VALVE SETTINGS

System Relief Valves:

Loader	2250 psi (15 515 kPa)
Selector Valve	2000 psi (13 790 kPa)
Bulldozer, 6405 or 6410	1750 psi (12 065 kPa)
Bulldozer, 6415	2250 psi (15 515 kPa)
Winch Relief Valve at 1900 rpm	950—1050 psi (6550—7240 kPa)

Loader Circuit Relief Valves at Fast Idle:

Bucket Dump	1250 psi (8620 kPa)
Bucket Rollback	2500 psi (17 240 kPa)
Boom Lift	3100 psi (21 375 kPa)
Auxiliary	2500 psi (17 240 kPa)

9705 Backhoe Circuit Relief Valve:

Crowd	2375 psi (16 375 kPa)
Swing Right	1625 psi (11 205 kPa)
Swing Left	2000 psi (13 790 kPa)
Boom Raise	3500 psi (24 135 kPa)
Boom Lower	2375 psi (16 375 kPa)

9500 Backhoe Circuit Relief Valve:

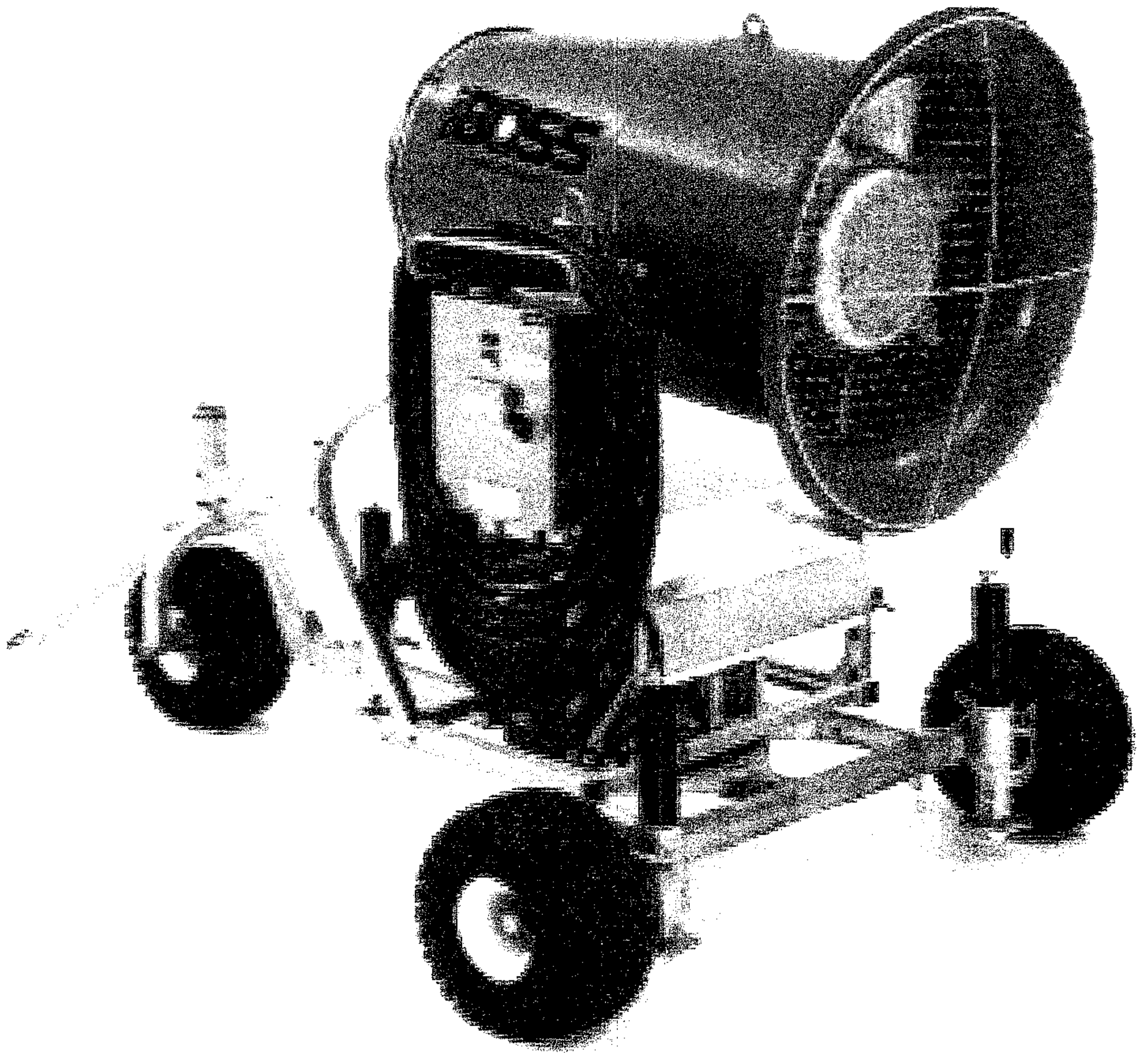
Crowd	2500 psi (17 240 kPa)
Swing Right	2375 psi (16 375 kPa)
Swing Left	2375 psi (16 375 kPa)
Boom Raise	2750 psi (18 960 kPa)
Boom Lower	2500 psi (17 240 kPa)

LUBRICANTS

See front of this book for the codes [ ].

CAPACITIES	U.S.	Imp.	Metric
Engine Cooling System [N]	5 gal	4.2 gal	18.9 L
Engine Crankcase w/ Filter [E]	15 qt	12.5 qt	14.2 L
Steering Clutch [C]	28 qt	23.3 qt	26.5 L
Final Drive (Each) [C]	6.25 qt	5.2 qt	5.9 L
Transmission [C]	13.5 gal	11.3 gal	51.1 L
Hydraulic System (Refill) [C]:			
Bulldozer	6.4 gal	5.3 gal	24.5 L
Loader	7 gal	5.8 gal	26.5 L
Fuel Tank	36 gal	30.0 gal	136.3 L

DUST BOSS DB-60



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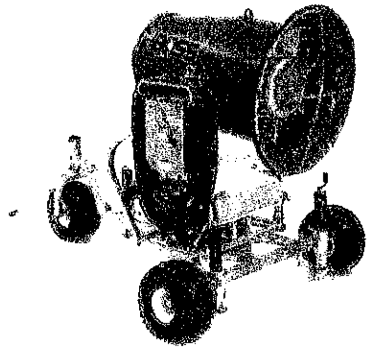
DB-60 SPECS >



GENERAL SPECIFICATIONS

> 30,000 CFM (849 50 CMM) generated by 25 HP fan.
> 21,000 square feet (1,950 square meters) coverage. Up to 84,000 square feet (7,804 square meters) coverage available with optional 180° oscillation.
> Oscillator gives 0–40° of movement on standard unit. Unit can also be equipped with optional 180° oscillation.
> Adjustable angle of throw 0–50° of height adjustment.

ELECTRICAL SPECIFICATIONS

> U.S.: 3 Phase / 25 HP fan / 480 Volt / 60 Hertz.
Full load current is 46 amps. 60 Kw gen set is recommended.
Motor is designed with a 1.15 service factor capable of operating at +/- 10% of design voltage.
> Other motor options available, including all international electrical motors:
· 3 Phase / 25 HP fan /380 Volt / 50 Hz (Europe, Middle East, N. Japan, Latin America)
· 3 Phase / 25 HP fan /400 Volt / 50 Hz (Europe, Japan, New Zealand, Australia)
· 3 Phase / 25 HP fan /415 Volt / 50 Hz (Europe, New Zealand, Australia)
· 3 Phase / 25 HP fan /575 Volt / 60 Hz (Canada)
· 3 Phase / 25 HP fan /380 Volt / 60 Hz Korea)
· 3 Phase / 25 HP fan /440 Volt / 60 Hz (Mexico)
> 380, 400, 415 volt / 50 Hz motors are designed with a 1.00 service factor capable of operating at +/- 10% of design voltage.
> 10 HP (7.5 Kw) high-pressure booster pump with no lift.
> 1/8 HP (0.10 Kw) oscillator.
> 150 foot (45.72 meters) 6/4 electrical cord. Other options available.
> No male plug, "bare wired" is standard. Any plug is extra cost.
> Cabinet with control panel

WATER SPECIFICATIONS

> 10PSI (0.69 BAR) constant pressure needs to be delivered to booster pump. Maximum inlet water pressure should not exceed 100 PSI (6.89 BAR) when operating the booster pump.
> Maximum PSI delivered by booster pump is 200 PSI (13.79 BAR).
> Filter is included and should be used at all times. Contact us for recommendations when using nonpotable water.
(Filter system in-line 30 mesh 595 micron).
> 1 1/2" (38.10 mm) cam-and-groove quick disconnect female coupling for fire hose provided on machine.
> 30 brass nozzles (also available in stainless and nylon).
> Droplet size of 50–200 microns.
> Throw 200 feet (60 meters).

ENGLISH UNITS	WITHOUT BOOSTER PUMP				WITH BOOSTER PUMP		
Water Pressure, psi	40	60	80	100	160	180	200
Water Flow, gpm	12	14.6	16.9	18.9	23.8	25.4	26.7
METRIC UNITS							
Water Pressure, bar	2.8	4.14	5.5	6.89	11	12.4	13.8
Water Flow, lpm	45.3	55.4	64.0	71.6	90.5	96.0	101.2
1-1/2" FIRE HOSE WATER SUPPLY							

NOISE LEVELS

WITH BOOSTER PUMP	CONTROL PANEL SIDE	BACK SIDE OF FAN	OPPOSITE SIDE	DISCHARGE
0 feet	92	103	92	100
12 feet	88	89	84	88
WITHOUT BOOSTER PUMP	CONTROL PANEL SIDE	BACK SIDE OF FAN	OPPOSITE SIDE	DISCHARGE
0 feet	86	101	88	96
12 feet	80	87	80	84

DIMENSIONS

ON STANDARD WHEELED CARRIAGE

> 6.75 feet (81 inches; or 2.06 meters) wide.
> 9.75 feet (117 inches; or 2.97 meters) long.
> 7.17 feet (86 inches; or 2.19 meters) tall.
> 1800 lbs. (816.50 kilograms).

MAINTENANCE

> If using potable water, nozzles need to be inspected once a year
> Fan motor and high pressure pump should be greased every 10,000 hours.
> Oscillator bearing should be greased on a regular maintenance schedule, or as needed.

CHEMICAL ADDITIVES

> Can be used with surfactant to improve binding of dust particles or with tackifying agents to seal the ground to prevent dust from becoming airborne.
> Odor control chemicals can be used to help eliminate odor.

OPTIONS

> Unit is available with optional 180° oscillation. Standard oscillation provides 0–40° of movement.
> Available on frame with skid mount. Unit comes standard on wheeled carriage.
> Dosing pump can be added to unit for chemical applications.

WARRANTY

> Unit is covered by a 3-year/3,000-hour warranty.

D6N

Track-Type Tractor

CATERPILLAR®

Engine		
Flywheel Power	111.8 kW	150 hp
Engine Model	Cat® C6.6 ACERT™	
Weights		
Operating Weight – XL	16 668 kg	36,670 lb
Operating Weight – LGP	17 997 kg	39,593 lb

Engine

Engine Model	Cat® C6.6 ACERT™	
Flywheel Power	111.8 kW	150 hp
Net Power – Caterpillar	111.8 kW	150 hp
Net Power – ISO 9249	111.8 kW	150 hp
Net Power – SAE J1349	110.4 kW	148 hp
Net Power – EU 80/1269	111.8 kW	150 hp
Bore	105 mm	4.13 in
Stroke	127 mm	4.99 in
Displacement	6.6 L	402.75 in³

- Engine Ratings at 2200 rpm.
- Net power advertised is the power available at the flywheel when the engine is equipped with fan, air cleaner, muffler and alternator.
- No derating required up to 3000 m (9,840 ft) altitude, beyond 3000 m (9,840 ft) automatic derating occurs.

Transmission

1.5 Forward	3.1 km/h	1.93 mph
2.0 Forward	4.6 km/h	2.86 mph
2.5 Forward	5.7 km/h	3.54 mph
3.0 Forward	7.5 km/h	4.66 mph
3.5 Forward	10 km/h	6.21 mph
1.5 Reverse	3.1 km/h	1.93 mph
2.0 Reverse	5.1 km/h	3.17 mph
2.5 Reverse	6.4 km/h	4 mph
3.0 Reverse	8.6 km/h	5.34 mph
3.5 Reverse	11.6 km/h	7.21 mph
1.5 Forward – Drawbar Pull	320 kN	71,939 lb
2.5 Forward – Drawbar Pull	175 kN	39,341.6 lb
3.5 Forward – Drawbar Pull	97 kN	21,806.5 lb

Service Refill Capacities

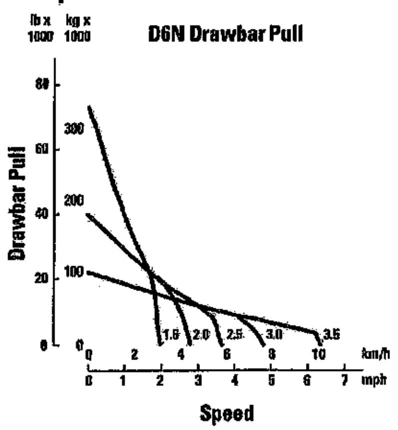
Fuel Tank	299 L	79 gal
Cooling System	48 L	12.68 gal
Final Drives (each)	8.5 L	2.25 gal
Hydraulic Tank	29.5 L	7.79 gal

Weights

Operating Weight – XL	16 668 kg	36,670 lb
Operating Weight – LGP	17 997 kg	39,593 lb
Shipping Weight – XL	16 363 kg	35,999 lb
Shipping Weight – LGP	17 692 kg	38,922 lb

- Operating Weight: Includes EROPS, A/C, lights VPAT dozer, transmission, drawbar, engine enclosure, 3-valve hydraulics, 100% fuel, and Cat Comfort Series Air Suspension Seat and operator.
- Shipping Weight: Includes EROPS, A/C, lights VPAT dozer, transmission, drawbar, engine enclosure, 3-valve hydraulics, 5% fuel, and Cat Comfort Series Air Suspension Seat.

Torque Rise



The direct injection electronic fuel system provides a controlled fuel delivery increase as the engine lugs back from rated speed. This results in increased horsepower below rated power. A combination of increased torque rise and maximum horsepower improves response, provides greater drawbar pull and faster dozing cycles.

Undercarriage

Width of Shoe – XL	610 mm	24.01 in
Width of Shoe – LGP	840 mm	33.07 in
Shoes/Side – XL	40	
Shoes/Side – LGP	46	
Grouser Height – XL	66 mm	2.6 in
Grouser Height – LGP	57 mm	2.2 in
Track Gauge – XL	1890 mm	74.4 in
Track Gauge – LGP	2160 mm	85.03 in
Track on Ground – XL	2611 mm	102.8 in
Track on Ground – LGP	3113 mm	122.56 in
Ground Contact Area – XL	3.18 m²	4,929 in²
Ground Contact Area – LGP	5.23 m²	8,107 in²
Ground Pressure	51.6 kPa	7.48 psi
Ground Pressure – XL	52.3 kPa	7.59 psi
Ground Pressure – LPG	34.4 kPa	7.63 psi
Track Rollers/Side – XL	7	
Track Rollers/Side – LGP	8	

Blades

Blade Type	VPAT, SU	
XL SU – Blade Width	3154 mm	10 ft 4 in
XL VPAT – Blade Capacity	3.18 m³	4.16 yd³
XL VPAT – Blade Width	3272 mm	10 ft 9 in
XL SU – Blade Capacity	4.28 m³	5.6 yd³
LGP VPAT – Blade Capacity	3.16 m³	4.13 yd³
LGP VPAT – Blade Width	4080 mm	13 ft 5 in

D6N Track-Type Tractor Specifications

Ripper

Type	Fixed Parallelogram	
Number of Pockets	3	
Overall Beam Width	2202 mm	86.7 in
Beam Cross Section	216 × 254 mm 8.5 × 10.0 in	
Maximum Penetration – XL	473 5 mm	18.6 in
Maximum Penetration – LGP	359.5 mm	14.2 in
Each Additional Shank	78 kg	172 lb

Winch

Winch Model	PA55	
Weight*	1276.5 kg	2,814 lb
Oil Capacity	74 L	19 55 gal
Winch and Bracket Length	1145 mm	45.1 in
Winch Case Width	975 mm	38.4 in
Drum Diameter	254 mm	10 in
Drum Width	315 mm	12.4 in
Flange Diameter	504 mm	19.8 in
Drum Capacity – 22 mm (0.88 in)	88 m	288 ft 9 in

- Slow and standard speed winches are available.

* Weight: Includes pump, operator controls, oil, mounting brackets and spacers.

Standards

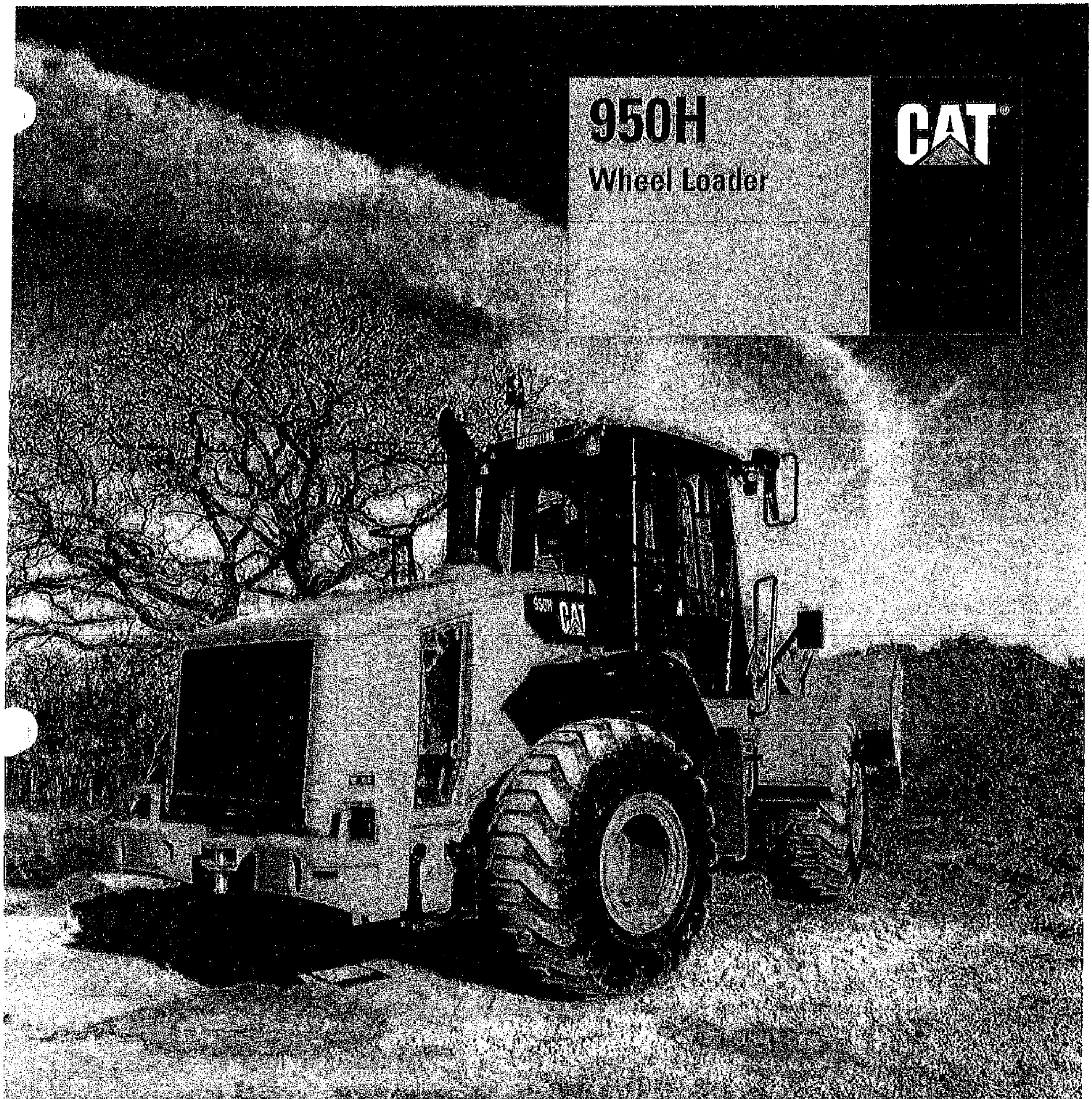
ROPS/FOPS
Brakes
Cab

- ROPS (Rollover Protective Structure) offered by Caterpillar for the machine meets ROPS criteria SAE J1040 MAY94, ISO 3471 1994 and DLV criteria SAE J397B, ISO 3164:1995.
- FOPS (Falling Object Protective Structure) meets SAE J/ISO 3449 APR98 Level II, ISO 3449:1992 Level II and DLV criteria SAE J397B, ISO 3164 1995.
- Brakes meet the standard ISO 10265:1998.
- The operator sound exposure Leq (equivalent sound pressure level) measured according to the work cycle procedures specified in ANSI/SAE J1166 OCT 98 is 83 dB(A), for cab offered by Caterpillar, when properly installed and maintained and tested with the doors and windows closed.
- The operator sound pressure level measured according to the procedures specified in ISO6394:2008 is 77 dB(A) for the cab offered by Caterpillar, when properly installed and maintained and tested with the doors and windows closed.
- Hearing protection is recommended when operating with an open operator station and cab (when not properly maintained or doors/windows open) for extended periods or in noisy environment.
- The exterior sound pressure level for the standard machine measured at a distance of 15 meters according to the test procedures specified in SAE J88 FEB 06, mid-gear-moving operation, is 81 dB(A).
- The labeled sound power level is 110 dB(A) measured according to the test procedure and conditions specified in 2000/14/EC.

950H

Wheel Loader

CAT



Engine

Engine Model	Cat® C7 ACERT™	
Gross Power - SAE J1995	162 kW	217 hp
Net Power - ISO 9249	147 kW	197 hp

- Caterpillar engine with ACERT™ Technology - EPA Tier III, EU Stage III Compliant

Buckets

Bucket Capacities	2.5-3.5 m^3	3.25-4.5 yd^3

Weights

Operating Weight	18 338 kg	40,435 lb

- For 3.1 m^3 (4.0 yd^3) general purpose bucket with BOCE

Operating Specifications

Static Tipping Load, Full Turn - Bucket	10 915 kg	24,068 lb

- For 3.1 m^3 (4.0 yd^3) general purpose bucket with BOCE

Engine

Engine Model	Cat® C7 ACERT™	
Gross Power SAE J1995	162 kW	217 hp
Net Power ISO 9249	147 kW	197 hp
Net Power SAE J1349	145 kW	195 hp
Net Power 80/1269/EEC	147 kW	197 hp
Peak Torque (Net) @ 1,400 RPM	907 N·m	669 ft-lb
Bore	110 mm	4.33 in
Stroke	127 mm	5 in
Displacement	7.2 L	439 in^3

- Caterpillar engine with ACERT™ Technology EPA Tier III, EU Stage III Compliant
- These ratings apply at 1,800 rpm when tested under the specified standard conditions.
- Rating for net power advertised based on power available when the engine is equipped with alternator, air cleaner, muffler and on-demand hydraulic fan drive at maximum fan speed.

Weights

Operating Weight	18 338 kg	40,435 lb

- For 3.1 m^3 (4.0 yd^3) general purpose bucket with BOCE

Buckets

Bucket Capacities	2.5-3.5 m^3 3.25-4.5 yd^3	
Max Bucket Capacity	3.5 m^3	4.5 yd^3

Operating Specifications

Breakout Force	165 kN	37,125 lb
Static Tipping Load, Full Turn Bucket	10 915 kg	24,068 lb
Static Tipping Load, Full Turn Forks	4273 kg	9,421 lb

- For 3.1 m^3 (4.0 yd^3) general purpose bucket with BOCE
- For 1829 mm (72 in) quick coupler pallet forks

Transmission

Forward 1	6.9 km/h	4.3 mph
Forward 2	12.7 km/h	7.9 mph
Forward 3	22.3 km/h	13.9 mph
Forward 4	37 km/h	23.0 mph
Reverse 1	7.6 km/h	4.7 mph
Reverse 2	13.9 km/h	8.6 mph
Reverse 3	24.5 km/h	15.2 mph
Reverse 4	40 km/h	24.9 mph

- Maximum travel speeds (23.5-25 tires).

Hydraulic System

Bucket/Work Tool System Pump Output	270 L/min	71 gal/min
Steering System Pump Type	Piston	
Hydraulic Cycle Time - Raise	6.2 Seconds	
Hydraulic Cycle Time - Dump	1.3 Seconds	
Hydraulic Cycle Time - Lower, Empty, Float Down	2 5 Seconds	
Hydraulic Cycle Time - Total	10 Seconds	

- Implement System (Standard), Piston Pump - Rated at 2,100 rpm and 1,000 psi (6900 kPa).
- Cycle time with rated payload

Brakes

Brakes	Meets required standards.

- Meet OSHA, SAE J1473 OCT90 and ISO 3450-1985 standards.

Axles

Front	Fixed front	
Rear	Oscillating +/- 13°	
Maximum Single-Wheel Rise and Fall	470 mm	18.5 in

Tires

Tires	Choose from a variety of tires to match your application

- Choice of:

23.5R25, L2, VSW

23.5R25, L2, VUT D2A

23.5R25, L2, XTLA

23.5R25, L3, VMT

23.5R25, L3, XHA

23.5R25, L5, XMINE

750/65R25, L3, XLD

23.5-25, L2, SGGL

- NOTE: In certain applications (such as load and carry) the loader's productive capabilities might exceed the tires' tonnes-km/h (ton-mph) capabilities. Caterpillar recommends that you consult a tire supplier to evaluate all conditions before selecting a tire model. The 23.5-25 size range and other special tires are available on request.

Cab

ROPS/FOPS	Meets SAE and ISO standards.

- Caterpillar cab with integrated Rollover Protective Structure (ROPS) are standard in North America and Europe.
- ROPS meets SAE J1040 APR88 and ISO 3471:1994 criteria.
- Falling Objects Protective Structure (FOPS) meets SAE J231 JAN81 and ISO 3449:1992 Level II criteria.
- The operator sound pressure level measured according to the procedures specified in ISO 6394:1998 is 72 dB(A) for the cab offered by Caterpillar, when properly installed and maintained and tested with the doors and windows closed
- Hearing protection may be needed when operating with an open operator station and cab (when not properly maintained or doors/windows open) for extended periods or in noisy environments.
- The sound pressure level is 111 dB(A) measured according to the static test procedure and conditions specified in ISO 6395:1998 for a standard machine configuration.

Service Refill Capacities

Fuel Tank - Standard	314 L	83 gal
Cooling System	42 L	11 gal
Crankcase	30 L	7.9 gal
Transmission	34 L	9 gal
Differentials and Final Drives - Front	36 L	9.5 gal
Differentials and Final Drives - Rear	36 L	9.5 gal
Hydraulic Tank	110 L	29 gal

938H

Wheel Loader

Engine

Engine Model	Cat® 6.6 ACERT™	
Net Power – SAE J1349	128 kW	172 hp
Net Power – ISO 9249	134 kW	180 hp

- Caterpillar® engine with ACERT™ Technology – EPA Tier III, EU Stage III Compliant.

Buckets

Bucket Capacities	2.3 - 3.0 m^3	3.0 - 4.0 yd^3

Weights

Operating Weight	15 059 kg	33,190 lb

- For 2.8 m^3 (3.65 yd^3) general purpose bucket with standard 20.5-R25 tires.

Operating Specifications

Static Tipping Load, Full Turn	10 076 kg	22,207 lb

- For 2.8 m^3 (3.65 yd^3) general purpose bucket with standard 20.5-R25 tires.

Engine

Engine Model	Cat® 6.6 ACERT™	
Gross Power – SAE J1995	147 kW	197 hp
Net Power – ISO 9249	134 kW	180 hp
Net Power – SAE J1349	128 kW	172 hp
Net Power – 80/1269/EEC	134 kW	180 hp
Peak Torque (Net) @ 1,400 rpm	840 N·m	620 ft-lb
Total Torque Rise	38 %	
Bore	105 mm	4.1 in
Stroke	127 mm	5 in
Displacement	6.6 L	402.8 in³

- Caterpillar engine with ACERT™ Technology – EPA Tier III, EU Stage III Compliant.
- These ratings apply at 2,100 rpm when tested under the specified standard conditions.
- Rating for net power advertised based on power available when the engine is equipped with alternator, air cleaner, muffler and on-demand hydraulic fan drive at maximum fan speed.

Weights

Operating Weight	15 059 kg	33,190 lb

- For 2.8 m³ (3.65 yd³) general purpose bucket with standard 20.5-R25 tires.

Buckets

Bucket Capacities	2.3 - 3.0 m³	3.0 - 4.0 yd³
Max Bucket Capacity	3 m³	4 yd³

Operating Specifications

Static Tipping Load, Full Turn	10 076 kg	22,207 lb
Breakout Force	123 kN	27,576 lb

- For 2.8 m³ (3.65 yd³) general purpose bucket with standard 20.5-R25 tires.

Transmission

Forward 1	8.1 km/h	5 mph
Forward 2	14.6 km/h	9.1 mph
Forward 3	25.5 km/h	15.8 mph
Forward 4	43.2 km/h	26.8 mph
Reverse 1	8.1 km/h	5 mph
Reverse 2	14.6 km/h	9.1 mph
Reverse 3	25.5 km/h	15.8 mph

- Maximum travel speeds with empty bucket and 20.5-R25 tires.

Hydraulic System

Steering System Pump Type	Piston	
Hydraulic Cycle Time – Raise	5.4 Seconds	
Hydraulic Cycle Time – Dump	1.4 Seconds	
Hydraulic Cycle Time – Lower, Empty, Float Down	2.7 Seconds	
Hydraulic Cycle Time – Total	9.5 Seconds	
Pilot System – Pump Output	295 L/min	77.9 gal/min

- Implement System (Standard), Piston Pump – Rated at 2,100 rpm and 1,000 psi (6900 kPa).
- Cycle time with rated payload.

Brakes

Brakes	Meets required standards

- Meet OSHA, SAE J1473 Oct90 and ISO 3450-1985 standards.

Axles

Front	Fixed front	
Rear	Oscillating ±12°	
Maximum Single-Wheel Rise and Fall	420 mm	17 in

Tires

Tires	Choose from a variety of tires to match your application.

- Choice of·
  - 20.5R25 XTLA L2 Radial
  - 20.5R25 XHA L3 Radial
  - 20.5R25 GP2B L3 Radial
  - 20.5R25 HRL L3 Radial
  - 20.5R25 RL-2+ L3 Radial
  - 650/65R-25 XLD L3 Radial (Low Profile)
  - 20 5-25 SRG LD L3 Bias (16 PLY)
  - 20.5-25 SRG LD L3 Bias (20 PLY)
  - 20.5-25 RM 99 L3 Bias
- NOTE: In certain applications (such as load and carry) the loader's productive capabilities might exceed the tires' tonnes-km/h (ton-mph) capabilities. Caterpillar recommends that you consult a tire supplier to evaluate all conditions before selecting a tire model. Other special tires are available on request.

Cab

ROPS/FOPS	Meets SAE and ISO standards

- Caterpillar cab with Integrated Rollover Protective Structure (ROPS) is standard in North America and Europe.
- ROPS meets SAE J1040 APR88 and ISO 3471·1994 criteria.
- Falling Objects Protective Structure (FOPS) meets SAE J231 Jan81 and ISO 3449:1992 Level II criteria.
- The operator sound pressure level measured according to the procedures specified in ISO 6394:1998 is 75 dB(A) for the cab offered by Caterpillar when properly installed and maintained and tested with the doors and windows closed.
- Hearing protection may be needed when operating with an open operator station and cab (when not properly maintained or doors/windows open) for extended periods or in noisy environment.
- The sound power level is 108 dB(A) measured according to the dynamic test procedure and conditions specified in ISO 6395:1998 for a standard machine configuration.

Service Refill Capacities

Fuel Tank – Standard	247 L	65.3 gal
Cooling System	36 L	9.5 gal
Crankcase	17.4 L	4.6 gal
Transmission	43 L	11.4 gal
Differentials and Final Drives – Front	57 L	15.1 gal
Differentials and Final Drives – Rear	53 L	14 gal
Hydraulic Tank	89 L	23.5 gal

725

Articulated Truck

CAT

Engine		
Engine Model	Cat® C11 ACERT™	
Gross Power – SAE J1995	230 kW	309 hp
Net Power – SAE J1349	225 kW	301 hp

Weights		
Rated Payload	23.6 tonnes	26 tons
Body Capacities		
Heaped SAE 2:1	14.3 m^3	18.8 yd^3

725 Articulated Truck Specifications

Engine

Engine Model	Cat® C11 ACERT™	
Gross Power – SAE J1995	230 kW	309 hp
Net Power – SAE J1349	225 kW	301 hp
Net Power – ISO 9249	227 kW	304 hp
Net Power – EEC 80/1269	227 kW	304 hp
Bore	130 mm	5.1 in
Stroke	140 mm	5.5 in
Displacement	11.15 L	680 in³

- The power ratings apply at rated speed of 1800 rpm when tested under the conditions for the specified standard.
- The net power advertised is the power available at the flywheel when the engine is equipped with alternator, air cleaner, muffler and fan at minimum speed.
- Net power when the fan is at maximum speed is 210 kW (282 hp) per the SAE reference conditions.
- The 725 meets EPA Tier 3/EU Stage 3a emission specifications for the U.S. and Europe through 2010.

Weights

Rated Payload	23.6 tonnes	26 tons

Body Capacities

Heaped SAE 2:1	14.3 m³	18.8 yd³
Struck	11.1 m³	14.5 yd³
Tailgate Heaped SAE 2:1	15.3 m³	20 yd³
Tailgate Struck	11.5 m³	15 yd³

Transmission

Forward 1	8 km/h	5 mph
Forward 2	15 km/h	9 mph
Forward 3	23 km/h	14 mph
Forward 4	35 km/h	21 mph
Forward 5	48 km/h	30 mph
Forward 6	57 km/h	35 mph
Reverse 1	9 km/h	5 mph

Sound Levels

Interior Cab	76 dB(A)

- The operator sound exposure Leq (equivalent sound pressure level) measured according to the work cycle procedures specified in ANSI/SAE J1166 OCT 98 is 76 dB(A), for the cab offered by Caterpillar, when properly installed and maintained and tested with the doors and windows closed.
- Hearing protection may be needed when operating with an open operator station and cab (when not properly maintained or doors/windows open) for extended periods or in noisy environments.

Operating Weights

Front Axle – Empty	13 020 kg	28,705 lb
Center Axle – Empty	4830 kg	10,650 lb
Rear Axle – Empty	4410 kg	9,720 lb
Total – Empty	22 260 kg	49,075 lb
Front Axle – Rated Load	2010 kg	4,430 lb
Center Axle – Rated Load	10 790 kg	23,790 lb
Rear Axle – Rated Load	10 790 kg	23,790 lb
Total – Rated Load	23 590 kg	52,010 lb
Front Axle – Loaded	15 030 kg	33,135 lb
Center Axle – Loaded	15 620 kg	34,440 lb
Rear Axle – Loaded	15 200 kg	33,510 lb
Total – Loaded	45 850 kg	101,085 lb

Body Plate Thickness

Front	8 mm	0.31 in
Scow	14 mm	0.55 in
Side	12 mm	0.47 in
Base	14 mm	0.55 in

Service Refill Capacities

Fuel Tank	355 L	94 gal
Cooling System	67 L	18 gal
Hydraulic System	151 L	49 gal
Engine Crankcase	41 L	11 gal
Transmission	36 L	9.5 gal
Final Drives/ Differential	164 L	43.3 gal
Output Transfer Gear Box	18 L	4.8 gal

Body Hoist

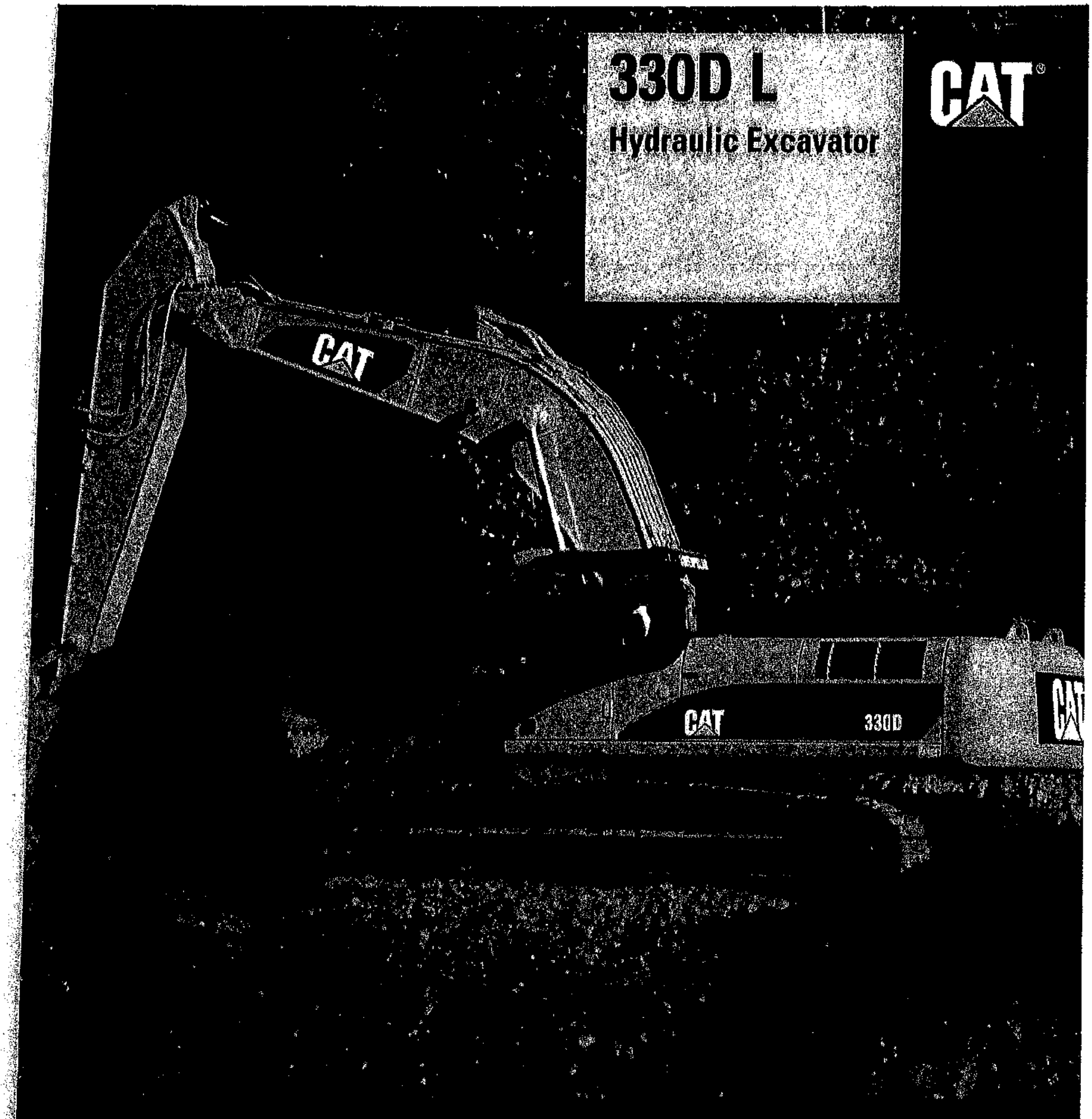
Raise time	10 Seconds
Lower time	8 Seconds

Standards

Brakes	ISO 3450 – 1996
Cab/FOPS	ISO 3449 Level II – 2005
Cab/ROPS	ISO 3471 – 2008
Steering	ISO 5010 – 2007

330D L
Hydraulic Excavator

CAT®



Engine		
Engine Model	Cat® C9 with ACERT™ Technology	
Net Flywheel Power	200 kW	268 hp
Weights		
Operating Weight	36 151 kg	79,700 lb

- Reach boom, R3.9DB (12 ft 10 in) Stick, 1.19 m^3 (1.56 yd^3) GP Bucket, 800 mm (32 in) Shoe

Engine

Engine Model	Cat C9 with ACERT™ Technology	
Net Flywheel Power	200 kW	268 hp
Net Power – ISO 9249	200 kW	268 hp
Net Power – SAE J1349	188 kW	252 hp
Net Power – EEC 80/1269	200 kW	268 hp
Bore	112 mm	4.4 in
Stroke	149 mm	5.87 in
Displacement	8.8 L	537 in³

- The 330D L meets U.S. EPA Tier 3 and EU Stage IIIA exhaust emission requirements.
- Net power advertised is the power available at the flywheel when the engine is equipped with fan, air cleaner, muffler and alternator
- No engine power derating required below 2300 m (7,500 ft).

Weights

Operating Weight	36 151 kg	79,700 lb

- Reach boom, R3.9DB (12 ft 10 in) Stick, 1 19 m³ (1 56 yd³) GP Bucket, 800 mm (32 in) Shoe

Service Refill Capacities

Fuel Tank Capacity	620 L	163.8 gal
Cooling System	40 L	10.6 gal
Engine Oil	40 L	10.6 gal
Swing Drive	19 L	5 gal
Final Drive (each)	8 L	2.1 gal
Hydraulic System (including tank)	410 L	108.3 gal
Hydraulic Tank	175 L	46.2 gal

Swing Mechanism

Swing Speed	10 RPM	
Swing Torque	108.7 kN·m	80,142 lb ft

Drive

Maximum Drawbar Pull	300 kN	67,443 lb
Maximum Travel Speed	5 km/h	3.1 mph

Hydraulic System

Main Implement System – Maximum Flow (2x)	280 L/min	74 gal/min
Max. pressure – Equipment	35 000 kPa	5,076 psi
Max. pressure – Equipment – Heavy	36 000 kPa	5,221 psi
Max. pressure – Travel	35 000 kPa	5,076 psi
Max. pressure – Swing	28 000 kPa	4,061 psi
Pilot System – Maximum flow	43 L/min	11.4 gal/min
Pilot System – Maximum pressure	4000 kPa	565.7 psi
Boom Cylinder – Bore	150 mm	5.9 in
Boom Cylinder – Stroke	1440 mm	56.7 in
Stick Cylinder – Bore	170 mm	6.7 in
Stick Cylinder – Stroke	1738 mm	68.4 in
DB Family Bucket Cylinder – Bore	150 mm	5.9 in
DB Family Bucket Cylinder – Stroke	1151 mm	45.3 in
TB1 Family Bucket Cylinder – Bore	160 mm	6.3 in
TB1 Family Bucket Cylinder – Stroke	1356 mm	53.4 in

Sound Performance

Performance	ANSI/SAE J1166 OCT 98

- When properly installed and maintained, the cab offered by Caterpillar, when tested with doors and windows closed according to ANSI/SAE J1166 OCT 98, meets OSHA and MSHA requirements for operator sound exposure limits in effect at time of manufacture.
- Hearing protection may be needed when operating with an open operator station and cab (when not properly maintained or doors/windows open) for extended periods or in noisy environment.

Standards

Brakes	SAE J1026 APR90
Cab/FOGS	SAE J1356 FEB88

324E

Hydraulic Excavator

CAT®

Engine		
Engine Model	Cat® C7.1 ACERT™	
Net Power – SAE J1349/ISO 9249	145 kW	194 hp
Drive		
Maximum Travel Speed	5.3 km/h	3.3 mph
Maximum Drawbar Pull	227 kN	51,302 lbf

Weight		
Minimum Operating Weight	25 127 kg	55,395 lb
Maximum Operating Weight	29 479 kg	64,990 lb

Engine

Engine Model	Cat® C7.1 ACERT™	
Net Power – SAE J1349/ISO 9249	145 kW	194 hp
Gross Power – SAE J1995	152 kW	204 hp
Bore	105 mm	4.13 in
Stroke	135 mm	5.31 in
Displacement	7.01 L	428 in³

Weights

Minimum Operating Weight*	25 127 kg	55,395 lb
Maximum Operating Weight**	29 479 kg	64,990 lb

*5 9 m (19'4") reach boom, R2 95CB1 (9'8") stick, 4.0 mt (4.4 t) counterweight, 1 33 m³ (1 74 yd³) bucket, 600 mm (24") TG shoes.
**SLR boom, 7.85 m (25'9") stick, 6.75 mt (7.4 t) counterweight, 0.6 m³ (0.78 yd³) bucket, 790 mm (31") shoes.

Hydraulic System

Main System – Maximum Flow (Total)	462 L/min	122 gal/min
Swing System – Maximum Flow	231 L/min	61 gal/min
Maximum Pressure – Equipment Heavy Lift	38 000 kPa	5,511 psi
Maximum Pressure – Equipment Normal	35 000 kPa	5,076 psi
Maximum Pressure – Travel	35 000 kPa	5,076 psi
Maximum Pressure – Swing	24 497 kPa	3,553 psi
Pilot System – Maximum Flow	23.1 L/min	6.1 gal/min
Pilot System – Maximum Pressure	3920 kPa	569 psi
Boom Cylinder – Bore	135 mm	5 in
Boom Cylinder – Stroke	1305 mm	51 in
Stick Cylinder – Bore	140 mm	6 in
Stick Cylinder – Stroke	1660 mm	65 in
CB1 Bucket Cylinder – Bore	130 mm	5 in
CB1 Bucket Cylinder – Stroke	1156 mm	46 in
DB Bucket Cylinder – Bore	150 mm	6 in
DB Bucket Cylinder – Stroke	1151 mm	45 in

Drive

Maximum Travel Speed	5.3 km/h	3.3 mph
Maximum Drawbar Pull	227 kN	51,302 lbf

Swing Mechanism

Swing Speed	9.2 rpm	
Swing Torque	73.4 kN m	54,137 lb ft

Service Refill Capacities

Fuel Tank Capacity	520 L	137.37 gal
Cooling System	44 L	11.62 gal
Engine Oil (with filter)	22.5 L	5.94 gal
Swing Drive (each)	10 L	2 64 gal
Final Drive (each)	6 L	1.59 gal
Hydraulic System (including tank)	280 L	75 29 gal
Hydraulic Tank	155 L	40.95 gal

Track

Number of Shoes (each side)	
Long Undercarriage	51
Number of Track Rollers (each side)	
Long Undercarriage	8
Number of Carrier Rollers (each side)	
Long Undercarriage	2

Sound Performance

ISO 6396	
Operator Noise (Closed)	71 dB(A)
Operator Noise (Open)	76 dB(A)
ISO 6395	
Spectator Noise	104 dB(A)

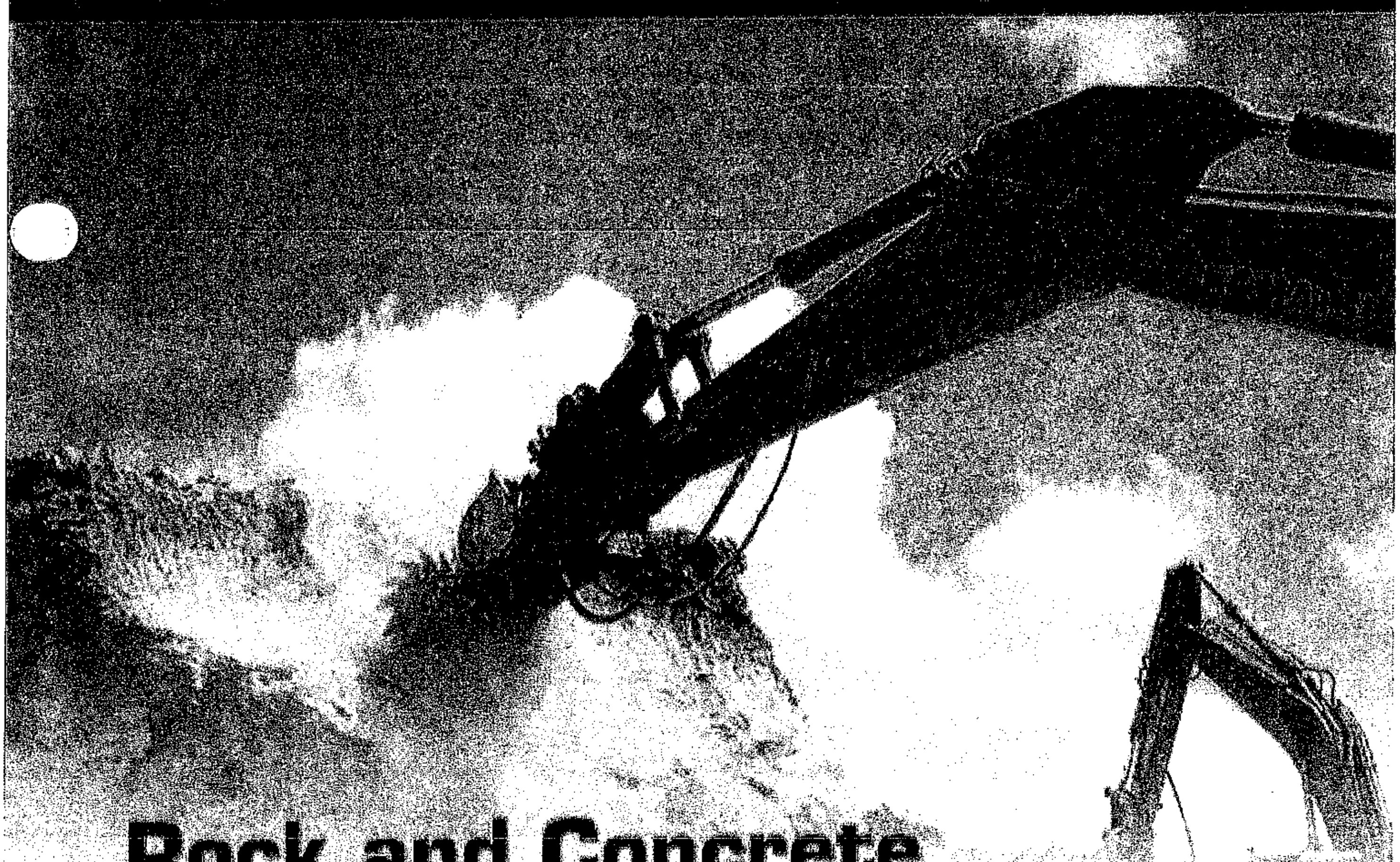
- When properly installed and maintained, the cab offered by Caterpillar, when tested with doors and windows closed according to ANSI/SAE J1166 OCT98, meets OSHA and MSHA requirements for operator sound exposure limits in effect at time of manufacture.
- Hearing protection may be needed when operating with an open operator station and cab (when not properly maintained or doors/windows open) for extended periods or in noisy environment.

Standards

Brakes	ISO 10265 2008
Cab/FOGS	ISO 10262 1998

ANTRAQUIP

Antraquip Hydraulic Cutter Boom Attachments



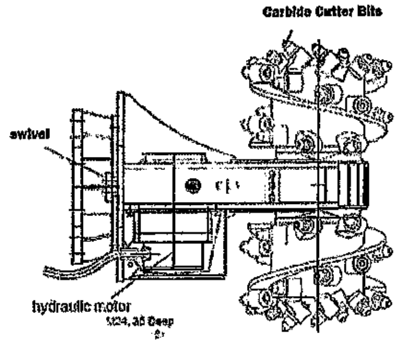
Rock and Concrete Cutting Solutions

The Leader in Rock Cutting Technology

Antraquip rock and concrete cutting attachments for excavators are the new innovation that has taken the construction industry by storm. AQ rotary cutters are powerful attachments that can excavate rock and concrete efficiently while limiting noise and vibrations. The models ranging from the AQ-1 to the AQ-6 can be mounted on and operated by the hydraulics of excavators ranging in size from 1.5 tons to 120tons.

The controlled excavation of rock and concrete with AQ cutters is unparalleled whether you need to excavate a trench to the desired dimension or whether you require the excavation of a tunnel to profile. So for your next project consider AQ cutter boom attachments as the potential solution for numerous applications including trenching, controlled demolition, scaling, profiling, slurry wall construction, tunneling, remediation.

Antraquip is now offering a variety of cutting drums designed for specific applications. Some of these include specialized drums for tunneling, profiling, remediation, and stump grinding. In addition, there are various types of carbide cutter bits (picks) available for each machine that are designed for different applications



Some of the advantages that Antraquip cutter boom attachments offer include:

- Rugged gears and housing
- The use of a powerful high torque hydraulic motor
- Robust cutting drums to ensure maximum production and a long life span
- A swivel mechanism that allows the cutter to be turned at 22.5 degree increments without having to remove the cutterhead from the excavator.
- Experienced field technicians and office personnel available for technical support at all times

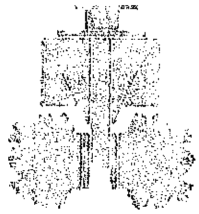
AQ-5 Demolition Project AQ cutting attachments can cut up to one inch rebar.

AQ-4 mounted on Liebherr 944 excavator working in medium hard limestone.

AQ-4 removing layer of concrete from bridge, mounted on a Hitachi 30 ton excavator

AQ-4 mounted on Komatsu PC400 mining Talc producing 100+ tons per hour

Dimensions and Specifications

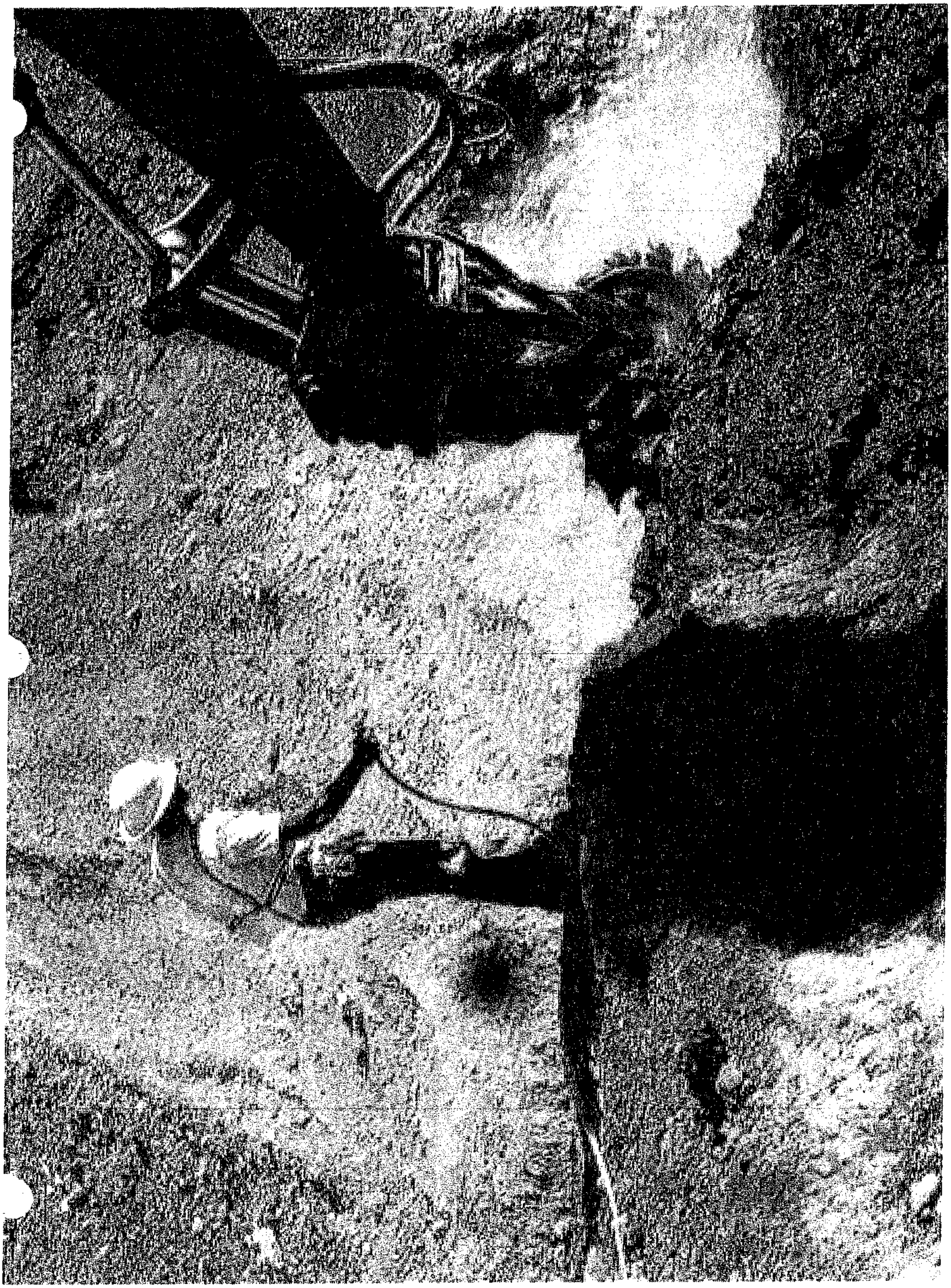


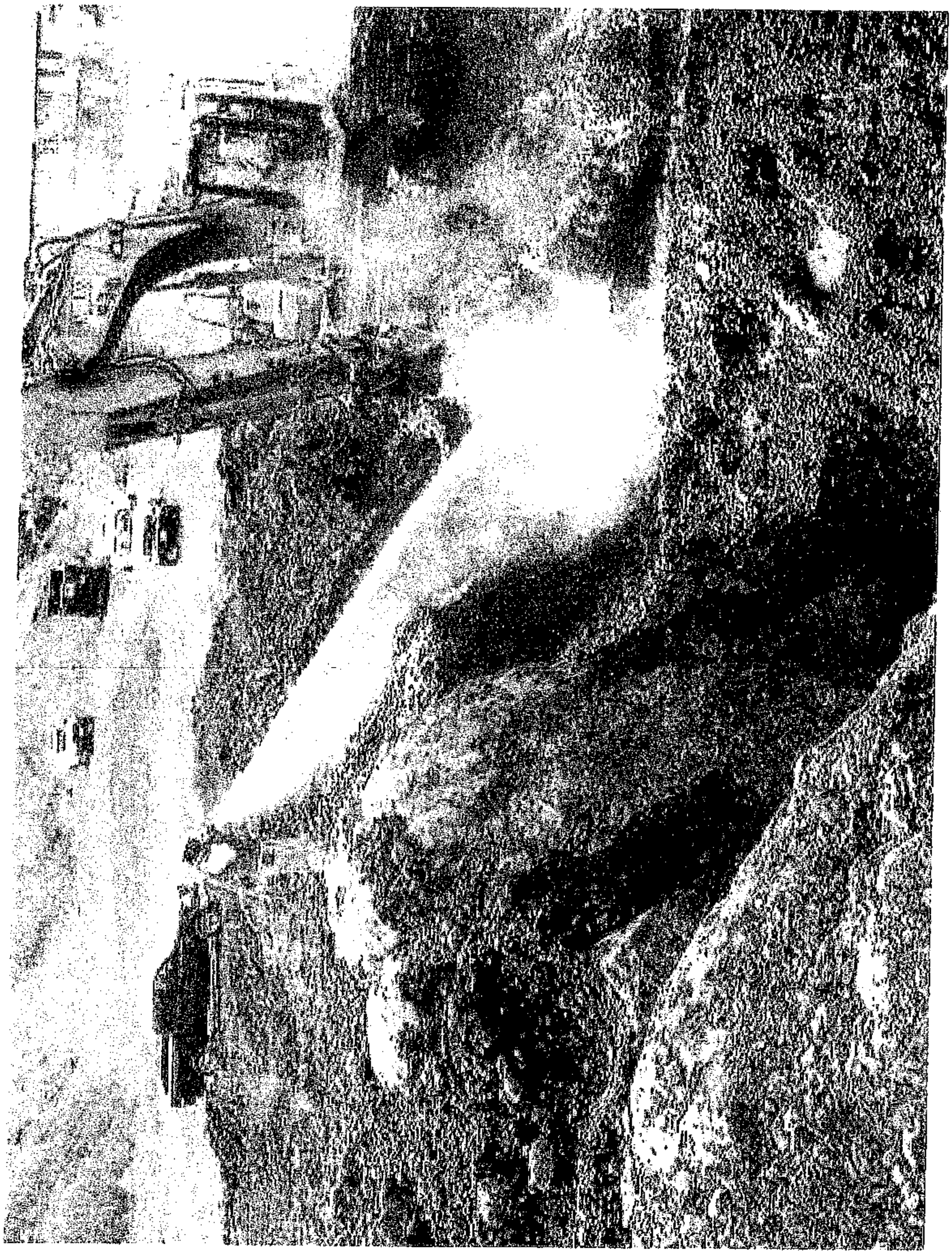
Transverse Cutters

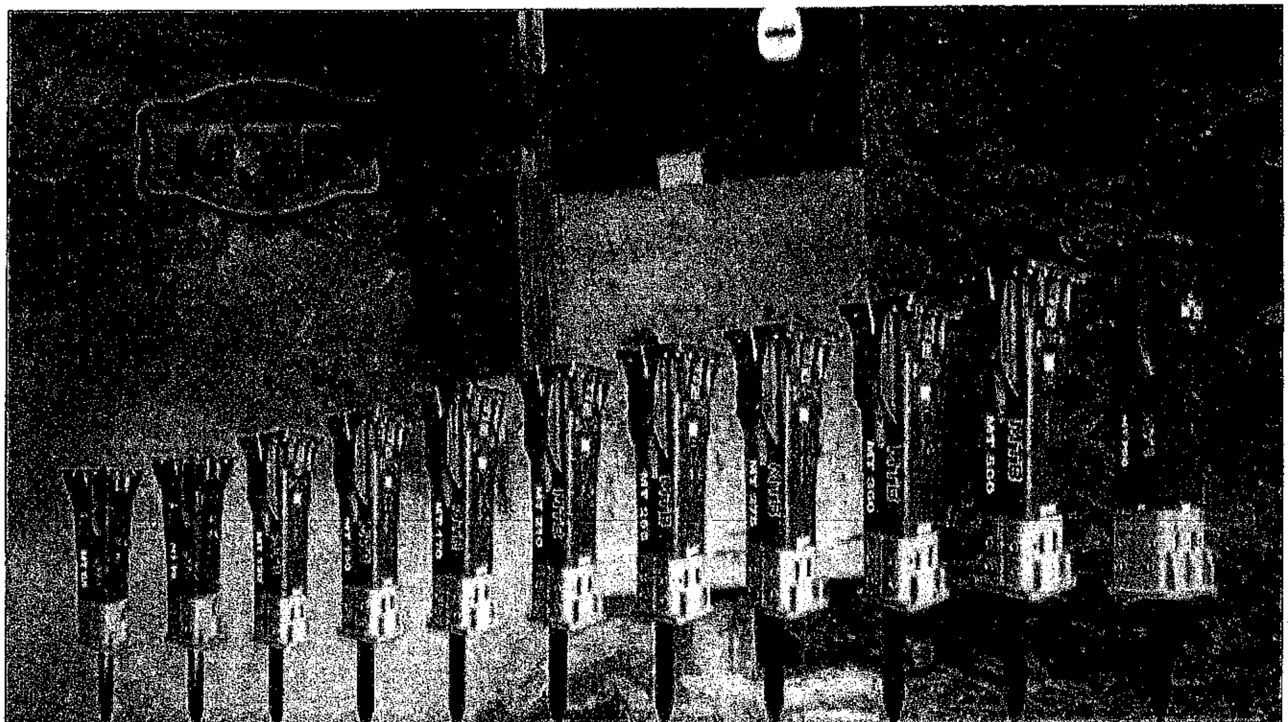
The AQ transverse cutting attachments are designed for hard rock excavation and demolition for excavators in weight classes from 3 to 150 tons.

*

	Unit	AQ-1	AQ-2	AQ-3	AQ-3XL	AQ-4	AQ-4XL	AQ-5	AQ-6XL
Cutting head diameter	in	12	16	23	23	26	28	32	37
Cutting head width	in	21	24	31	32	39 (S) , 47 (B)	48	52	63
Speed 0		X	X	X	X	75 at Q = 47 gpm	X	X	X
Speed 1	RPM	90 at Q=9 gpm	X	80 at Q = 32 gpm	90 at Q = 37 gpm	75 at Q = 63 gpm	75 at Q = 79 gpm	62 at Q= 92 gpm	62 at Q=186 gpm
Speed 2	RPM	90 at Q=11 gpm	90 at Q=15 gpm	80 at Q = 40 gpm	85 at Q = 45 gpm	75 at Q = 69 gpm	70 at Q = 92 gpm	57 at Q=106 gpm	48 at Q=211 gpm
Speed 3	RPM	90 at Q=12 gpm	90 at Q=18 gpm	X	85 at Q = 50 gpm	72 at Q = 78 gpm	65 at Q = 103 gpm	53 at Q=119 gpm	48 at Q=250 gpm
Speed 4	RPM	90 at Q=13 gpm	75 at Q=21 gpm	X	X	X	X	X	X
Oil Flow	gpm	9 - max. 21	11 - max. 26	32 - max. 45	35 - max. 65	47 - max. 84	66 - max. 128	92 - max. 158	180 - max. 260
Oil pressure max.	PSI	5075	5075	5075	5075	5075	5075	5075	5075
Max Torque output	ft lb	1,374	3,824	7,647	9,800	17,206	24,600	34,400	80,500
Max Cutting force	lbs	2,736	5,834	8,112	10,400	15,697	22,140	26,073	53,380
Approx. weight	lbs	484	990	1,980	2,215	3,850 (4,070)	4,800	7,260	13,200
Maximum input power	HP	42	60	87	120	160	215	270	470
Recommended carrier weight	tons	3 - 7	6 - 17	10 - 22	15 - 30	25 - 40	45 - 70	50 - 80	80 - 150
Recommended engine power of carrier	HP	17 - 60	27 - 90	80 - 120	80 - 160	150 - 240	80 - 120	220 - 310	300 - 470







Box Type Low Noise Breakers												
		MTB 65	MTB 95	MTB 120	MTB 150	MTB 170	MTB 210	MTB 255	MTB 275	MTB 360	MTB 500	MTB 700
Working Weight	lb	1433	2095	2646	3528	4123	4851	5556	6505	8269	10474	15215
Impact Energy Class	ft.lb	1500	1800	2000	2500	3500	5500	6500	7500	11000	13000	15000
Impact Frequency	bpm	350-700	390-700	400-700	360-650	350-550	350-550	330-525	320-520	320-510	300-420	285-400
Min & Max Oil Supply	gpm	15.8-31.7	18.5-34.4	18.5-34.4	26.4-47.6	31.7-47.6	42.33-60.8	47.6-66	44.9-79.2	52.8-79.2	66-89.8	79.2-105.6
Operating Pressure	psi	1815	1815	2000	2000	2000	2035	2035	2035	2035	2035	2180
Tool Diameter	inch	3.74	3.93	4.33	4.72	5.12	5.51	5.9	6.3	6.69	7.47	8.27
	mm	95	100	110	120	130	140	150	160	170	190	210
Carrier Weight	1000 lb	15.4-26.7	19.8-33	24.3-39.7	39.7-57.3	48.5-63.7	55.1-70.5	66.1-77.2	77-110	88.2-154.4	99.2-145.4	132.3-220.5

WATER TRUCKS

Features:

Multiple front, rear, and side spray nozzles.

Hydrant fill capability and low point drains.

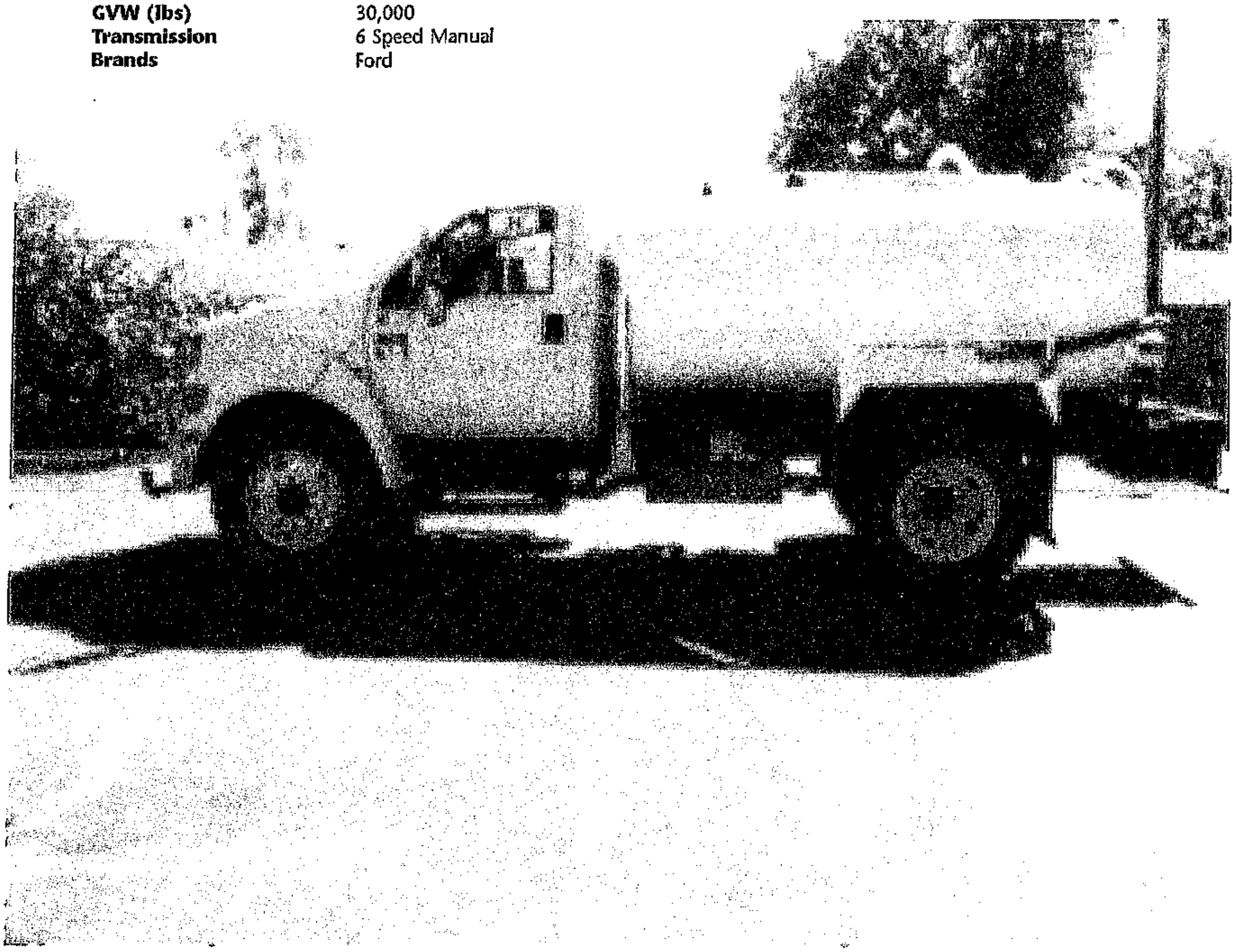
1½ in. hose with spray nozzle.

In-cab controls and back up alarms.

Specifications

Available Range: 2,000 Gal,

Class, Tank Capacity (gal)	**2,000**
Engine/HP	Diesel/207
A/C	Yes
GVW (lbs)	30,000
Transmission	6 Speed Manual
Brands	Ford



APPENDIX C

SITE SAFETY AND HEALTH PLAN

SITE SAFETY

AND

HEALTH PLAN

FOR

Exide North Landfill
Response Action

7471 5th Street
Frisco, TX 75034

Prepared for:

Exide Technologies
Frisco, TX

Prepared by:

Remediation Services, Inc.
2735 S. 10th St.
Independence, Kansas 67301

July 18th, 2012

Prepared by: ______________________________ Date: ____________________

Reviewed by: ______________________________ Date: ____________________

TABLE OF CONTENTS

TABLE OF CONTENTS - Continued

TABLE OF CONTENTS - Continued

SECTION I

REMEDIATION SERVICES, INC.
Independence, Kansas

RSI Project No. 75034

SITE SAFETY AND HEALTH PLAN

1.0 Site Introduction

This document has been prepared to provide a Site Safety and Health Plan (SSHP) for a project to be completed for Exide Technologies. The site is located at 7471 5th Street, Frisco, TX 75034. (See Figure 1 - Site Location Map at the end of this section.). Site activities shall be performed in accordance with the Company's Safety and Health policies (see Appendix A-8) and OSHA Safety and Health Standards. All employees, including subcontractor employees, shall be bound by the terms of these documents. Where the word "shall" is used, the provisions are mandatory.

1.1 General Site Description

Remediation Services, Inc. (RSI) has prepared this Site Safety and Health Plan (HASP) for the implementation of the Response Action Work Plan (RAWP) prepared by W & M Environmental Group Inc. for work at Exide Technologies, Inc. Frisco, TX recycling facility (Site). The RAWP includes stabilization of treated slag which exceeds the Universal Treatment Standard (UTS) for lead and/or cadmium in active cells at the North Landfill. An aggregate distribution yard and agricultural land is located to the west. A heavy equipment yard and residential areas are located to north. Residential areas located to the east and the Exide facility is located to the south.

1.2 Work Activities

The work activities performed during this project will require Level D, Modified Level D, and Level C personal protection. The work activities include, but are not limited to, the following:

- Mobilization
- Site Preparation
- Stabilization, Excavation and Stockpiling of Wastes
- Sampling of Waste Stockpiles
- Confirmation Sampling of Excavation Area
- Placement of Waste Materials
- Decontamination of Equipment
- Demobilization

FIGURE 1

Exide North Landfill
7471 5th Street
Frisco, TX 75034

SITE LOCATION MAP

2.0 Site Organization Structure

The general management of this project is the ultimate responsibility of Grant Sherwood, principal of RSI.

2.1 Project Superintendent

The project superintendent is the person assigned by RSI to have overall responsibility for completing tasks set forth in the Site Safety and Health Plan. In the area of safety, this person is responsible for:

- Obtaining the project safety plan and any known information regarding site specific chemical hazards and other known potential hazards;
- Arranging for any necessary or required training of project personnel;
- Assisting the Site Safety Officer (defined below) in the selection and procurement of any necessary safety equipment, monitoring devices, protective clothing, respirators, etc.;
- Implementation of the Site Safety and Health Plan; and
- Enforcing provisions of the Site Safety Plan among all personnel on or visiting the project site.

The Project Superintendent will be To Be Determined.

2.2 Site Health and Safety Officer

The Site Health and Safety Officer (HSO) is the person assigned by RSI to be responsible for work and safety procedures on the project site. The HSO will be appointed by and will report to the Director of Health and Safety, Daniel Roth. The Site Health and Safety Officer's responsibilities in the area of health and safety include:

- A thorough understanding of the project Site Safety Plan;
- Obtaining any necessary safety equipment;
- Orientation of all project personnel prior to commencement of work;
- Verification that personnel on the project site have received the required training;
- Inspecting and maintenance of safety equipment during the time it is used on the project site;
- Conducting air monitoring activities in accordance with the Site Safety Plan;
- Establishing a work zone, decontamination zone, safety stations, etc. when needed and instructing project personnel regarding their locations;
- Coordinating the Site Safety Plan with other contractors on the project site;
- Recording work practices, health and safety precautions taken, and air monitoring levels;
- Modifying the Site Safety Plan, as necessary, including notification to the Industrial Hygienist (IH) and project manager of any changes, when applicable;
- Enforcing provisions of the Site Safety Plan among project personnel and any others, including visitors, under control of RSI on the project;

- Supervising project personnel and safety equipment in the event of any medical emergency or accident; and

- Notification of local police, fire, and hospital personnel of the nature of the work and dates of field activity (if required). These organizations will also be given health and safety information on chemical agents at the work site. This information includes chemical names, expected exposure routes, hazards, and toxic effects. This notification will be performed prior to commencement of work at the site.

The Site Health and Safety Officer for this project will be to be determined.

2.3 Project Personnel

All project personnel will be responsible for knowledge of the Site Safety Plan for work in which they are engaged and for compliance with the provisions of the plan. Project personnel are expected to exercise due care in the work performed on the project site and shall be responsible for reporting any unsafe conditions, accidents, injuries, or exposure to harmful or potentially harmful substances to the Site Health and Safety Officer.

Other personnel assigned to this site will be as follows:

Name	Job Assignment
To be determined	Operator
To be determined	Operator
To be determined	Technician
To be determined	Truck Driver

3.0 Personnel Safety and Health Training

General site workers engaged in hazardous substance removal or other activities that may expose workers to hazardous substances and health hazards will receive a minimum of 40 hours of off-site instruction, and a minimum of 3 days of actual field experience under the direct supervision of a trained, experienced supervisor.

- Truck Drivers delivering materials that remain in the cab of the truck while it is being unloaded do not have to have 40 hour hazwoper training.

The introductory training program given to personnel consists of 40 hours of classroom training in accordance with OSHA 29 CFR 1910.120, which provides a basic overview of subject material and, where applicable, equipment and procedure demonstrations. This initial training covers the following topics:

- General toxicology overview;
- Basic safety, personnel, and industrial hygiene practices;
- Field operating practices and procedures - limiting exposures, decontamination, buddy system, etc.;
- Operation, use, and maintenance of protective equipment and respiratory devices;
- Respirator fit testing;
- Personal protective clothing - types and limitations;
- Contingency planning - response to minor spills, communications protocol, evacuation procedures;
- Operation, use, and maintenance of direct reading monitoring equipment;
- Sampling procedures; and
- Basic first aid and CPR training.

Eight-hour annual refresher training, which incorporates the latest information on equipment improvements and advances in safety and operating practices, is also part of the training program. Records of employee training are maintained and updated regularly.

On-site management and supervision personnel directly responsible for, or who supervise employees engaged in, hazardous waste operations will receive 40 hours of initial training, 3 days of supervised field experience, and at least 8 additional hours of specialized supervisory training.

Daily planning and safety meetings are conducted at project sites to inform each work team of its activities and pertinent safety considerations. The Site Safety & Health Officer will document the daily safety meetings. Hazard identification, warning and contingency plans are developed in advance, and employees are constantly briefed on their involvement should these plans be needed. Personnel are encouraged to report potential and actual problems to foremen and/or supervisors during the workday as well as during safety meetings.

4.0 Hazards - Chemical/Physical

The contaminants that may be encountered at the project site are described in Table 1 at the end of this section. Contaminates of concern during this project are lead and cadmium which are present in the slag located in the landfill. MSDS's and/or descriptions of the materials, which may be encountered on this site, are included in Section III.

4.1 Chemical Hazard

Special consideration should be given to the application of TLV's in assessing exposure to mixtures of two or more substances because the total effect may be greater than the sum of their separate parts. Most threshold limits have built-in safety factors to guard against adverse effects to moderate deviations from normal environments. The safety factors of most substances are not of such a magnitude as to take care of gross deviations.

Table 1 lists the chemical and physical characteristics of the primary constituents of concern, which have been identified from past investigations.

An action level for an upgrade in the level of respiratory protection is calculated by adjusting the PEL or TLV of a substance by a safety factor and NIOSH recommended respiratory protection factor. The safety factor is based upon various factors, including waste mix, site conditions monitoring equipment being utilized and the warning properties of the waste such as odor. When any of the monitoring instruments exceed the specified action level, the level of personal protection will be increased to the appropriate level.

Action levels triggering an upgrade from modified Level D to Level C or B are established by examining exposure limit data to select the compound with the lowest TWA as the reference compound.

The following levels shall be used as a guide to determine if an upgrade to a higher level of protection is required. However, some individuals are more sensitive to various chemicals than others. Upgrading to a higher level of protection, i.e., Level D to Level C, is always appropriate if an individual is sensitive to the odors. Level B personal protection is included in this plan. Site air monitoring shall be used to determine if Level B protection is required.

Engineering controls, such as wetting or covering the waste materials should always be utilized to control the escape of VOC's or creation of dust prior to increasing the level of personal protection.

4.2 Physical Hazards

Physical hazards such as slips, trips, and falls may occur. Workers must walk cautiously at a site to avoid tripping, especially when uneven terrain is present. Falls are more serious when they occur from heights. Extra precautions must be taken if guardrails or railings are absent. Ladders used for access to a high place should be securely lashed or otherwise fastened at the top to prevent sliding and the feet must be on a firm and level base. Vehicles used at a site can strike workers. While driving in reverse, the operator usually has a more limited field of view than while driving forward and must use extra caution. Such vehicles must be equipped with a backup alarm to warn workers that the vehicles are moving in reverse. Table 2 describes additional physical safety hazards and controls.

Material Handling: Accidents in manual handling of materials are primarily the result of unsafe working habits -- improper lifting, carrying too heavy a load, incorrect gripping, or failing to wear personal protective equipment. These may be avoided by testing the weight of an object before attempting to lift and carry it. If it is too heavy, get help, and if possible, use mechanical lifting aids. The proper method for lifting is:

- Get a good footing.
- Place feet about shoulder width apart.

- Bend knees to pick up load. Never bend from waist.
- Keep back straight.
- Get a firm hold. Grasp opposite corners of the load, if possible.
- Keep the back as upright as possible.
- Lift gradually by straightening the legs - don't jerk the load.
- Keep the weight as close to the body as possible.
- When changing directions, turn the entire body, including the feet.
- Don't twist the body.

4.2.1 Utilities

Prior to beginning excavation activities, the underground utilities shall be located. The appropriate owners will locate underground utilities by contacting the Texas on Call System at 1-800-245-4545 In addition all site personnel will note the location of all overhead lines in the work areas. Maintain at least 10 feet of clearance from overhead power lines. If work must be conducted in an area where the 10 feet of clearance cannot be maintained, contact the utility to have the power shut off or shields installed.

Date One Call Contacted: mm/dd/yyyy by Daniel Roth
Confirmation Number: #
Utilities Contacted:

4.2.2 Confined Space Entry

RSI's "Confined Space Entry" policy shall be adhered to during entry into any area, which is designated a confined space. See Appendix A-3 for Confined Space Entry Procedures.

- Entering trenches or excavations greater then 4 feet deep or entering a frak tank will be considered confined space entries.

OSHA regulations regarding the sloping and shoring of excavations shall be strictly adhered to. See Appendix A-7 for Excavation Standards.

Use of the Buddy System:

In situations in which there is the potential for hazardous chemical exposure, no work is to be conducted without the benefit of the buddy system. Before the start of work each day, employees are to form buddy teams with which to work throughout the day. Decisions as to implementation of the buddy system will be the responsibility of the site health and safety officer and will be based on activities and potential exposure.

4.2.3 Lockout/Tag out Procedures

RSI's Lockout/Tag out Procedures shall be strictly adhered to during all work at this site. See Appendix A-5 for Lockout/Tag out Procedures.

4.2.4 Mechanical Hazards

Equipment operators must have experience operating any equipment, which they will be required to operate at the site and must be cognizant of the persons working around them. Equipment must be operated in compliance with all OSHA Construction Standards. Persons working around equipment must be cognizant at all times of where the equipment is operating. Make eye contact with the operator before approaching the equipment in operation.
Site Communications:

The following hand signals shall be used to communicate with others if not within talking distance:

- Hand gripping throat - Out of Air, Can't Breathe
- Grip buddy's wrist or waist - Leave Area Immediately
- Both hands atop head - Need Assistance
- Finger touching nose or respirator - Can Smell Contamination
- Thumbs up - OK, I'm All Right, I Understand, Let's Go
- Thumbs down - No, Negative

4.2.5 Fire

Since powered equipment will be in use at the project site, a fire hazard will exist. All powered equipment shall have available a fire extinguisher to control any fire which may occur while using such equipment.

4.2.6 Noise

Excess noise exposures may be encountered while using powered equipment. Equipment such as rock crushers, jackhammers and processes such as concrete demolition are expected to produce excessive noise. The Site Health and Safety Officer will determine if noise monitoring and hearing protection is necessary. When such equipment or processes are being utilized, operators and technicians in the area will require hearing protection.

4.3 Work Limitations

Both physiological and psychological stress effect hazardous material clean-up personnel. Wearing protective clothing increases the risk of accidents. They are heavy and cumbersome; they decrease dexterity and agility; they interfere with vision, and they cause fatigue. These factors all increase physical stress and the potential for accidents. It is the responsibility of each employee to report any condition, including stress related conditions, that would render him unfit for work or create a dangerous situation for him or others.

4.3.1 Heat-Related Disorders

Potential heat stress hazards are common at sites in which employees must wear impermeable clothing. Table 3 describes hazard evaluation and controls for heat and cold stress. The three major classes of heat stress are the following:

- Heat exhaustion is a response to heat characterized by fatigue, weakness, and collapse due to an inadequate intake of water necessary to compensate for water lost through excessive perspiration.

- Heat stroke is a response to heat characterized by extremely high body temperature and failure of the sweating mechanisms.
- Heat stroke is an immediate, life-threatening emergency for which medical care is urgently needed.
- Heat cramps involve muscular pains and spasms caused from loss of electrolytes through sweating. Any person exhibiting symptoms of heat-related disorder must exit the work area and take a break until the symptoms subside and must drink plenty of fluids during the break. Everyone must drink fluids at frequent intervals throughout the work day to prevent heat-related disorders.

The Site Health and Safety officer will be responsible for work/rest regimen and availability of fluids on site to control heat-related hazards.

In high ambient temperatures, follow heat-stress precautions:

- Drink plenty of cool water or juice before becoming thirsty;
- Take regular breaks at a designated rest station out of direct heat and sunlight;
- Increase the frequency of breaks with increasing heat and humidity;
- Modify the work schedule, working during cooler times of the day and breaking during hot noon hours;
- Check resting pulse and increase number of breaks if pulse does not return to normal within a reasonable amount of time.

4.3.2 Hypothermia (cold stress)

Hypothermia may be encountered when wind and/or rainy conditions exist. Wearing proper clothing for the weather conditions present can best protect against hypothermia. In a cold environment, wear several thin layers of clothing as opposed to a single thick layer. If rainy weather conditions exist, wear the proper rain gear to prevent inner clothes from becoming saturated. If the potential exists for inner clothing to become saturated, carry a change of clothing. Table 3 describes hazard evaluation and controls for heat and cold stress.

In cold temperatures, follow hypothermia precautions:

- Dress in removable layers to prevent sweating;
- Carry protective rain gear and use it before rain starts;
- Drink warm liquids;
- Monitor coworkers for signs of shivering, un-coordination, or confusion.

4.3.3 Lighting

Work may only progress during daylight hours or with adequate temporary lighting.

4.4 Biological Hazards

The plant and animal life that may be present on any site offer another concern of exposure. Many plants and animals are poisonous to humans, and a working knowledge should be maintained on the local habitat. Adequate first aid measures for these possible exposures should be maintained at the site.

4.4.1 Exposure to Bloodborne Pathogens

For purposes of this health and safety plan, personnel fall into the category of classification B in the Bloodborne Pathogens Program, which are jobs where required tasks normally do not but could involve exposure to blood, bodily fluids, or tissues - for example, in the event first aid or CPR is required. If exposure to blood, bodily fluids, or tissues occurs, universal precautions such as the following will minimize the chance of contracting disease.

- Wash hands with soap and water as soon as possible after contact with blood, bodily fluids, or human tissue from an injured worker. When handwashing facilities are not readily available, antiseptic hand cleansers in conjunction with clean cloth/paper towels shall be used and hands should be washed with soap and water as soon afterwards as possible.

- Wear gloves when anticipating contact with blood, bodily fluid, tissues, mucous membranes, or contaminated surfaces, or if breaks in the skin are present.

- Wear appropriate protective equipment at all times, including a mask and eye protection, if aerosolization or splattering is likely to occur when attending to an injured worker or when conducting normal work routines.

- Ensure that mouthpieces and appropriate personal protective equipment are readily available in first aid kits.

- Report immediately to the Site Safety Officer all sticks or cuts, mucosal splashes, or contamination of open wounds with blood or bodily fluids.

- Dispose of all spills that contain or may contain biological contaminants in accordance with policies for hazardous waste disposal. Until cleanup is complete an accident area should be roped off from other workers.

The following work practice controls shall also be used to eliminate or minimize employee exposure. Where occupational exposure remains after instituting these controls, personal protective equipment shall also be used.

- Ingestion of bloodborne pathogens - Eating, drinking, smoking, applying cosmetics, and handling contact lenses are prohibited in work areas where there is a reasonable likelihood of occupational exposure. Food and drink shall not be kept in refrigerators, freezers, shelves, cabinets, or on countertops or benchtops where blood or other potentially infectious materials are present.

- If handling potentially infectious body parts following dismemberment in an accident, specimens of blood or other potentially infectious materials shall be placed in a container which prevents leakage during collection, handling, processing, storage, transport, or shipping. The container shall be labeled or color coded according to labeling requirements and closed prior to storage, transportation, or shipping. If outside contamination of the primary container occurs, the primary container shall be placed within a secondary container that is puncture resistant in addition to the above characteristics.

- Equipment which may become contaminated with blood or other potentially infectious materials shall be examined prior to servicing or shipping and decontaminated as necessary, unless the site supervisor determines that decontamination of such equipment is not feasible. A readily observable biohazard label shall be attached to the equipment stating which portions remain contaminated. The site supervisor shall ensure that this information is conveyed to all affected employees, the servicing representative and/or manufacturer as appropriate, prior to handling, servicing, or shipping so that appropriate precautions may be taken.

- Personal protective equipment - appropriate personal protective equipment will be provided, such as gloves and mouthpieces in the first aid kit.

- All emergency first aid kits will contain red biohazard bags to contain waste created in first aid/emergency situations.

- Gloves will be worn at all times.

- Containers will not be overfilled.

- Containers will be tightly closed or sealed prior to transportation.

- Pools of blood, bodily fluid, tissue, or spills from biohazard waste containers shall be cleaned up with sodium hypochlorite or Clorox bleach, 1 part to 10 parts water.

Employees who have had an exposure incident will be referred for a confidential post-exposure evaluation and follow up. This will be made available within a reasonable time and location, and performed by or under the supervision of a licensed physician or licensed health care professional.

When an exposure incident is reported, the Project Manager will complete the Bloodborne Pathogens Incident Evaluation Form and will immediately refer the employee for a confidential medical evaluation and follow up. This referral must be made within 24 hours.

Decontamination of Equipment

1. Clean spills from around equipment immediately.

2. Employees engaged in cleaning equipment shall use personal protective equipment that will ensure that there is no contact of potentially contaminated material with skin or personal clothing.

3. Clean large equipment with a germicidal detergent or bleach (1 part to 10 parts water), avoiding splatter or dripping. If dripping is reasonably anticipated, use a drop cloth under the equipment being cleaned.

4. Wipe contamination from small, reusable equipment. Label the equipment with warning labels indicating which parts are contaminated before sending it to an appropriate location for reprocessing.

5. All cleaning materials and personal protective equipment shall be disposed of as infectious waste or properly prepared for transport to a laundry as potentially infectious laundry.

6. Wash hands after removal of personal protective equipment.

TABLE 1

CONTAMINANTS WHICH MAY BE FOUND AT THE SITE

Known or Suspected Materials	Phase	Route of Exposure	PEL:/TLV:/ IDLH:	LEL	IP(eV)	Additional Information
Lead	Slag	Inhalation/Ingestion Eye contact/ skin contact	PEL: 0.05 mg/m^3 TLV: 0.05 mg/m^3	NA	NA	Central nervous system depression, slurred speech, bioaccumulative
Cadmium	Slag	Inhalation/Ingestion Eye contact/skin contact	TLV: 0.002 mg/m^3 (respirable dust) PEL: 0.005 mg/m^3	NA	NA	The substance irritates the eyes and the respiratory tract. Inhalation of fume may cause lung oedema (see Notes). Inhalation of fume may cause metal fever.

TABLE 2

PHYSICAL HAZARDS & CONTROLS

Hazard	Engineering/Administrative Controls
Flying debris/objects	Provide shielding and Personal Protective Equipment (PPE)
Noise > 85 dBA	Noise protection and monitoring required
Steep terrain/unstable surface	Brace and shore equipment
Buildup of explosive gases	Provide 20 lb. A,B,C fire extinguisher and ventilation
Buildup of static electricity	No spark sources within 50 feet of an excavation, heavy equipment, or Underground Storage Tank (UST) removal. Ground as appropriate.
Gas cylinders	Make certain gas cylinders are properly anchored and chained. Keep cylinders away from ignition sources.
High pressure hose rupture	Check to see that fitting and pressurized lines are in good repair before using.
Electrical shock	Make certain third wire is properly grounded. Do not tamper with electrical wiring unless qualified to do so.
Suspended loads	Work not permitted under suspended loads.
Moving vehicles	Backup alarm required for heavy equipment. Observer remains in contact with operator and signals safe backup. Personnel to remain outside of turning radius.
Overhead electrical wires	Heavy equipment to remain at least 10 feet from overhead power line for power lines of 50 kV or less. For each kV > 50, increase distance 1 inch.
Buried utilities, drums, tanks, and so forth	Locate buried utilities, drum, tanks, etc., prior to digging or drilling, and mark location.
Slip, trip, fall hazards due to muddy work areas	Use wood pallets or similar devices in muddy work areas.
Back injury	Use proper lifting techniques, or provide mechanical lifting aids.
Protruding objects	Flag visible objects.
Fall hazards	Full body harness, suitably tied off when working at heights > 6 feet.
Splashing and/or inhalation of contaminated liquids and/or gases	Use appropriate personal protection equipment including proper respiratory protection.

TABLE 3

HAZARD EVALUATION & CONTROL

HEAT AND COLD STRESS			
GUIDELINES FOR WORKING IN TEMPERATURE EXTREMES WHILE WEARING PERSONAL PROTECTIVE EQUIPMENT (PPE).			
Temperature	**Work Cycle**	**Rest Cycle**	**Control Measures**
< 32° F for < 55° F & raining	2 hrs.	15 min.	Review cold stress in safety meeting. Rest in a warm area. Drink at least 8 ounces of warm beverage at each rest break. Schedule a midday lunch break of at least 30 minutes in a warm area, to begin not later than 5 hours after startup.
72° to 77° F	2 hrs.	5 min.	Review heat stress in safety meeting. Take resting pulse rate before beginning work. Drink 8 ounces of cool water before beginning work and 4 ounces at rest break. Have ice available.
77° to 82° F	2 hrs.	5 min.	As above, but seated rest break. Monitor pulse rate (see below).
82° to 87° F	60 min.	15 min.	As above, but rest area to be shaded.
87° to 90° F	30 min.	15 min.	As above. Try to provide a shaded work area.
> 90° F	15 min.	15 min.	As above. Provide a shaded area with seats in the work area for team members to use as needed. Try to reschedule work to avoid midday heat.
PULSE CRITERIA. Take resting radial (wrist) pulse at start of workday; record it. Measure radial pulse for 30 seconds as rest period begins. Pulse not to exceed 100 beats per minute (bpm), or 20 bpm above resting pulse. If pulse exceeds these criteria, reduce workload and/or shorten the work cycle by one third, and observe for signs of heat stress. No team member is to return to work until his/her pulse has returned to < 110 bpm, or resting pulse + 20 bpm.			
SYMPTOMS AND TREATMENT OF HEAT AND COLD STRESS			
Heat Stroke	**Heat Exhaustion**	**Frostbite**	**Hypothermia**
Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high body temperature.	Pale, clammy, moist skin; profuse sweating; weakness; normal temperature; headache; dizzy; vomiting.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering; apathy; sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Cool victim rapidly by soaking in cool (not cold) water. Get medical attention immediately!	Remove victim to a cool, air-conditioned place. Loosen clothing, place in head low position. Have victim drink cool (not cold) water.	Remove victim to a warm place. Rewarm area quickly in warm (not hot) water. Have victim drink warm fluids (not coffee or alcohol). Do not break any blisters. Elevate the injured area and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids (not coffee or alcohol). Get medical attention.

5.0 Medical Surveillance

An initial baseline medical examination and medical test is required of all employees before their initial hazardous waste/materials operations assignment. Some employees may be required to have additional tests included in the initial exam. This will be at the discretion of the examining physician depending on the results of the medical history, the physical examination, and on the workers age, further medical testing, such as chest x-ray, pulmonary function testing, and an electrocardiogram may be necessary.

Site-specific medical examinations and tests may be required whenever an employee is assigned to site operations that may contain a specific compound that has not been previously tested for. Additional exams and tests also may be required depending on the frequency and types of exposure a worker may experience. An annual exam will be required for all site personnel and also at termination of employment.

Personnel participating in the medical monitoring program will receive written notification if a medical report indicates any test is out of the normal limits. Employees shall be provided with a copy of medical reports upon request.

Non-scheduled medical examinations may be conducted under any of the following circumstances:

- After acute exposure to any toxic or hazardous material.
- At the discretion of a project manager, health and safety officer, or physician.
- At the justified request of an employee.

The ability of on-site personnel to wear respiratory protection is certified by the medical surveillance physician in compliance with 29 CFR Part 1910.134 and ANSI Z88.2 - 1980. See Appendix A-2 for RSI's Respiratory Protection Plan.

6.0 Site Controls

Physical barriers to prohibit unauthorized personnel from entering the work site will be maintained and inspected on a daily basis.

Site security is necessary to:

- Prevent the exposure of unauthorized people to site hazards.
- Avoid the increased hazards from vandals or persons seeking to abandon other waste on the site.
- Prevent theft.
- Avoid interference with safe working procedures.

6.1 Site Control Procedures

6.1.1 During Working Hours

- Maintain security in the transition and exclusion zone, specifically controlling access of unauthorized visitors.
- Establish an identification system to identify authorized persons and limitations to their approved activities.
- Assign responsibility for enforcing authority for entry and exit requirements.
- Ensure that all gates are closed during working hours when access is not required.
- Have the Project Team Leader and Site Health and Safety Officer approve all RSI-sponsored visitors to the site.
- Have trained site personnel accompany visitors at all times and provide them with the appropriate protective equipment.
- Any person without appropriate training and medical monitoring will not be allowed in the exclusion zone.

6.1.2 During Off-Duty Hours

- If necessary, assign trained, in-house technicians for site surveillance.
- If necessary, use security guards to patrol the site boundary.
- Enlist public enforcement agencies, such as the local police department, if the site presents a significant risk to local health and safety.
- Secure all equipment.

6.2 Exclusion Zone

The exclusion zone shall be identified areas in which contaminated materials are being disturbed. The Site Safety and Health Supervisor shall map the exclusion zone and conduct a briefing with all personnel. This map shall be posted on site. RSI shall control entry in to this area. Exit may only be made through the Contamination Reduction Zone. All changes in the site zone shall require additional safety briefings.

6.3 Contamination Reduction Zone

The Contamination Reduction Zone (CRZ) shall serve as the personnel, truck, and equipment decontamination area and will contain an area for personnel decontamination.

6.4 Support Zone

The support zone shall be established outside the zone of significant contamination and adjoining the transition zone. This zone shall be used as the entry area for personnel, trucks, equipment, and materials into the exclusion zone. Office/storage trailers shall be set up in this area. Maintenance of heavy equipment will be completed in an area designated for this use. An additional area will be maintained in the support zone for final cleaning of hands, arms, and face.

6.5 General Hygiene/Work Practices

All employees and visitors will be required to maintain good hygiene/work practices that include:

- Thoroughly wash hands, arms and face before any hand to mouth activity such as eating, drinking, and smoking.

- Smoking will be allowed only in the break area designated for smoking.

- Eating and drinking are prohibited in all areas determined to be contaminated.

- No excessive facial hair will be allowed which interferes with a proper fit of the respirator mask.

- Shower as soon as possible after leaving the site.

- Change clothing each day.

- Avoid contact with contaminated materials. Whenever possible, walk around wet or discolored surfaces.

- Do not sit, kneel, or lean against any surface that may contain contaminants.

- If protective clothing displays any loss of integrity such as a rip or tear, immediately proceed through the decon station and replace clothing.

- Properly remove and clean or dispose of all clothing and equipment at the end of each work shift in the Contamination Reduction Zone.

- While inside the Exclusion Zone, use the buddy system. Do not work alone and keep your buddy in sight at all times after entering the contaminated work areas.

6.6 Decontamination

6.6.1 Personal Decontamination

The decontamination zone shall contain liners and be constructed in such a way as to protect the adjacent environment. All decon solutions shall be contained for proper disposal.

Typical Level C/D Decontamination Set-Up

Decontamination Procedures. Decontamination of personnel will be accomplished using equipment-washing stations.

Station 1: Segregated Equipment Drop

- Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross-contamination.

Equipment:	various size containers Plastic liners Plastic drop cloths

Station 2: Boot Cover and Glove Wash

- Scrub outer boot covers and gloves with decon solution or detergent/water.

Equipment:	various size containers Decon solution or detergent 2-3 long-handled, soft bristle scrub brushes

Station 3: Boot Cover and Glove Rinse

- Rinse off decon solution from Station 2 using copious amounts of water. Repeat as many times as necessary.

Equipment:	various size containers High-pressure spray unit water 2-3 long-handled, soft bristle scrub brushes

Station 4: Boot Cover Removal (if appropriate)

- Remove boot covers and deposit in container with plastic liner.

Equipment:	various size containers Plastic liners Bench or stool

Station 5: Outer Glove Removal

- Remove outer gloves and deposit in container with plastic liner.

  Equipment: various size containers
  Plastic liners

Station 6: Tyvek Suit Disposal

- Remove Tyvek suite and deposit in container with plastic liner.

  Equipment: various size containers
  Plastic liner

Provision will be made for employees to clean their respirators in the support zone. After removal of the cartridges, the respirators should be washed in soapy water, rinsed in clean water and disinfected with a sterile wipe. The respirator should be allowed to dry and then stand in a sealed plastic bag or other airtight container away from heat and direct sunlight.

6.6.2 Equipment Decontamination

Any sampling equipment, small tools, or safety equipment that cannot be decontaminated will be containerized and disposed with other site wastes. Heavy equipment will be decontaminated in the area set up for this use. Each piece of equipment must be thoroughly decontaminated prior to transfer to the support zone.

All decon solutions shall be collected and contained in such a way as to protect the adjacent environment. The decon solutions shall be contained for proper disposal.

Small Equipment and Instruments: If small pieces of equipment and instruments become contaminated, they shall be washed thoroughly. The wash water will be collected and disposed of in the appropriate manner.

Large equipment shall be steam cleaned or washed with a detergent solution from a high-pressure washer before being removed from the work area. The rinsates will be collected in such a way to protect the adjacent environment and disposed of in the appropriate manner.

7.0 Personal Protection Equipment

Level D, Modified Level D and Level C PPE will be worn during specific site activities. Air monitoring will be conducted prior to entering all confined spaces.

The Level D protection work uniform includes:

- Hard Hat
- Long Pants and Shirt with sleeves
- Safety glasses or goggles
- Steel-toed boots

The Modified Level D work uniform includes all Level D equipment and:

- Tyvek©, CleanGuard©, Poly Pro© or coveralls (poly coated tyvek for power washing)
- Leather, Nitrile or butyl rubber gloves shall be used if contact with material is expected.
- Rubber boot covers over steel-toed boots or steel-toed rubber boots

Level C protection includes:

- All Modified D equipment
- Full-face or Half Face air purifying respirator (APR) equipped with HEPA cartridges.
- Powered Air Purifying Respirator (PAPR)equipped with HEPA cartridges (optional).

The following is a list of the tasks to be completed and the anticipated levels of protection that will be required.

TASK	LEVEL OF PROTECTION
➢ Mobilization	Level D
➢ Site Preparation	Level D
➢ Stabilization,Excavation and Stockpiling of Wastes	Level C/Modified Level D[2]
➢ Sampling of Waste Stockpiles	Modified Level D
➢ Confirmation Sampling of Excavation Areas	Level C/Modified Level D[3]
➢ Placement and Compaction of Waste Materials	Level C/Modified Level D[4]
➢ Decontamination of Equipment	Level C/Modified Level D[5]
➢ Demobilization	Level D

Notes:

[1] Nitrile or Butyl Gloves and Rubber boot covers will be required in addition to tyvek suits when contact with contaminated material is expected. If stabilization activities begun the level of protection will be upgrade to match the level of protection required by the stabilization activities.

[2] Initial work to be conducted in Level C PPE until a negative exposure assessment for lead (Pb) (< 30ug Pb/m^3) and a negative exposure assessment for cadmium (Cd) (<2.5 ug/m^3) have been completed. PPE may be down graded based upon the air sampling results by written amendment to this plan.

[3] Confirmation Sampling conducted in the work zone will be conducted in Level C PPE until the negative exposure assessments from the Stabilization process has been completed.

[4] The level of protection will be the same level of protection required by the stabilization activities.

[5] Level C PPE with poly coated tyveks with rubber glove and rubber boot covers to be worn while power washing and scraping equipment. PPE may be down graded to Modified Level D with Poly coated tyveks, rubber gloves and rubber boot covers and a face shield based on the exposure assessments previously conducted.

TABLE 4

PERSONAL PROTECTIVE EQUIPMENT

EQUIPMENT	PROTECTION PROVIDED	SHOULD BE USED WHEN	LIMITING CRITERIA
Level C: **Recommended:** Full-face piece, air-purifying canister-equipped respirator. Chemical-resistant clothing (hooded, one- or two-piece chemical splash suit; disposable chemical-resistant one-piece suit). Inner and outer chemical-resistant gloves. Chemical-resistant safety boots/shoes. Hard hat. **Optional:** Two-way radio communications. Coveralls. Disposable boot covers. Face shield. Escape mask. Long cotton underwear.	The same level of skin protection as Level B, but a lower level of respiratory protection.	The atmosphere contaminants, liquid splashes, or other direct contact will not adversely affect any exposed skin. The types of air contaminants have Been identified, concentrations measured, and a canister is available that can remove the contaminant. All criteria for the use of air purifying respirators are met.	Atmospheric concentrations of chemicals must not exceed IDLH levels. The atmosphere must contain at least 19.5 percent oxygen.

TABLE 4

PERSONAL PROTECTIVE EQUIPMENT

EQUIPMENT	PROTECTION PROVIDED	SHOULD BE USED WHEN	LIMIT
Level D: **Recommended:** Coveralls or regular work uniform. Safety glasses or chemical splash goggles. Hard hat. Rubber overshoes over steel toed boots. Cotton gloves (Nitrile or butal rubber gloves shall be used if contact with waste material is expected.) **Optional:** Escape mask. Face shield.	No respiratory protection. Minimal skin protection.	The atmosphere contains no known hazard. Work functions preclude splashes, Immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemical.	The atm at least 1

TABLE 4

PERSONAL PROTECTIVE EQUIPMENT

EQUIPMENT	PROTECTION PROVIDED	SHOULD BE USED WHEN	LIMIT
Modified Level D: **Recommended:** Tyvek Coveralls. Cotton gloves (Nitrile or butal rubber gloves shall be used if contact with waste material is expected.) Hard hat. Goggles/safety glasses. Rubber overshoes over steel toed boots. **Optional:** Escape mask. Face shield.	No respiratory protection. Minimal skin protection.	The atmosphere contains no known hazard. Work functions preclude splashes, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemical.	The atm at least 1

8.0 Monitoring

8.1 Personnel Exposure Monitoring

8.1.1 Air Monitoring

Air monitoring will be conducted by collecting samples with low volume samplers on air sampling cassettes for total lead and total cadmium. Air samples will be collected in the breathing zone for each task being conducted. The sampling will be biased towards individuals with the expected greatest exposure potential.

Initial Exposure Assessments for Lead and Cadmium as required by 1926.62 and 1926.1127 will be collected on selected workers for each task during the first 3 days of intrusive activities. Air monitoring for lead and cadmium will be conducted on a weekly basis throughout the project.

Level C respiratory protection will be required on all individuals in the regulated area until negative assessments have been completed or if action levels in the table below are exceeded in any of the successive sampling events.

If the either of the actions levels for Pb or Cd are exceed, two successive sampling events 7 days apart below the action level will be required prior to downgrading the respiratory protection.

Hazard	Monitoring Instrument	Action Level(s)	Action or Measure
Lead	Low Flow Air Samplers and MCE 0.8 um Filter Cassettes	0.030 mg/m^3	Institute engineering controls by spraying water and upgrade to Level C PPE
Cadmium	Low Flow Air Samplers and MCE 0.8 um Filter Cassettes	0.0025 mg/m^3	Institute engineering controls by spraying water and upgrade to Level C PPE

8.1.2 Perimeter Air Monitoring

The perimeter air monitoring will be conducted as detailed in the Perimeter Air Monitoring Plan which is attached as an appendix to the Response Action Plan.

9.0 Emergency Response and Contingency Procedures

Copies of the following telephone numbers will be posted in site trailers, kept in all site vehicles, and provided to personnel in charge on-site.

Ambulance:	911
Hospital:	(972) 963-3333 Centennial Medical Center
Fire:	911
Police:	911
Client Contact:	(972) 335-2121 ext 33 Laurel Johnson, Health & Safety Manager, Exide Technologies

Directions to the Hospital: From the job site proceed to the plant entrance and turn left (north) on Eagan Way and proceed to the intersection with Parkwood Drive. Turn right (south) on Parkwood Drive and proceed to the intersection with Lebanon Road. Turn left (east) on Lebanon road and proceed to the Hospital entrance and follow the signs the emergency room entrance. Distance = 4.5 miles

(See Figure 2 - Map to Medical Center)

RSI Officer:		(620) 331-1200/OR AS BELOW:
Grant Sherwood	(Home)	(620) 331-2179
	(Mobile)	(918) 671-6106
John Gillman	(Home)	(620) 289-4726
	(Mobile)	(918) 671-0401
Butch Holum	(Home)	(620) 331-2842
	(Mobile)	(918) 671-9587
Dan Roth	(Home)	(620) 331-8096
Safety Officer	(Mobile)	(918) 760-2027

When calling for assistance in an emergency situation, the following information should be provided. NEVER hang up first in an emergency situation.

Name of person making call.
Telephone number and location of person making call.
Name of person(s) injured.
Nature of emergency.
Actions already taken.

9.1 Emergency Action - Standard Operating Procedures

It is expected that any emergency will be related to a physical injury. All appropriate emergency numbers will be posted and be familiar to all site personnel.

In an emergency, medical treatment may be needed for both on and off site. First aid kits will be available for minor cuts and wounds. Eye wash equipment will also be available.

In the event an employee is injured on site, the following response shall be required:

1. Lend immediate assistance to the injured person and simultaneously have another employee institute notification procedures to inform a supervisor of the accident.

2. Supervisor or any other available person shall direct the summons for emergency medical assistance.

3. Evacuation shall commence immediately following the blasting of air horns, radio instructions, or the raised waving arms signal. In the event of an evacuation, site personnel shall immediately leave the work areas, and deploy to the decon area to await further instructions.

4. Accident victims who require emergency transportation to the hospital shall be transported by ambulance. Accident victims who do not require ambulance service but do require medical attention will be transported to the appropriate facility by company vehicle. Gloves and any blood tissue or any other waste needs to be placed in the bag provided and sent with the Emergency Medical Services or Ambulance to the appropriate facility.

9.1.1 Medical Emergencies

In the event of illness or injury, appropriate first aid should be administered while awaiting an ambulance or paramedics. Only an individual trained and certified in First Aid and CPR should perform these duties. A trained person will be on-site during site activities.

Information regarding chemical exposure and personal medical history will be provided to hospital personnel for anyone being transported to a clinic or hospital for treatment. Personal medical information can be obtained through the RSI office in Independence, Kansas (620) 331-1200.

This Health and Safety Plan must accompany any individual taken to the hospital for treatment of any kind.

9.1.2 Emergency Equipment

The following pieces of emergency equipment will be available on site:

- Fire extinguisher
- Eye wash
- First aid kit
- Bloodborne Pathogen Kit

9.1.3 First Aid Measures

In the even that exposure occurs, the following procedures will be used:

Ingestion:	Summon medical help.
Inhalation:	Move victim to fresh air, seek medical attention
Skin Exposure:	Remove and replace contaminated clothing, flush skin with water.
Eye Contact:	Flush eye immediately with copious amounts of water. Repeat until irritation is eliminated. Seek medical attention.

If time and circumstances allow, contaminated dust coveralls, masks, and gloves will be removed, and the injured person's body will be decontaminated before transportation to the hospital.

9.1.4 Site Emergency Warning and Notification System

The Site Emergency Warning and Notification System will consist of the use of a two-way radio system and / or a warning horn.

It is anticipated that evacuation of the site would be for one of three reasons.

1. Excavation of unknown material or pressure vessel;
2. A high organic vapor reading which could render the organic vapor cartridge in the respirator useless;
3. Severe storm approaching the site in which no prior warning was given.

Two-way radio communication will be maintained between the support zone and the exclusion zone. Radio communication will be the primary warning system. Compressed gas horns will be kept at both the work area and the support zone as the secondary warning system. Repetitive blasts of the horn will signify that immediate evacuation of the exclusion zone is required. Hand signals will be used as the backup warning system.

The assembly area for initial head count will be the personal decontamination station. An additional head count will be made in the support zone to ensure that all site personnel are accounted for.

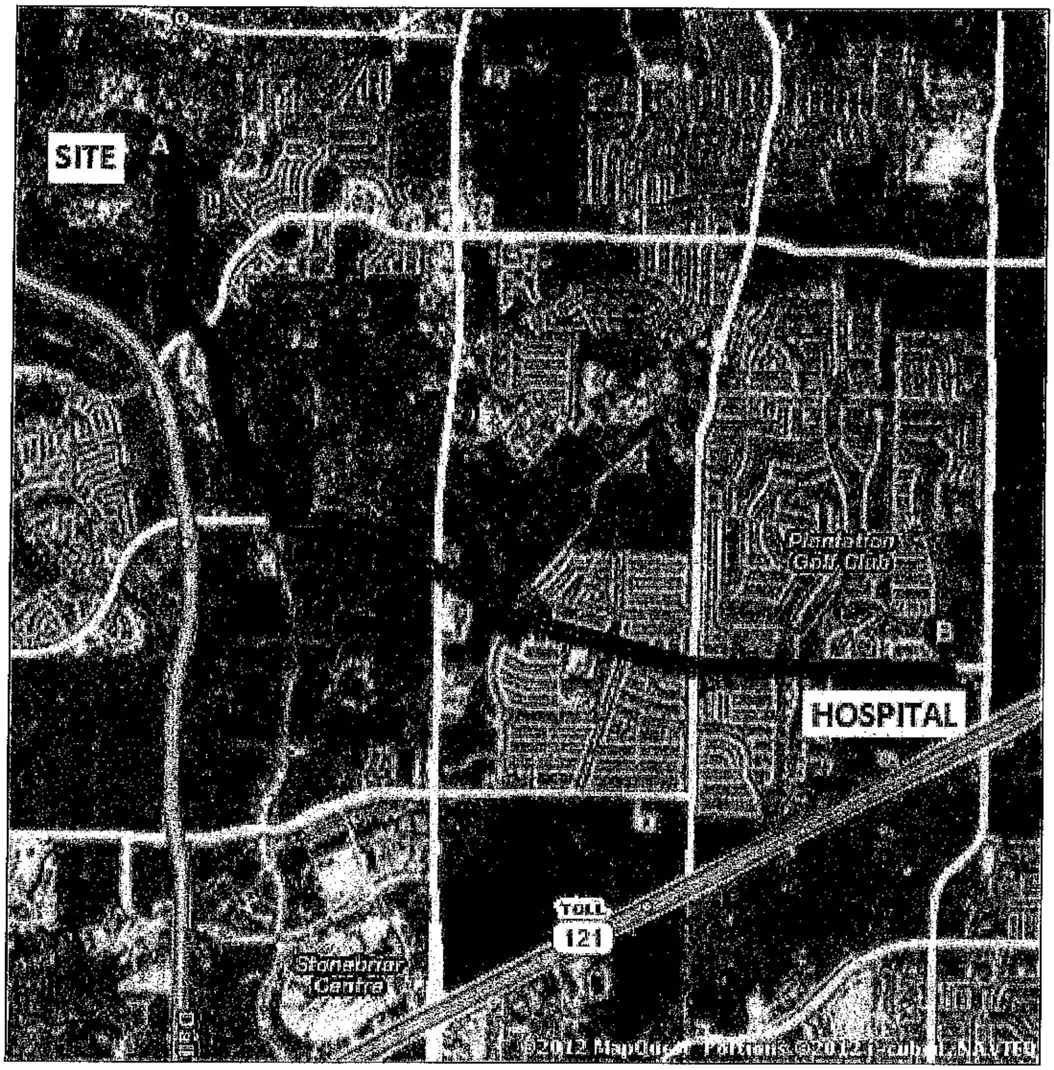
9.2 Accident/Illness Reporting

All injuries and illnesses must be reported to one of the Corporate Officers as soon as possible (within 24 hours for minor problems, and immediately for major problems). Notification shall be made to RSI as soon as possible. An accident or occupational illness shall prompt an immediate review and modification of the Site Safety and Health Plan to prevent reoccurrence.

Accidents must be reported on the appropriate company forms in order for claims to be processed. To obtain hospital treatment requires submittal of the Company's Workers Compensation Insurance information, which is covered by the Zurich American Insurance Company of Illinois, Policy # WC5398266-00.

FIGURE 2

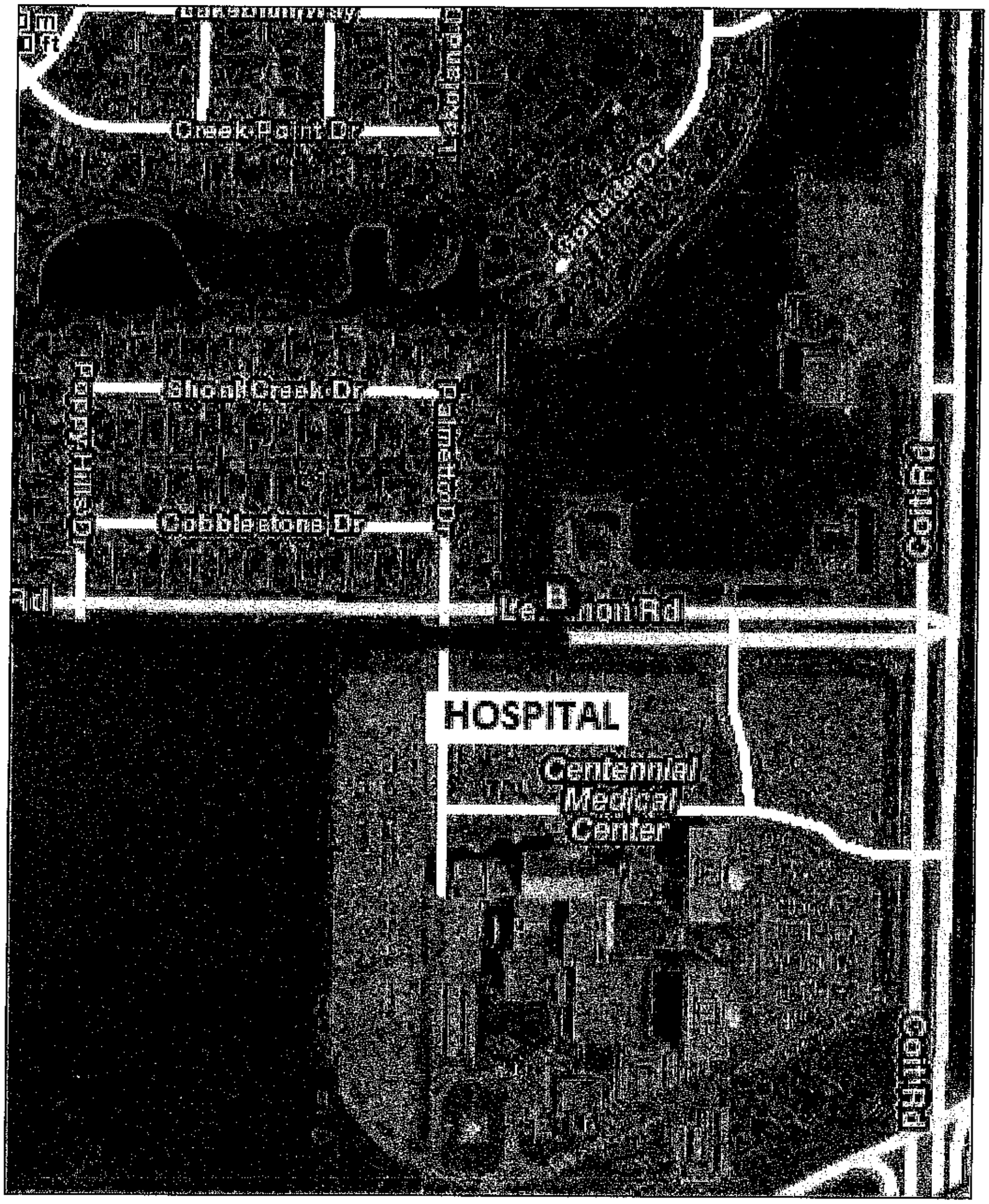
Centennial Medical Center
12505 Lebanon Road
Frisco, TX 75035
(972) 963-3333



From the job site proceed to the plant entrance and turn left (north) on Eagan Way and proceed to the intersection with Parkwood Drive. Turn right (south) on Parkwood Drive and proceed to the intersection with Lebanon Road. Turn left (east) on Lebanon road and proceed to the Hospital entrance and follow the signs the emergency room entrance. Distance = 4.5 miles

FIGURE 2.1

Centennial Medical Center
12505 Lebanon Road
Frisco, TX 75035
(972) 963-3333



From the job site proceed to the plant entrance and turn left (north) on Eagan Way and proceed to the intersection with Parkwood Drive. Turn right (south) on Parkwood Drive and proceed to the intersection with Lebanon Road. Turn left (east) on Lebanon road and proceed to the Hospital entrance and follow the signs the emergency room entrance. Distance = 4.5 miles

10.0 Documentation

Waste site operations generate enormous amounts of information. This information shall be documented with the use of the reporting forms included in Section II. The logs and records shall be the ultimate responsibility of the Site Safety Supervisor and shall be maintained on site for review. However, all personnel shall be individually responsible for completion of the information required by the exposure logs, sign in/out report, and the heat stress-monitoring log.

The safety and health logs and records shall be transferred to the Independence office upon completion of the project and be kept on record for a period of not less than 30 years.

SECTION II

Remediation Services, Inc.

EXPOSURE TO BLOODBORNE PATHOGENS INCIDENT REPORT

Employee Name: ______________________________

Office/Location: ______________________________

Date: ____/____/____ Time: ________ a.m./p.m.

Circumstances: Supervisor's Assessment of the Following Control Measures Used at the Time of the Exposure (see definitions below):

Route of Exposure: ______________________________

____

____

Engineering: ______________________________

____

____

Work Practice: ______________________________

____

____

Personal Protective Equipment: ______________________________

____

____

Reason for Failures of the Control Measures or Failure to Comply with Recommended Protective Measures: ______________________________

____

____

Measures Taken to Minimize Reoccurrence of Incident: ______________________________

____

____

Supervisor's Signature: ______________________________

Definitions:

Exposure Incident: A specific eye, mouth, other mucous membrane, non-intact skin, or parentaral contact with blood or other potentially infectious materials that results from the performance of an employee's duties.

Engineering Controls: Controls (e.g., sharps, disposal containers, self-sheathing needles) that isolate or remove the bloodborne pathogen hazard from the workplace.

Work Practice Controls: Controls that reduce the likelihood of exposure by altering the manner in which a task is performed (e.g., prohibiting recapping of needles, a two-handed technique).

Personal Protective Equipment is specified clothing or equipment worn by an employee for protection against a hazard. General work clothes not intended to function as protection against a hazard are not considered to be personal protective equipment.

AIR MONITORING LOG

Date:________________________ Project Number:_______________

Project Name:____

Employee Name:____

Type of Sample: Area_______ Personal__________

High Volume______ Low Volume_______

Pump Number:_______________ Flow Rate:____________________

Sample Number:______________ Cassette Size: 25mm___ 37mm___

Calibration: Pre:______________ Post:______________

Sample Location:____

____

____

Start:________________________ Stop:_______________________

Comments and Description of Work:_____________________________________

____

____

____

AIR MONITORING LOG

Date:________________________ Project Number:_______________

Project Name:____

Employee Name:____

Type of Sample: Area_______ Personal__________

High Volume______ Low Volume_______

Pump Number:_______________ Flow Rate:____________________

Sample Number:______________ Cassette Size: 25mm___ 37mm___

Calibration: Pre:______________ Post:______________

Sample Location:____

____

____

Start:________________________ Stop:_______________________

Comments and Description of Work:_____________________________________

____

____

Remediation Services, Inc.

AIR MONITORING LOG

Sampler: ____________

Method: ____________

Location ____________

Date	Parameter	Time/Temp	Concentration	Sampler Initials

Remediation Services, Inc.
CONFINED SPACE ENTRY PERMIT

Complete 1-10 For All Confined Space (Level I) and Permit Required Confined Space (Level II) Entries

1. Location of work: ______________________________
2. Description of work: ______________________________
3. Have appropriate RSI personnel been notified of the work? ☐ Yes ☐ No
4. Permit good: From: Time: ____________ Date: ____________
   To: Time: ____________ Date: ____________
   Note: As soon as one of the following occurs, the permit is void:
   After 12 hours; End of shift; End of job; or Conditions change that alter permit
5. Has line, vessel, or confined space been drained and cleaned? ☐ Yes ☐ No
   How? ☐ Washing ☐ Air purging ☐ Ventilating ☐ Inert gas purging
6. Isolation techniques used (check all that apply)
   ☐ Blinding, blanking ☐ Plugging (mud or other) ☐ Parting lines
   ☐ Cathodic protection ☐ Dropping valves ☐ Double block and bleed
   ☐ Mechanical lockout ☐ Electrical lockout
   (Explain) ______________________________
   ☐ Electrical tagout (Explain) ______________________________
   ☐ Other: ______________________________

7a. Atmospheric testing results: _______% O_2 (19.5-23.5%) _______% L.E.L. (safe <10% L.E.L.)
   _____ ppm Toxic gas and type(list) ____________ Tester initial and time ____________

7b. Atmospheric retesting results: _____% O_2 (19.5-23.5%) _______% L.E.L. (safe <10% L.E.L.)
   _____ ppm Toxic gas and type(list) ____________ Tester initial and time ____________

8. Is forced ventilation required? ☐ Yes ☐ No
9. PPE required? (Check all that are required for the job):
   ☐ Chemical Impervious Clothing ☐ Welders helmet/glasses ☐ Goggles
   ☐ Rubber boots ☐ Hand protection ☐ Safety glasses
   ☐ Face shield ☐ Hearing protection ☐ Safety harness
   ☐ Lifeline ☐ Skin creams ☐ Retrieval line
   ☐ Retrieval equipment ☐ Hard hats
   ☐ Respiratory protection (list type): ____________ ☐ Other (Explain) ____________
10. Attendant required? ☐ Yes ☐ No (Attendant is required for any confined space entry where hazardous atmosphere exists. If NO, proceed to #16.)
   Name/Title of Attendant: ______________________________

Complete 11-15 Only For A Permit-Required Confined Space Entry (Level II)

11. Communication method used by attendant to monitor entrants (List): ____________
12. Emergency rescue equipment at site? ☐ Yes ☐ No List equipment ____________
13. Emergency rescue services name and telephone #: ____________
14. Emergency medical service name and telephone #: ____________
15. How will they be summoned? ____________

Complete 16-17 For All Confined Space (Level I) and Permit Required Confined Space (Level II) Entries

16. Additional special precautions (Explain): ____________
17. Signatures (below):

Authorized Entrant (Print Name)	Entry Supervisor (Print Name)
Signature, Title & Company	Signature and Title

Authorized Entrant (Print Name)	Entry Supervisor (Print Name)
Signature, Title & Company	Signature and Title

Remediation Services, Inc.

VISITOR'S NOTICE

PROJECT ______________________________

LOCATION______________________________

The area to which you are requesting entry is a Waste Cleanup Site. Entry into the work areas designated as contaminated have restrictions in accordance with OSHA 1910.120. There are specified requirements as to on-the-job training, off-site training, site safety training, personal protective clothing and equipment, medical surveillance, emergency response planning and decontamination procedures.

Under these regulations, all visitors, including subcontractors, in addition to the certified training, must attend the company's information briefing prior to entering the worksite.

Please sign below as an indication that you have read and understand this notice, and that you will abide by all the safety and health regulations as they pertain to this site. Your signature relieves Remediation Services, Inc. and ____________________ (owner's name), their officers, employees, and agents of any liability of consequences related to potential hazards associated with site entry.

Date	Name	Company	Purpose of Visit	Time In/Out	RSI Witness
				/	
				/	
				/	
				/	
				/	
				/	
				/	
				/	
				/	
				/	
				/	

Remediation Services, Inc.

VISITOR'S NOTICE

PROJECT ______________________________

LOCATION ______________________________

The area to which you are requesting entry is a Hazardous Waste Cleanup Site. Entry into the work area's designated as contaminated have restrictions in accordance with OSHA 1910.120. There are specified requirements as to on-the-job training, off-site training, site safety training, personal protective clothing and equipment, medical surveillance, emergency response planning and decontamination procedures.

Under these regulations, all visitors, including subcontractors, in addition to the certified training, must attend the company's information briefing prior to entering the worksite.

Please sign below as an indication that you have read and understand this notice, and that you will abide by all the safety and health regulations as they pertain to this site. Your signature relieves Remediation Services, Inc. and ____________________ (owner's name), their officers, employees, and agents of any liability of consequences related to potential hazards associated with site entry.

Date	Name	Company	Purpose of Visit	Time In/Out	RSI Witness
				/	
				/	
				/	
				/	
				/	
				/	
				/	
				/	
				/	
				/	
				/	

Remediation Services, Inc.

HEAT STRESS MONITORING

Project No. ____________________

Location ____________________

Date ____________________

Temperature ______(start of work) Humidity ______%

Name	Time	Temperature	15 sec result x 4	RPR

Temperature ______(start of work) Humidity ______%

Remediation Services, Inc.

Respirator Fit Test Record

Record Year: 20_____

Date: ______________________________

Employee Name: ______________________________

Tested By: ______________________________

Test Method: (circle) Qualitative Other (Describe) __________

Respirator Brand: ______________________________

Model: ______________________________

Size: ______________________________

Facepiece Type: ______________________________

Wearer Acceptance: Good _____ Fair _____ Poor _____

Fit Test: Pass _____ Fail _____

Comments: ______________________________

Remediation Services, Inc.

EMPLOYEE REGISTER

Date	Employee Name	Time In	Time Out	Lunch In/Out

EQUIPMENT DECONTAMINATION RELEASE

Date____/____/____

Type of Machine / Equipment____________________________

Serial Number____________________________

Method of Decontamination

____

____

____

Method of Decontamination Verification
(Check appropriate Box)

Visual ☐ Other____________________

Visual Inspection Satisfactory Yes ☐ No ☐

I certify that the piece of equipment / machinery listed above has been satisfactorily decontaminated to allow it to leave the site

____

SIGNATURE

Remediation Services, Inc.

DAILY SAFETY MEETING

Project Name ______________________

Project Number ________________

Date ________________ Time ____________________

SAFETY TOPICS DISCUSSED:

____

____

____

____

____

____

____

____

____

____

ACTIONS TAKEN (If none were necesscary, so state)

____

____

____

____

____

____

____

____

ATTENDEES:

Printed Name	Signature	Printed Name	Signature

MEETING CONDUCTED BY: ____________________ ____________________

Printed Name Signature

Remediation Services, Inc.

MACHINERY INSPECTION

Project No. ____________________

Location ____________________

Date ____________________

The following machinery / equipment has been inspected by the undersigned on this date and found to be in safe operating condition.

Type of Machinery/ Equipment ____________________ Serial No. ____________________

- ☐ Windows intact - not cracked or broken?
- ☐ Backup Alarm Operational?
- ☐ Fire Extinquisher in place and inspected?
- ☐ Grab Bars and steps inplace?
- ☐ Inspect for leaks?
- ☐ Other:

Type of Machinery/ Equipment ____________________ Serial No. ____________________

- ☐ Windows intact - not cracked or broken?
- ☐ Backup Alarm Operational?
- ☐ Fire Extinquisher in place and inspected?
- ☐ Grab Bars and steps inplace?
- ☐ Inspect for leaks?
- ☐ Other:

Type of Machinery/ Equipment ____________________ Serial No. ____________________

- ☐ Windows intact - not cracked or broken?
- ☐ Backup Alarm Operational?
- ☐ Fire Extinquisher in place and inspected?
- ☐ Grab Bars and steps inplace?
- ☐ Inspect for leaks?
- ☐ Other:

Remediation Services, Inc.

PERSONNEL EXPOSURE LOG

Project No. ________________
Location ________________
Date ________________

Name	Task	Level of Protection	Time In	Time Out	Total Time

Remediation Services, Inc.

DAILY SAFETY REPORT SUMMARY

Inspector: ______________________ Project No.: ______________________

Date: ______________________

Level of Protection: ______________________

ACTIVITIES INSPECTED: ______________________

SITE CONDITIONS: ______________________

FOLLOW-UP REQUIREMENTS ______________________

REMEDIATION SERVICES, INC.
P.O. Box 587
Independence, KS 67301

Safety Inspection Report
JOB No.____________ JOB NAME____________________________

Project Manager_______________________ ***Date*** ________________

PERSON(S) CONDUCTING INSPECTION

Subcontractors Onsite (List Name and Trade)

Weather and Site Conditions: Check all that apply

Rain or Mist		Winds – Calm	
Ice or Snow		Winds – 5 – 10 mph	
Clear Sky		Winds -10 – 15 mph	
Partly Cloudy		Winds >15 mph	
Overcast		Average Daily Temperature	

COLUMN
A= Adequate at Time of Inspection
B = Needs Consideration
C = Needs Immediate Attention
N/A = Not Applicable

INSPECTION ITEM	A	B	C	N/A	ACTION TAKEN
1. Job Information					
• OSHA 200 forms posted and complete?					
• OSHA Poster Posted?					
• Phone # and Route to Hospital Map Posted?					
• HASP Initital Review Sign Off Sheet Completed?					
• Daily Safety Meeting Form Completed?					
• Work Areas Properly Signed and Barricaded?					
2. Housekeeping					
• Office Trailer Clean and Orderly?					
• Job Trailer Clean and Orderly?					
• Job Site Clean of Debris and Trash?					
3. Fire Prevention					
• Fire Extinquisher(s) in office trailer has current inspection?					
• Fire Extinquisher(s) located on each mobile equipment? Current inspection?					
• "NO SMOKING" posted and enforced near flammables?					
4. Electrical					
• Extension Cords with bare wires or missing ground prongs taken out of service?					
• Ground Fault Circuit interupters being used?					

INSPECTION ITEM	A	B	C	N/A	ACTION TAKEN
• Chains and slings inspected and tagged as required?					
• Walking surfaces have anti-slip strips in place?					
• Walking surfaces clean and free from water and oil?					
• Proper hand holds are in place on equipment?					
12. Heavy Equipment					
• Daily Inspections sheets are complete?					
• Back up Alarms are operational?					
• Equipment Air Cond./Heater working properly?					
• Windows and mirrors are clean and not cracked?					
13. Personal Protective Equipment					
• Hard Hats are being worn?					
• Reflective Vests being worn?					
• Safety Glasses are being worn?					
• Steel Toe Boots with slip resistant soles?					
• Respirators being used when required?					
o Current fit test record maintained on site?					
o Respirators Stored in Plastic Bags?					
• Hearing protection being worn when required?					
• Gloves being worn for the appropriate job?					
14. Traffic Control					
• Personnel/equipment position> 25' from center line of railroad tracks?					
• Warning Signs and traffic cones in place when working in the road or right of way?					
• Construction entrance visibility clear and unobstructed when entering and exiting roadway?					
15. Unsafe Acts or Practices Observed: (List)____________________					

Comments:____

Signature________________________ Date______________

Remediation Services, Inc.
P.O. Box 587
Independence, Kansas 67301

ACCIDENT INVESTIGATION

Date:___________
Time:___________
Weather Conditions:____
Job Location:____
List all Personnel onsite at time of accident:_______________________________
____

ACCOUNT OF THE ACCIDENT: (Provide sequence of events, extent of damage, accident type, who and what where involved, witnesses to the accident, ect.) Provide drawing on attached sheet if necessary.

____
____
____
____
____
____
____

Direct Causes (energy sources, hazardous materials ect):____________________
____
____

Indirect Causes (Unsafe acts or conditions, etc.):_________________________
____
____
____

Recommendations to prevent recurrence:______________________________
____
____
____

Employee Name__________________ **Supervisor**____________________

Signature______________________ **Signature** ____________________

Date _________________________ **Date** _________________________

SECTION III

APPENDIX A

<u>Appendix A-1</u>

Hazard Communication Program

Material Safety Data Sheets

REMEDIATION SERVICES, INC
HEALTH AND SAFETY PROGRAM

Hazard Communication Program

General Information

In order to comply with 29CFR 1910.1200, Hazard Communication, Remediation Services, Inc. (RSI) has established the following Hazard Communication Program. All work units of the company are included within this program.

A copy of the OSHA Standard has been attached to this section for review of any interested employee.

Container Labeling

The project manager will verify that all containers received at the jobsite for use will:

- Be clearly labeled as to the contents
- Note the appropriate hazard warning
- List the name and address of the manufacturer on the "On Site Chemical Usage Log" (see appendix A-7 for forms).

The Safety Supervisor at each site will confirm that all secondary containers are labeled with either an extra copy of the original manufacturer's label or with a generic label with a block for identity and blocks for the hazard warning. (For help with labeling, contact Dan Roth at RSI Corporate Offices 620-331-1200).

Material Safety Data Sheets

The clerical administrative assistant will be responsible for obtaining and maintaining the Material Safety Data Sheets for the Company and will update the corporate and sight specific MSDS books as appropriate.

Copies of MSDS's for all hazardous chemicals to which employees of this company may be exposed will be kept in Remediation Services, Inc's offices in Independence, Kansas. Those that are relevant to various specific sites where RSI undertakes field operations will be kept at the field sites and copies will be sent to RSI's main office in Independence, Kansas.

MSDS's will be available to all employees in their work area or project site for review during each work shift. If MSDS's are not available, or new chemicals in use do not have MSDS's, immediately contact your supervisor, the site Project Manager or Dan Roth.

Employee Training and Information

The Director of Human Resources is responsible for the records of the employee-training program. The RSI Safety Director will implement the program and will document that all elements specified below are carried out.

Prior to starting work, each new employee of RSI will attend a health and safety orientation and will receive information and training on the following, (this training my also occur during 40-Hour Hazwoper Training):

- An overview of the requirements contained in the Hazard Communication Standard.
- Chemicals present in the workplace operations,
- Location and availability of our written Hazard Communication Program,
- Physical and Health Effect of the hazardous chemicals,
- Methods and observation techniques used to determine the presence of release of hazardous chemicals in the work area,
- How to lessen or prevent exposure to these hazardous chemicals through usage of control/work practices and personal protective equipment,
- Steps the company has taken to lessen or prevent exposure to these chemicals,
- Emergency procedures to follow if they are exposed to these chemicals,
- How to read labels and review MSDS's to obtain appropriate hazard information,
- Location of MSDS file and location of hazardous chemical list.

After training, each employee will sign a form to verify that they attended the training, received written materials, and understood the company policies on Hazard Communication. Prior to a new chemical hazard being introduced into any section of this company, each employee of that section will be given information as outlined above.

List of Hazardous Chemicals

A list of all Hazardous Chemicals used by the employees of RSI is located at the Corporate Offices in Independence, KS. Information regarding specific Hazardous Chemicals present at field sites is located in the Site Safety Plan.

Hazardous Non-Routine Tasks

Periodically, employees may be required to perform hazardous non-routine tasks. Prior to starting work on such projects, each affected employee will be given information by their Supervisor about hazardous chemicals to which they by be exposed during such activity.

This information will include:

- Specific chemical hazards,
- Protective/safety measures the employees can take,
- Measures the company has taken to lesson the hazards including ventilation, respirators, presence of another employee and emergency procedures.

Informing Contractors

At RSI's Headquarters

Contractors performing work at RSI's Main Office Location will be informed of any hazardous chemicals present at the location.

NOTE: All contractors will be requested to provide MSDS's for any chemicals they may bring to any location.

At Remote Sites

It is the responsibility of the Site Safety Supervisor to provide RSI's subcontractors (with employees at the site) the following information:

- Hazardous chemical brought to the site by RSI, to which they may be exposed while on the job site.

- Precautions the employees may take to lessen the possibility of exposure by the use of appropriate protective measures.

The Site Safety Supervisor will be responsible for contracting each RSI subcontractor, before work is started at the site, to gather and disseminate any information concerning chemical hazards that the sub contractor is brining to the site.

Responsibilities of Site Owner

It is the site owner's responsibility to inform RSI's Site Safety Supervisor about the hazardous chemicals at the site to which RSI's employees and RSI's subcontractors may potentially be exposed.

RSI's Responsibilities to Inform Site Owner

RSI's Site Safety Supervisor has the responsibility of informing the site owner of chemicals RSI has brought to the site and providing the owner with MSDS's for these chemicals.

EMPLOYEE TRAINING GUIDELINES

1. **Prepare Objectives**

   a. Develop safety attitude
   b. Make employees aware of the hazardous chemicals
   c. Motivate employees to protect themselves by preventing exposure to hazardous chemicals
   d. Learn how to read and understand labels and MSDS's
   e. Make employees aware of the Hazard Communication Standard

2. **Design Training Program**

   a. Identify what and where hazardous chemicals are found in the work area.
   b. The nature (odor, appearance, form, ect.) and the hazards (solubility, reactivity, inhalation hazard, explosives, ect.) of the chemical will be discussed including local and systemic toxicity considerations.

c. The specific nature of the operation involving hazardous chemicals that might result in employee exposure.
d. Specific information to aid the employee in the recognition and evaluation of conditions and situations, which may result in the release of hazardous chemicals.
e. Purpose for, and description of, detection or monitoring devices.
f. The purpose for and application of specific first aid procedures and practices.
g. The type, use, and limitations of personal protective equipment. This includes location and availability
h. Review of the Hazard Communication Standard.

3. Techniques used in the training program

a. Handout Material
b. Audiovisual material
c. Demonstration of protective equipment, what is it, how to wear it, where it is located.
d. Tests or quizzes.
e. Attendance records

4. Assessing effectiveness

a. Were training objectives met?
b. What material was missing?
c. What part of the program was already known and consequently unnecessary?
d. What material was confusing?
e. How often should training be repeated?
f. What did the employee learn and/or fail to learn?

<u>Appendix A-2</u>

Respiratory Protection Program

REMEDIATION SERVICES, INC
HEALTH AND SAFETY PROGRAM

Respiratory Protection Program

Purpose

It is recognized that engineering controls are preferred for controlling employee exposures to atmospheres, which may contain hazardous chemicals. However, Remediation Services, Inc, typically performs work at sites where engineering controls are not feasible.

Federal Regulations and RSI concerns for employee safety have led to the development of a written respiratory protection program for RSI employees who may have to wear respiratory protection in the course of their work.

This written respirator program is designed to meet or exceed OSHA requirements for respiratory protection and to provide the appropriate guidance in the selection and use of respirators.

RSI provides a variety of respiratory protection devices for personnel for use at various sites. NIOSH/OSHA decision logic is used for the proper selection of respiratory protective equipment. RSI uses only NIOSH/MSHA approved respiratory protective equipment, provides training on proper usage and qualitative fit testing (for negative pressure face pieces). Employees are examined by a physician who determines whether they are physically able to wear respiratory protection during their work. This examination is carried out at least annually for each employee who wears respiratory protection. An example of the form can be found in Section Y (FORMS) of this book.

When an employee of RSI must wear corrective lenses and will need to be able to wear a full-face respirator of any sort, in the course of his/her work, corrective lenses in a face piece insert are provided by RSI.

Respirator Selection

The individual site safety supervisors are responsible for the selection of the appropriate respiratory protection for the chemicals which they and their fellow employees may encounter or be potentially exposed to.

The types of respirators available are of two basic types, negative pressure and atmosphere supplying, with several brands available in each type. There are also several brands of rescue and escape packs available for use for sites where they may be required.

The respirators are selected based on information about the chemical exposures based on information about the chemicals anticipated to be present at the site, and from information about chemicals brought to the site by RSI. The data on these chemicals is used to select the appropriate face piece, cartridge, filter, ect., or air supplied respiratory protection, where appropriate. (Appropriate respiratory protection information for various chemicals is available from several sources at the office; The NIOSH/OSHA Pocket Guide to Chemical Hazards; NIOSH Guide to Industrial Respiratory Protection; American National Standards Institute Z88.2-1980; 3-M's "Easi-Air Respiratory Guide" and the 3M Respiratory Selection Guide Book. The NIOSH/OSHA decision logic is used to decide which respiratory protection is appropriate. In addition, various vendor supplied respirator selection guides are available at the various sites, once the appropriate face pieces have been selected for the project.

<u>Respirator Training</u>

Respirator training is done either at time of initial hire, or during 40 hour Hazardous Waste Training or Hazardous Waste Refresher Training. Additional respirator training may be done as necessary when the type of respiratory protection is changed.

The training addresses the proper wear and use of respirators, their limitations and care. The method of inspection and donning of the respirators, and the method of face piece tightness checks is also addressed. Qualitative fit testing using either irritant smoke and/or banana oil is also performed. This fit testing is repeated at least annually or if conditions warrant an additional fit test due physical changes of the employees face or changes in types or brands of respirators.

Respiratory training and acknowledgement of the training is recorded on a specific form developed for this purpose. Records of respirator training are retained at the Corporate Offices of RSI.

Respirator Use

Respirator use is dictated by the needs of the individual site. The specific type of respirator(s), and other associated PPE are described in the site-specific health and safety plan, along with provisions to either upgrade or downgrade to a different level of protection as the site needs may require.

Where negative pressure respirators are used, cartridges and/or filters are chosen based on the hazards at the site.

Where the site needs dictate air-supplied respirators, either airline or self-containing breathing units, backup personnel with rescue equipment and the appropriate respiratory protection will be present. The care of those units during and after use is described briefly below.

Escape respirators are available on projects when extremely hazardous materials may be present which may be potentially released into the ambient atmosphere.

Respirator Care

In the case of negative pressure respirators, the individuals they are assigned to care for the respirators. This includes daily inspection and cleaning of respirators. The individuals are also responsible for changing their cartridge/filter as necessary, throughout the workday.

In the case of air-supplied respirators, the face pieces are cleaned/decontaminated after each use. The replacement parts and connections must be specific to the brand and model number of the type of airline mask used (parts are not interchangeable). Manufacturer's guidelines will be followed as the care and maintenance of airline and positive pressure or pressure demand respirators.

Hose connections and ends of airline hoses will be maintained in a clean fashion (for example, wrapped with Saran wrap) when it is not in use, to prevent contamination of the air supply. Hoses will not be place where they can be run over by vehicles or heavy equipment. They will not be placed on sharp edges or in areas where material, which may damage the hoses, may be present. All equipment will be inspected periodically and the condition noted and documented by the site safety supervisor. All equipment, including hoses, will be inspected prior to use.

Air supplied units are inspected and refilled after each use with grade D breathing air from an acceptable source (e.g., fire station, plant source of breathing air, SCUBA supply shop).

Breathing air tanks are tested for hydrostatic pressure tolerance at least annually by return to the suppliers for testing and certification.

The self-rescue respirators are inspected for damage and replenished or replaced according to manufacturer's instructions.

Storage of respirators and related supplies

All respirators are stored in a clean, dry area, where the face piece, straps, and cartridge and other attachment points cannot be damaged or deformed.

Cartridges and filters are kept sealed in their containers until use. Used absorbent cartridges or filters are disposed of at the end of each day, or more frequently if indicated by odors or other warning properties related to the chemical (s) involved. End of use indicators are available for some respirator cartridges and canisters.

Corporate Responsibility for Respirator Program

The person responsible for the corporate respirator program is Daniel Roth, Corporate Safety Manager.

Record Keeping

Fit testing records, physician's approval for wear of respiratory protection, respiratory training (whether from 40-hour Hazwoper training, 8 Hr

Hazwoper training, or individual training at time of hire) records are kept at RSI's Corporate Headquarters. Copies of the most recent fit test, physician's approval and most recent training or retraining are sent to the work site or carried by the individual to the work site, along with other relevant training records and certificates (e.g., First Aid and CPR).

Appendix A-3

Confined Space Entry Procedures

REMEDIATION SERVICES, INC
HEALTH AND SAFETY PROGRAM

Confined Space Entry Program

Introduction

These guidelines outline the minimum acceptable criteria to be utilized by Remediation Services, Inc. personnel for all confined space entry. All projects requiring confined space entry must be reviewed thoroughly by the Project Manager, and Safety and Health Officer.

The guidelines include a classification table for confined spaces and a checklist of required items for each confined space classification. It is followed by the specific requirements and work practices for each classification. This material has been adapted form the NIOSH criteria document, " Working in Confined Spaces".

CONFINED SPACE DEFINITION:

The term "confined space" shall mean any space, not designed for continuous occupancy by persons, which has limited access and egress for the removal of a disable person, due to the location and size of the openings, and which may be subject to the accumulation of toxic or flammable materials, or which may have an oxygen-deficient or oxygen-enriched atmosphere.

Confined spaces include but are not limited to: storage tanks; process vessels: bins: boilers: ventilation, exhaust, and process ducts; manholes; sewers; trenches; underground utility vaults; tunnels; pipelines; enclosed conveyors; process ovens; incinerators; and batch rail cars and trucks.

Confined spaces also include open-top spaces more then four feet (4') in depth, where toxic or flammable materials could accumulate, such as pits, tubs, vaults, vessels, and sumps.

CONFINED SPACE ENTRY PERMIT:

A document to be initiated by the supervisor of personnel who are to enter into or work in a confined space. The Confined Space Entry Permit (CSEP) will be completed by the Safety Officer before personnel will be permitted to enter the confined space. The CSEP shall be valid only for the performance of the work identified and for the location and time specified. The beginning of a new shift with change of personnel will require the issuance of a new CSEP. A copy of the CSEP is attached.

CONFINED SPACE OBSERVER:

And individual assigned to monitor the activities of personnel working within a confined space, and who is capable of identifying existing and predictable hazards in the surroundings, in accordance with 29 CFR 1926.650. The CSO shall be capable of identifying working conditions whish are unsanitary, hazardous or dangerous to employees, and will have authorization to take prompt corrective action to eliminate them. The confined space observer monitors and provides external assistance to those inside the confined space. The confined space observer summons rescue personnel in the event of an emergency and assists the rescue team.

LIMITED INGRESS AND EGRESS DEFINITION:

Use of this term shall indicate that a normal walkway entrance at floor level or via standard stairs is not provided, so that is would be difficult to remove a disabled person.

ABBREVIATIONS USED IN THIS STANDARD AND THEIR DEFINITIONS:

CFR:	Code of Federal Regulations
CSEP:	Confined Space Entry Permit
CSO:	Confined Space Observer
LEL:	Lower Explosive Limit
NIOSH:	National Institute of Occupational Safety and Health
MSHA:	Mine Safety and Health Administration
PEL:	Permissible Exposure Limit
TLV:	Threshold Limit Value

(Note: Some people, because of individual susceptibility, may be affected by concentrations below standard TLV values).

SECTION I – ENTRY AND RESCUE

The confined Space Classification Table is based on existing or potential hazards relative to the confined space. The classification is based upon the characteristics of the confined space, oxygen level, flammability and toxicity.

CLASS A:

If any of the hazards present a situation that is immediately dangerous to life or health (EDLH), the confined space shall be designated CLASS A. The classification shall be determined by the most hazardous condition of entering, working in, and exiting a confined space.

CLASS B:

Class B confined space has the potential for causing injury and illness but is not immediately dangerous to life and health.

CLASS C:

Class C entry would be one in which the hazard potential would not require any special modification of the work procedure.

The checklist of consideration delineates the minimum preparation required for each Class of confined space entry. In the recommended standard where specific procedures, activities or requirements are correlated with a classification; the procedure, activity or requirement is mandatory.

If the work practice involved in the confined space has the potential to increase existing hazards or generate additional ones, it shall be necessary to frequently evaluate the space to determine if a classification change is warranted.

Rescue procedures shall be specifically designed for each entry. If a confined space has an A or B classification, there shall be a trained standby person assigned to that confined space with a fully charged, positive pressure, self-contained breathing apparatus (SCBA) at hand. Additional duties of the standby person are to maintain unobstructed lifelines and communications to all workers within the confined space, and to summon rescue personnel if necessary. Under no circumstances will the standby person enter the confined space until he is relieved and is assured that adequate assistance is present. However, while awaiting rescue personnel the standby person will make rescue attempts utilizing the lifelines from outside the confined space. Rescue teams entering a Class A or B confined space shall be equipped with all the aforementioned safety equipment of the standby person and require life lines.

In the event of a Class C confined space rescue, a supplied-air respirator or a self contained breathing apparatus shall be used, a person summoned or one who recognizes the need for rescue shall summon assistance and await their arrival outside the confined space. Respirators and lifelines shall be donned by the rescue personnel with necessary equipment for removal of the victim(s).

Entry into a confined space shall be by permit only. The permit is an authorization and approval in writing that specifies the location and type of work to be done, and certified that all existing hazards have been evaluated by the Project Manager and S&H Officer, and necessary protective measures have been taken to insure the safety of each worker.

The supervisor or a qualified person (CSC) shall be responsible for securing the permit and both shall sign off when the following areas and actions have been reviewed and confined:

A. Location and description of the work to be done.
   (Class A, B, and C)

B. Hazards that may be encountered.
   (Class A, B, and C)

C. Complete the isolation checklist.
   (Class A, B, and C)
   a. Blanking and/or disconnecting
   b. Electrical Lockout
   c. Mechanical Lockout

D. Special clothing and equipment.
(Class A and B)

a. Personal protective equipment and clothing
b. Safety harness and / or lines.
c. Tools approved for use in accordance with Hazardous Location Classification
d. Approved electrical equipment

E. Atmospheric test readings
(Class A, B, and C)

a. Oxygen level
b. Flammability and /or explosive levels
c. Toxic substance levels

F. Atmospheric monitoring while work is being performed.
(Class A on a continuous basis and Class B as determined by the Project Manger/Safety and Health Officer)

G. Personnel training and complete understanding of the hazards.
(Class A, B, and C)

H. Standby person (s) as named on the permit.
(Class A, B, and C)

I. Emergency procedures and location of first aid equipment.
(Class A and B)

J. Confined space classification A, B, and C.

This permit shall be dated and carry an expiration time that will be valid for one shift only. The permit shall be updated for each shift with the same requirements.

The permit for a Class A or B confined space shall be posted in a conspicuous place, close to the entrance, with a copy on file with the Site Safety and Health Officer and the Site Owner/Client.

The permit will serve as a guide and not be limited to the areas mentioned. The training requirements of personnel entering and/or working in confined spaces shall be suitable for the nature of the hazard and the work to be performed and will therefore vary with the confined space classification. The permit will vary among different industrial activities; however, it should serve the same purpose for all industries, to insure the safety of the worker.

In a confined space classified as a Class II or Class III hazardous location according to the 1978 National Electrical Code, Article 500, Sections 5 and 6, a fire watch shall be established as part of the entry procedure. IN such areas, surface dust and fibers shall be removed and no hot work shall be initiated until the airborne particulate level is below 10% of the LFL for the material. When combustible dusts or ignitable fibers or flyings are present, all equipment and ventilation systems used in the confined space shall comply with Articles 502 and 503 of the National Electric Code.

The percentage of oxygen for entry into a confined space shall be no less then 19.5% and no greater then 25% at 760 mm Hg. At sea level the normal atmospheric pressure for air (20.9% O_2 + 78.0% N_2 + 1% Ar + trace amounts of various inert gases) is 14.7 psi or 760 mm Hg absolute. The partial pressure of oxygen (PO_2) at sea level will be approximately 160 mm Hg. PO_2 can be reduced by reducing the O_2 level in air at a given elevation or through increasing altitude. If tests indicate the oxygen level to be greater then 25% hot work is prohibited until ventilating techniques have reduced the oxygen level to approximately 21%. If the percentage of oxygen falls below 19.5%, approved respiratory equipment shall be used. When the contaminants in the atmosphere cannot be kept within permissible exposure levels as set down in 29CFR Part 1910.1000 Sub-part Z, then the employee shall wear an approved respirator.

SECTION II – SAFETY EQUIPMENT AND CLOTHING (CLASS A, B, AND C)

The entry permit shall include a list of necessary protective equipment to be used in the confined space as determined by the Project Manager/Safety and Health Officer.

Those items normally used to protect against traumatic injury include: Safety glasses, hardhats, footwear and protective clothing.

A. Eye and Face Protection:
For persons who wear corrective lenses, either prescription ground safety glasses or Plano-goggles shall be provided. Additionally, if eye-irritating chemicals, vapors or dusts are present, safety goggles shall be required, and if both the face and eyes are exposed to a hazard as during scrapping scale or cutting rivets, a full coverage face shield with goggles shall be used. During welding operations the special goggles or shields required shall be in accordance with 29CFR 1910.252 and ANSI, Z87.1.

B. Head Protection:
Hard hats shall comply with the requirements cited in 29CFR 1910.135 and ANSI, Z89.1

C. Foot Protection:
All foot protection shall meet or exceed the requirements cited in 29CFR 1910.136 and ANSI, Z41.1 and shall provide, in addition to protection from falling objects, protection from any other hazard identified by the CSO/Project Manager/Safety and Health Officer.

D. Body Protection:
All personnel entering a confined space shall wear full coverage work clothing as specified by the Safety Plan. Gloves and clothing made of impervious rubber or similar materials are to be worn to protect against toxic or irritating materials. If the hazards of heat or cold stress exist in the confined space, clothing which has been tested to provide protection from over-exposure to these hazards shall be worn. Other body protection required in specific operations such as welding (flame proofed), riveting (heat resistant), and to abrasive blasting (abrasion resistant) shall be provided to insure worker safety.

E. Hearing Protection:
Shall be required when engineering technology is insufficient to control the noise level and the ambient exposure limit exceeds those allowed in Table G-16 of 29CFR 1910.95. Emergency alarms shall be distinguishable when hearing protection is worn. The sound level meters used to measure noise levels shall be certified by NIOSH in accordance with 24 CFR 82. Where the potential for explosion exists, the sound level meters shall be of an explosion proof design.

F. Respiratory Protection:

Shall be determined by the Safety Officer based upon conditions and test results of the confined space, and the work activity to be performed. Halfmask respirators are not recommended for use in any atmosphere greater then 10 x PEL because of the probability of accidentally breaking the face piece seal due to the work conditions in a confined space. The minimum service time of self-contained breathing apparatus shall be calculated on the entry time, plus the maximum work period, plus twice the estimated escape time for safety margin.

The respirators used shall be NIOSH and MSHA approved devices and shall be fitted and maintained in accordance with 29CFR 1910.134. Self contained breathing apparatus, with audible alarms and all gas masks approved by the Bureau of Mines my be used until further notice.

G. Hand Protection:

If hands are exposed to rough surfaces or sharp edges, the degree of protection can range from canvas to metal mesh gloves, depending on the material handled. Gloves made of impervious rubber or similar material are to be worn to protect against toxic or irritating materials. Heat protective gloves are required when employees handle objects with temperatures greater then 60^C (140^F). Where a current flow through the body of more than 5 milliamperes may result from contact with energized electrical equipment, employees shall wear insulting gloves that that have been visually inspected before use. Above 5000 volts, rubber gloves in accordance with 29 CFR 1910.137 shall be worn.

Additional safety equipment that is necessary to protect the worker in the environment of a confined space:

A safety belt with "D" rings for attaching a life line shall be worn at all times; the combination of a body harness and /or safety belt with life line shall be used when an employee is required to enter to conduct the gas analysis; when an employee is working in an area where entry for purposes of rescue would be contraindicated (special limitations or fire hazard); when any failure of ventilation would allow the build-up of toxic or explosive gases within the time necessary to evacuate the area, or when the atmosphere is immediately dangerous to life and health. When it is determined by the Project Manager/Safety & Health Officer/CSC that none of the special hazards associated with confined spaces pose an immediate threat to life, as in a Class C entry, then life lines shall be readily available but not used during entry and work procedures.

Other protective measures shall include: Safety nets used to protect employees working 10 feet about ground or grade level when other protective devices are impractical; life jackets worn if the workers are exposed to falls into liquids over 4 feet in depth; and insulated floor mats when hot work requires use of electrical energy.
When employees enter a confined space, a barricade shall be erected if inadvertent entry poses a problem. The barricade shall have a mechanism to prevent closure of the escape way, signs warning of the danger present, platform (3 feet x 3 feet as a minimum) for entry or exit. Such added features as a tripod with block and tackle for safety lines and communication equipment should be considered when the entry plan is formulated.

SECTION III – WORK PRACTICES (CLASS A, B, AND C)

Before entering a confined space, employees shall review the guidelines appropriate for safe entry and emergency exit. These guidelines or standards shall be definitive on all the possible hazards. Areas covered by such guidelines shall follow this recommended standard.

A. Purging and Ventilating (Class A, B, and C)
Environmental control within a confined space is accomplished by purging and ventilating. The method used will be determined by the potential hazards that arise due to the product sorted or produced, suspected contaminants, the work to be performed and the design of the confined space. When ventilating and/or purging operations are to be performed, the blower controls shall be at a safe distance from the confined space. In a Class A entry, an audible warning device shall be installed in all equipment to signal when there is a ventilation failure. When a ventilation system is operational, airflow measurements shall be made before each work shift to ensure that a safe environmental level is maintained. Initial testing of the atmosphere shall be performed from outside the confined space before ventilation begins to determine what precautions are necessary in purging and ventilating. Testing of

more remote regions within the confined space may be performed once the immediate area within the confined space has been made safe. Exhaust systems shall be designed to protect workers in the surrounding area from contaminated air. If flammable concentrations are present all electrical equipment shall comply with the requirements of NEC (NFPA No. 70) hazardous locations, and the bonding requirements of Article 250 of NEC, 1978. Where continuous ventilations is not a part of the operating procedure, the atmosphere shall be tested until continuous acceptable levels of oxygen and contaminants are maintained for three tests at 5-minute intervals. Care shall be taken to prevent recirculation of contaminated air and interaction of airborne contaminants.

Continuous general ventilation shall be maintained where toxic atmospheres are produced as part of a work procedure, such as welding or painting, or where a toxic atmosphere may develop due to the nature of the confined space, as in the case of evaporation of residual chemicals. General ventilation is an effective procedure for distributing contaminants from a local generation point throughout the workspace to obtain maximum dilution; however, special precautions shall be taken if the ventilating system partially blocks the exit opening. These precautions include a method for providing respirable air to each worker for the time necessary for exit, and a method of maintaining communications.

Local exhaust ventilation shall be provided when general ventilation is not effective due to restrictions in the confined space or when high concentrations of contaminants occur in the breathing zone of the worker. Local high concentrations of contaminants may occur during work activities such as welding, painting and chemical cleaning. The worker shall not be exposed to concentrations of contaminants in excess of those specified in 29 CFR Part 1910.1000 Subpart Z. Therefore, respiratory protection, as recommended in Section 8 may be needed in addition to engineering controls. The use of respiratory protection will be determined by Director of Operations, Project Manager and Safety and Health Officer.

However, when fumes may be generated that contain highly toxic or other airborne metal contaminants, the provisions of 29 CFR 1910.252 shall be observed. When freely moving exhaust hoods are used to provide control of fumes generated during welding, such hoods shall maintain a velocity of 100 feet per minute in the zone of the welding.

Special precautions shall be taken when out gassing or vaporization of toxic and/or flammable substances is likely. If the vapor-generating rates can be determined, the exhaust rate required can be calculated to dilute the atmosphere below the PEL and/or 10% of the LFL, whichever is the lower. This shall be the lowest acceptable ventilation rate. If the area of concern is relatively small, diffusion of the contaminants may be controlled by enclosure with a relatively low volume exhaust for control, or by exhaust hoods located as close as possible to the area of vaporization or out gassing. If the area to be ventilated is too extensive to be controlled by local exhaust, then general ventilation procedures shall be used to control the contaminant level. When the problem of out gassing is due to the application of protective coatings or paint, toxic atmosphere is no longer possible.

There are three components necessary for combustion: Fuel, Oxygen, and a Source of Ignition. If work with fire becomes necessary in a confined space and the source of fuel cannot be controlled, then the atmosphere shall be inerted. This is a highly hazardous work situation, and continuous monitoring of the inerted make-up ventilation is mandatory. Monitoring shall include flow measurement as well as gas analysis. The inerting operation shall be continuously monitored and supervised by the Manager and Safety and Health Officer. Since every confined space will have its own infiltration rate, inerting shall continue for the entire duration of the work at a rate that will prevent air from entering the confined space.

B. Isolation, Lockout, Tagging (Class A, B)

The isolation procedures shall be specific for each type of confined space. Safety equipment required during this procedure shall be designated by the Safety and Health Officer and be dependent upon the potential hazards involved. A Class A or B confined space shall be completely isolated from all other systems by physical disconnection, double block and bleed, or blanking off all lines. In continuous systems, where complete isolation is not possible, such as sewers or utility tunnels, specific written safety procedures that are approved and enforced by the Owner shall be used. Blanks used to seal off lines shall be capable of withstanding the maximum working pressure or load of the line (with a minimum safety factor or 4), be provided with a gasket on the pressure side to insure a leak proof seal, and be make of chemically non-reactive material. Cutoff valves serving the confined space, shall be locked in the closed position and tagged for identification. In addition to blanking, pumps and compressors serving these lines entering the confined space shall be locked out to prevent accidental activation.

All blanks for that specific confined space shall be recorded on the entry permit and recorded in RSI's file, which shall be available for inspection.

If a drain line is located within the confined space, provision shall be made when necessary to tag it and leave it open. This shall also be recorded on the entry permit.

Additional procedures, which are necessary when the confined space is of a double wall type construction, e.g., water-jacketed or similar type, shall be determined by the project Manager/Safety and Health Officer and noted on the entry permit.

Electrical isolation of the confined space to prevent accidental activation of moving parts that would be hazardous to the worker is achieved by locking circuit breakers and/or disconnects in the open (off) position with a key-type padlock. The only key is to remain with the person working inside the confined space. If more than one person is inside the confined space, each person shall place his own lock on the circuit breaker. In addition to the lockout system, there must be an accompanying tag that identifies the operation and prohibits use.

Mechanical isolation of moving parts can be achieved by disconnecting linkages, or removing drive belts or chains.

Equipment with moving mechanical parts shall also be blocked in such a manner that there can be no accidental rotation.

C. Cleaning (Class A, B, and C)

Procedures and process used to clean the inside of a confined space shall be reviewed and authorized by the Director of Operations, Project Manager and Safety and Health Officer. The method to be prescribed shall be dependent upon the product in the space. If the confined space contains a flammable atmosphere above the upper flammable limit, it shall be purged with an inert gas to remove the flammable substances before ventilating with air. Initial cleaning shall be done from outside the tank if at all possible.

Special procedures should be adopted to handle the hazards created by the cleaning process itself. For example: If the tank is steamed, (1) is shall be allowed to cool prior to entry; (2) ventilation shall be maintained during neutralization procedures to prevent build-up of toxic materials; (3) steaming shall not be a cleaning method when the product stored was a liquid with an auto-ignition temperature 120% or less of the steam temperature, and (4) the pipe or nozzle of the steam hose shall be bonded to the tank to decrease the generation of static electricity that could accumulate in tanks during steaming procedures. These and other hazards and controls shall be evaluated by the Director of Operations, Project Manager, Safety and Health Officer and Confined Space Observer.

D. Equipment and Tools (Class A, B, and C)

Equipment and tools to be used in a confined space shall be carefully inspected and shall meet the following requirements:

1. Hand tools shall be kept clean and in good repair.
2. Portable electric tools, equipment, and lighting shall be approved in accordance with 29CFR Part 1910.9000 Subpart S, and be equipped with a ground fault circuit interrupter that meets the requirements of 29 CFR 1910.304. All ground shall be checked before electrical equipment is used in a confined space.

3. All electrical cords, tools, and equipment shall be of heavy-duty type with a heavy-duty insulation and inspected for visually detectable effects before use in a confined space.
4. Air driven power tools shall be used when flammable liquids are present. The use of air driven power tools will reduce the risk of explosion, not eliminate it. Explosions can arise by tools overheating (drilling), sparks produced by striking (percussion), grinding or discharge of accumulated electrostatic charges developed from the flow of compressed air.
5. Lighting used in Class A and B Confined spaces shall be of explosion proof design and where necessary equipped with guards. Only equipment listed by the Underwriters Laboratories for use in Division 1 atmospheres of the appropriate class and group, or approved by U.S. Bureau of Mines or Mining Enforcement and Safety Administration, or Mine Safety Health Administration, or the U.S. Coast Guard shall be used. Electric cords shall not hang lighting unless specifically designed for that purpose. The illumination of the work area shall be sufficient to provide for safe work conditions as referenced in the ANSI standard A11-1-1965, or the Revision, 1970.

   UNDER NO CIRCUMSTANCES WILL MATCHES OR OPEN FLAMES BE USED IN A CONFINED SPACE FOR ILLUMINATION.

6. Cylinders of compressed gases shall never be taken into a confined space, and shall be turned off at the cylinder valve when not in use. Exempt from this rule are cylinders that are part of the self-contained breathing apparatus or resuscitation equipment.
7. Ladders shall be adequately secured, or of a permanent type which provides the same degree of safety as cited in 29 CFR Part 1920.25.
8. Scaffolding and staging shall be properly designed to carry maximum expected load (safety factor of 4), be equipped with traction type planking, and meet the requirements of 29 CFR 1910.28.

9. Electrical lines, junctions and appurtenances will be in accordance with National Electrical Code (NEC) and National Fire Code (NFC) as cited in 29 CFR 1910.134.
10. Only hose lines and components designed specially for the compressed gas and working pressure shall be used, and such systems shall have a pressure relief valve outside the confined space.
11. All equipment that may be used in a flammable atmosphere shall be approved as explosion proof and intrinsically safe for the atmosphere involved by a recognized testing lab such as the U.S. Bureau of Mines or MSHA for methane and by the Underwriters Laboratories or by Factory Mutual for all cases.

SECTION IV – RECORD KEEPING (CLASS A, B)

RSI shall maintain a written record of training including safety drills, inspections, tests, and maintenance. The records shall be retained one year after the last date of training, inspection, tests or maintenance. IN the event of separation of the employee, disposal of the equipment or appliance, records may be disposed of after one year.

Where atmospheric testing indicates the presence of a toxic substance, records shall be maintained in accordance with the existing Federal Regulations. These records shall include the dates and times of measurements, duties and location of the employees within the confined space, sampling and analytical methods used, number, duration, and results of the samples taken, PEL concentrations estimated from these samples, types or personal protective equipment used, if any, and employee's names. These records shall be made available to the designated representatives of the Secretary of Labor, of the Secretary of Health, Education and Welfare, of the Owner, and of the employee or former employee.

REMEDIATION SERVICES, INC
INDEPENDENCE, KANSAS

TO BE POSTED IN ALL PROJECT OFFICES

TO: All Employees

REFERENCE: Confined Space Entry

A CONFINED SPACE ENTRY PERMIT IS REQUIRED IF ANY OF THE FOLLOWING CONDITIONS EXIST:

Limited or restricted means for entry and exit.

Not designed for continuous employee occupancy

A known potential to contain a hazardous atmosphere

A material with the potential for engulfment of an entrant

An internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls, or a floor which slopes downward and tapers to a smaller cross section.

Any other recognized serious safety or health hazard

The confined space entry permit must be "signed off" by the Project Manager/Health and Safety Officer prior to entry, (see attached).

Confined space must be large enough and so configured that an employee can bodily enter and perform assigned work.

Appendix A-4

Training Certificates

(Training Certificates will be added when personnel have been assigned to this project)

Appendix A-5

Lock Out/Tag Out Procedures

REMEDIATION SERVICES, INC.

Lockout/Tagout Procedures

SCOPE and PURPOSE:

The purpose of this document is to provide a written procedure that establishes requirements for the lockout/tagout of machinery and equipment to protect employees from the hazards and subsequent injuries that may occur as the result of the unexpected release of a hazardous energy source during operations.

A list of all machinery and equipment identified as being subject to the requirements of 29 CFR 1910.147 lockout/tagout standard will be compiled for each specific project. In order to compile these lists, an assessment will be made of each chemical and associated (air and water) lines and the equipment used to transport these materials (e.g., pumps). Accordingly, there will be a specific procedure established for each system.

The potential energy sources will be identified and addressed in the site specific lockout/tagout procedures for each project.

TRAINING:

The supervisor, assistant supervisor, and designated technicians are hereby identified as authorized employees. As an authorized person they are the only ones certified to lock or tag out equipment or machinery. Where it is subsequently discovered that machine operators are also going to be required to maintain equipment or machinery, they too will be identified as both authorized and affected under this program. Therefore there will be occasions where the authorized person is also an affected person and will be trained accordingly.

Training for the authorized employees will include all aspects of the lockout/tagout program and all specific policies and procedures on each individual machine and equipment identified in this program.

A list of AUTHORIZED employees can be found in Appendix B.

Affected persons are those employees who operate machinery or equipment upon which lockout or tagging out is required under this program. Training of these individuals will be less stringent in that it will include the purpose and use of the lockout tagout procedures. Examples of machinery and equipment are: valves, pumps, filter press, etc.

Whether an employee is considered to be qualified will depend upon various circumstances in the workplace. It is possible and, in fact, likely for an individual to be considered "qualified" with regard to certain equipment in the workplace, but "unqualified" as to other equipment. An employee who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training and who is under the direct supervision of a qualified person is considered to be qualified person for the performance of those duties.

Training for qualified employees will include elements identified in 1910.332 b (2) and (3). "Other" employees are identified as those that do not fall into the categories of authorized, affected, or qualified employee categories. It will essentially include all other employees.

In essence, all employees have to be trained but to varying degrees. "Other" category employees will be provided instruction in what the program is and not to touch any machine or equipment when they see that it has been locked or tagged out.

Note: Each employee trained will be certified as having received the training and a clear understanding what is required of them.

Retraining will be done on an annual basis or when an audit reveals that employees are not following the program appropriately or when a change in the procedure occurs.

TAGS:

Lockouts are preferred to tagouts. However, there may be instances where this is not possible. When the use of tags is the only means of energy isolation, the employees will be instructed in its limited ability to provide the same protection that a lockout provides. When tags are used, the same restrictions apply as with locks, even though the removal of the tags are easier. The importance of the tagout policy and the importance of following all rules and regulations regarding this policy will be stressed to all employees.

ELECTRICAL HAZARDS TRAINING

In all cases, disconnection or disabling of an electrical circuit will be limited to unplugging and locking out the plug connection to the device, or locking out a switch so that the machine cannot be switched on.

Therefore, the training in this section will only address this aspect of electrical safety. Qualified subcontractors will perform all electrical services.

ENFORCEMENT POLICY*

Supervisory personnel shall effectively enforce compliance with the lockout/tagout policies and procedures as set forth in this document. The chain of command will be followed when discipline is required. Each supervisor is responsible for the actions of their subordinate employees. For accountability purposes, any employee violating these procedures or policies will be disciplined. Accordingly, that employee's supervisor will also be disciplined and that supervisor's supervisor will be disciplined.

The first action will be to verbally warn employees of their non-compliance with the program. Immediately thereafter, a training session will be scheduled, the violated policy and procedure will be reviewed with the employee and certification will be made of the training.

For every disciplinary action taken subsequent to the verbal warning the employee will receive:

1st offense: written warning

2nd offense: indefinite suspension

3rd offense: termination of employment

Please note that supervisors will be subject to the same disciplinary actions as their subordinate employees. The program incorporates many different elements that are designed to protect workers. Heavy responsibility is therefore placed on each employee to follow these established policies and procedures.

*(Suggested enforcement policy found in the OSHA document.)

PERIODIC INSPECTIONS

In order to ascertain that the lockout/tagout program is being properly utilized, random audits and planned visual observations will be conducted in order to determine the extent of employee compliance. Specifically, three areas will be reviewed:

1. Whether the steps in the energy control procedure are being followed.

2. Whether the employee(s) involved know their responsibilities under the procedure.

3. Whether the procedure is adequate to provide the necessary protection and what changes, if any, are needed.

SUGGESTED INSPECTION PROCEDURE

Inspections will be conducted when the program is initially implemented and at least annually thereafter.

The inspection will be made by an authorized person other than the one implementing the energy control procedure being inspected.

If deviations are identified, or if employees do not clearly understand the procedure, retraining should be conducted to the extent that the procedures are properly followed. Certification of the training must be done.

If problems with the procedures are encountered, the process should be re-evaluated and more appropriate procedures should be implemented.

The inspections may be done on a one-on-one basis and/or also through meetings with the entire crew.

Where tagouts are used, extend the inspection to include the affected person also because with tags, the role of the affected employee is important in avoiding accidental or inadvertent activation of the equipment or machinery being serviced.

APPLICATION OF CONTROL MEASURES

PREPARATION FOR SHUTDOWN:

Before authorized or affected employees turn off a machine or equipment, the authorized employee will have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the means to control the energy.

MACHINE OR EQUIPMENT SHUTDOWN:

The machine or equipment will be turned or shut down using the specific procedures for that specific machine. An orderly shutdown will be utilized to avoid any additional or increased hazards to employees as a result of equipment de-energization.

MACHINE OR EQUIPMENT ISOLATION:

All energy control devices that are needed to control the energy to the machine or equipment will be physically located and operated in such a manner as to isolate the machine or equipment from the energy source.

LOCKOUT OR TAGOUT DEVICE APPLICATION:

Lockout or tagout devices will be affixed to energy isolating devices by authorized employees. Lockout devices will be affixed in a manner that will hold the energy isolating device in a "safe" or "off" position.

Where tagout devices are used, they will be affixed in such a manner that will clearly state that the operation or the movement of energy isolating devices from the "safe" or "off" position is prohibited.

The tagout devices will be attached to the same point a lock would be attached. If the tag cannot be affixed at that point, the tag will be located as close as possible to the device in a position that will be immediately obvious to anyone attempting to operate the device.

STORED ENERGY:

Following the application of the lockout or tagout devices to the energy isolating devices, all potential or residual energy will be relieved, disconnected, restrained, and otherwise rendered safe. All hazardous liquid will be bled from the system lines, or tanks emptied, prior to work which could allow release of such liquid. All air powered pumps will have the air supply shut off and locked out and/or disconnected.

Where the re-accumulation of stored energy to a hazardous energy level is possible, verification of isolation will be continued until the maintenance or servicing is complete.

VERIFICATION OF ISOLATION:

Prior to starting work on machines or equipment that have locked or tagged out, the authorized employee will verify that isolation or de-energization of the machine or equipment has been accomplished.

RELEASE FROM LOCKOUT OR TAGOUT:

Before lockout or tagout devices are removed and the energy restored to the machine or equipment, the following actions will be taken:

1. The work area will be thoroughly inspected to ensure that non-essential items have been removed and that machine or equipment components are operational.

2. The work area will be checked to ensure that all employees have been safely positioned or removed. Before the lockout or tagout devices are removed, affected employees will be notified that the lockout or tagout devices are being removed.

LOCKOUT OR TAGOUT DEVICE REMOVAL:

Each lockout or tagout device will be removed from each energy isolating device by the employee who applied the device.

VERIFICATION

1. Only qualified persons will operate the equipment, operating controls, and verify de-energization and cannot be restarted.

2. Only qualified persons will conduct tests and visual inspections, as necessary, that all tools, electrical jumpers, shorts, grounds, and other such devices have been removed, so that the circuits and equipment can be safely energized.

VERIFICATION CONTINUED

3. Employees exposed to the hazards associated with re-energizing the circuit or equipment will be warned to stay clear of circuits and equipment.

4. Each lock and tag will be removed by the employee who applied it or under his or her direct supervision.

GROUP LOCKOUT OR TAGOUT

When servicing or maintenance is to be performed by a crew, they will each be provided with a lock or a tag. An authorized employee will assume responsibility of the entire crew so as to ascertain the exposure status of each group member and ensure continuity of protection.

Each employee will affix a personal lockout or tagout device to a group lockout device group lock box or comparable mechanism when he or she begins work and shall remove those devices when he or she stops working on the machine or equipment being serviced or maintained.

OUTSIDE PERSONNEL (CONTRACTORS, ETC.)

All outside personnel and contractors will be informed by the site supervisor of RSI's lockout/tagout procedures and will be required to follow them. No work will be commenced in the plant by outside personnel or contractors before the site supervisor has certified that they are aware of these procedures.

SHIFT OR PERSONNEL CHANGES

In order to maintain continuity of lockout or tagout protection, the Project Manager will assume responsibility. He will assure that:

1. Employees affected by the transfer or lockout or tagout devices between the off going and on-coming employees are apprised of the transfer and coordinate the change.

2. Certify that all aspects of the lockout and tagout program are followed to minimize exposure to hazards from the unexpected energization, start up of the machine or equipment, or release of stored energy.

GENERAL TANK AND TANK VALVE LOCKOUT PROCEDURES

PURPOSE OF THE LOCKOUT: Lockout will be used when repairing, maintaining, cleaning, or any other task in which unexpected energy release is possible to employees who may work on TANKS AND TANK VALVES.

AUTHORIZATION: Only employees identified as authorized and trained in the lockout/tagout procedures for the above named SYSTEM will work on the equipment.

ENERGY SOURCES: A hazard analysis will be performed on each tank of SYSTEM and the energy source(s) listed below:

Hazardous liquid flow

____

____

ENERGY ISOLATION PROCEDURE:

<u>TANKS MUST BE EMPTIED PRIOR TO WORK ON VALVES OR TANKS</u>

THE LISTED PROCEDURE FOR EACH OF THE AFFECTED SYSTEMS WILL BE FOLLOWED TO DEACTIVATE THE SYSTEM.

TO REACTIVATE THE SYSTEM, THE SYSTEM PROCEDURE WILL BE REVERSED, AS DESCRIBED IN THE INDIVIDUAL SYSTEMS LOCKOUT PROCEDURES.

LOCKOUT TAGOUT LOG RECORD

SYSTEM	DATE TIME	LOCKED/TAGGED BOTH	RETURNED TO SERVICE L/T/BOTH REMOVED DATE TIME L/T B

Appendix A-6

OSHA Respiratory Protection Standard

MAJOR REQUIREMENTS OF OSHA'S RESPIRATORY PROTECTION STANDARD 29 CFR 1910.134

OSHA Office of Training and Education
Rev. December 2006

This document discusses the major requirements of OSHA's Respiratory Protection Standard, 29 CFR 1910.134.

No attempt has been made to discuss every detail of the standard. Readers are encouraged to consult OSHA's Respiratory Protection web page for the complete text.

MAJOR REQUIREMENTS OF 29 CFR 1910.134

Introduction

- This standard applies to General Industry (Part 1910), Shipyards (Part 1915), Marine Terminals (Part 1917), Longshoring (Part 1918), and Construction (Part 1926).

(a) Permissible Practice

- Paragraph (a)(1) establishes OSHA's **hierarchy of controls** by requiring the use of **feasible engineering controls** as the primary means to control air contaminants. Respirators are required when "effective engineering controls are not feasible, or while they are being instituted."

- Paragraph (a)(2) requires employers to provide employees with respirators that are "applicable and suitable" for the purpose intended "when such equipment is necessary to protect the health of the employee."

(b) Definitions

This paragraph contains definitions of important terms used in the regulatory text.

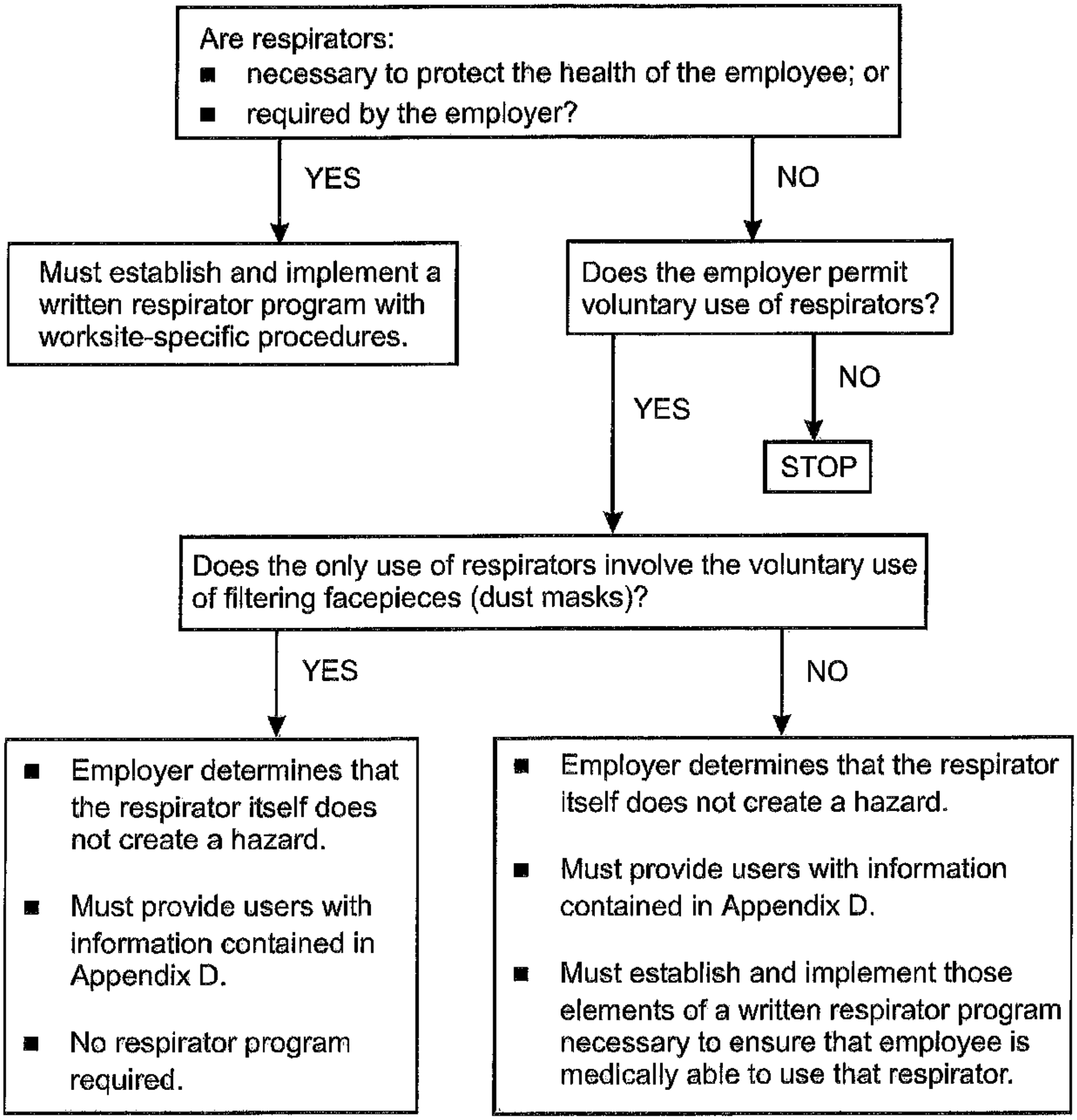
(c) Respiratory Protection Program

- Must designate a **qualified program administrator** to oversee the program.

- Must provide respirators, training, and medical evaluations **at no cost to the employee.**

- OSHA has prepared a *Small Entity Compliance Guide* that contains criteria for selection of a program administrator and a sample program.

Respirator-Use Requirements Flow Chart
29 CFR 1910.134(c)



(d) Selection of Respirators

- Must select a respirator **certified by the National Institute for Occupational Safety and Health (NIOSH)** which must be used in compliance with the conditions of its certification.

- Must identify and evaluate the respiratory hazards in the workplace, including a reasonable estimate of employee exposures and identification of the contaminant's chemical state and physical form.

- Where exposure cannot be identified or reasonably estimated, the atmosphere shall be considered immediately dangerous to life or health (IDLH).

- Respirators for IDLH atmospheres:
  - Approved respirators:
    - full facepiece pressure demand self-contained breathing apparatus (SCBA) certified by NIOSH for a minimum service life of thirty minutes, or
    - combination full facepiece pressure demand supplied-air respirator (SAR) with auxiliary self-contained air supply.
  - All **oxygen-deficient atmospheres (less than 19.5% O_2 by volume)** shall be considered IDLH.

    <u>Exception</u>: If the employer can demonstrate that, under all foreseeable conditions, oxygen levels in the work area can be maintained within the ranges specified in Table II (i.e., between 19.5% and a lower value that corresponds to an altitude-adjusted oxygen partial pressure equivalent to 16% oxygen at sea level), then *any* atmosphere-supplying respirator may be used.

- Respirators for non-IDLH atmospheres:
  - Employers must use the **assigned protection factors (APFs)** listed in Table 1 to select a respirator that meets or exceeds the required level of employee protection.
    - When using a combination respirator (e.g., airline respirators with an air-purifying filter), employers must ensure that the assigned protection factor is appropriate to the mode of operation in which the respirator is being used.
  - Must select a respirator for employee use that maintains the employee's exposure to the hazardous substance, when measured outside the respirator, at or below the **maximum use concentration (MUC).**
    - Must not apply MUCs to conditions that are IDLH; instead must use respirators listed for IDLH conditions in paragraph (d)(2) of this standard.
    - When the calculated MUC exceeds the IDLH level or the performance limits of the cartridge or canister, then employers must set the maximum MUC at that lower limit.
    - The respirator selected shall be appropriate for the chemical state and physical form of the contaminant.

- For protection against gases and vapors, the employer shall provide:
    - an atmosphere-supplying respirator, or
    - an air-purifying respirator, provided that:
        - the respirator is equipped with an **end-of-service-life indicator (ESLI)** certified by NIOSH for the contaminant; or
        - if there is no ESLI appropriate for conditions of the employer's workplace, the employer implements a **change schedule** for canisters and cartridges that will ensure that they are changed before the end of their service life and describes in the respirator program the information and data relied upon and basis for the change schedule and reliance on the data.
- For protection against particulates, the employer shall provide:
    - an atmosphere-supplying respirator; or
    - an air-purifying respirator equipped with high efficiency particulate air (HEPA) filters certified by NIOSH under 30 CFR Part 11 or with filters certified for particulates under 42 CFR Part 84; or
    - an air-purifying respirator equipped with any filter certified for particulates by NIOSH for contaminants consisting primarily of particles with mass median aerodynamic diameters of at least 2 micrometers.

(e) Medical Evaluation

- Must provide a medical evaluation to determine employee's ability to use a respirator, **before fit testing and use.**

- Must identify a **physician or other licensed health care professional (PLHCP)** to perform medical evaluations using a medical questionnaire or an initial medical examination that obtains the same information as the medical questionnaire (information required is contained in mandatory Appendix C).

- Must obtain a **written recommendation** regarding the employee's ability to use the respirator from the PLHCP.

- Additional medical evaluations are required under certain circumstances, e.g.:
  - employee reports medical signs or symptoms related to ability to use respirator;
  - PLHCP, program administrator, or supervisor recommends reevaluation;
  - information from the respirator program, including observations made during fit testing and program evaluation, indicates a need; or
  - change occurs in workplace conditions that may substantially increase the physiological burden on an employee.

- Annual review of medical status is not required.

(f) Fit Testing

- All employees using a **negative or positive pressure tight-fitting facepiece** respirator must pass an appropriate **qualitative fit test (QLFT)** or **quantitative fit test (QNFT).**

- Fit testing is required prior to initial use, whenever a different respirator facepiece is used, and **at least annually thereafter**. An additional fit test is required whenever the employee reports, or the employer or PLHCP makes visual observations of, changes in the employee's physical condition that could affect respirator fit (e.g., facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight).

- The fit test shall be administered using an OSHA-accepted QLFT or QNFT protocol, as contained in mandatory Appendix A.
  - QLFT Protocols:
    - Isoamyl acetate
    - Saccharin
    - Bitrex
    - Irritant smoke
  - QNFT Protocols:
    - Generated Aerosol (corn oil, salt, DEHP)
    - Condensation Nuclei Counter (PortaCount)
    - Controlled Negative Pressure (Dynatech FitTester 3000)
    - Controlled Negative Pressure (CNP) REDON

- QLFT may only be used to fit test negative pressure air-purifying respirators (APRs) that must achieve a fit factor of 100 or less.

- If the fit factor determined through QNFT is ≥100 for tight-fitting half facepieces, or ≥500 for tight-fitting full facepieces, the QNFT has been passed with that respirator.

<u>Note</u>: If a particular OSHA standard (e.g., 29 CFR 1910.1001 Asbestos) requires the use of a full facepiece APR capable of providing protection in concentrations up to 50 times the Permissible Exposure Limit (PEL), this respirator must be QNFT. This is because a protection factor of 50 (50 X PEL) multiplied by a standard safety factor of 10 is equivalent to a fit factor of 500.

The safety factor of 10 is used because protection factors in the workplace tend to be much lower than the fit factors achieved during fit testing. The use of a safety factor is a standard practice supported by most experts to offset this limitation. This is discussed in the record at 63 FR 1225.

(g) Use of Respirators

- Tight-fitting respirators shall not be worn by employees who have facial hair or any condition that interferes with the face-to-facepiece seal or valve function.

- Personal protective equipment shall be worn in such a manner that does not interfere with the seal of the facepiece to the face of the user.

- Employees shall perform a user seal check **each time they put on a tight-fitting respirator** using the procedures in mandatory Appendix B-1 or equally effective manufacturer's procedures.

- Procedures for respirator use in IDLH atmospheres are stated. In addition to these requirements, interior structural firefighting requires the use of SCBAs and a protective practice known as "2-in/2-out" — at least two employees must enter and remain in visual or voice contact with one another at all times, and at least two employees must be located outside. (Note that this is not meant to preclude firefighters from performing emergency rescue activities before an entire team has assembled.)

(h) Maintenance and Care of Respirators

Must clean and disinfect respirators using the procedures in Appendix B-2, or equally effective manufacturer's procedures at the following intervals:

- as often as necessary to maintain a sanitary condition for exclusive use respirators,
- before being worn by different individuals when issued to more than one employee, and
- after each use for emergency use respirators **and those used in fit testing and training.**

(i) Breathing Air Quality and Use

Compressed breathing air shall meet the requirements for Type 1-Grade D breathing air as described in ANSI/CGA *Commodity Specification for Air*, G-7.1-1989.

(j) Identification of Filters, Cartridges, and Canisters

- All filters, cartridges, and canisters used in the workplace must be labeled and color coded with the NIOSH approval label.
- The label must not be removed and must remain legible.

(k) Training and Information

- Must provide effective training to respirator users, including:
  - why the respirator is necessary and how improper fit, use, or maintenance can compromise the protective effect of the respirator
  - limitations and capabilities of the respirator
  - use in emergency situations
  - how to inspect, put on and remove, use and check the seals
  - procedures for maintenance and storage
  - recognition of medical signs and symptoms that may limit or prevent effective use
  - general requirements of this standard
- Training required prior to initial use, unless acceptable training has been provided by another employer within the past 12 months.
- **Retraining required annually** and when:
  - workplace conditions change,
  - new types of respirator are used, or
  - inadequacies in the employee's knowledge or use indicates need.

- The basic advisory information in Appendix D shall be provided to employees who wear respirators when their use is not required.

(l) Program Evaluation

Employer must conduct evaluations of the workplace as necessary to ensure proper implementation of the program, and consult with employees to ensure proper use.

(m) Recordkeeping

- Records of medical evaluations must be retained and made available per 29 CFR 1910.1020.
- A record of fit tests must be established and retained until the next fit test.
- A written copy of the current program must be retained.

Appendix A-7

Excavation Standards

Electronic Code of Federal Regulations
e-CFR™

e-CFR Data is current as of July 16, 2012

Title 29: Labor
PART 1926— SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION

Browse Previous | Browse Next

Subpart P— Excavations

Authority: Sec. 107, Contract Worker Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Secs. 4, 6, 8, Occupational Safety and Hea1th Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12–71 (36 FR 8754), 8–76 (41 FR 25059), or 9–83 (48 FR 35736), as applicable, and 29 CFR part 1911.

Source: 54 FR 45959, Oct. 31, 1989, unless otherwise noted.

§ 1926.650 Scope, application, and definitions applicable to this subpart.

(a) Scope and application. This subpart applies to all open excavations made in the earth's surface. Excavations are defined to include trenches.

(b) Definitions applicable to this subpart.

Accepted engineering practices means those requirements which are compatible with standards of practice required by a registered professional engineer.

Aluminum Hydraulic Shoring means a pre-engineered shoring system comprised of aluminum hydraulic cylinders (crossbraces) used in conjunction with vertical rails (uprights) or horizontal rails (walers). Such system is designed, specifically to support the sidewalls of an excavation and prevent cave-ins.

Bell-bottom pier hole means a type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a belled shape.

Benching (Benching system) means a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-in means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

Competent person means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Cross braces mean the horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

Excavat on means any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

Faces or sides means the vertical or inclined earth surfaces formed as a result of excavation work.

Failure means the breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

Hazardous atmosphere means an atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

Kickout means the accidental release or failure of a cross brace.

Protective system means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Ramp means an inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

Registered Professional Engineer means a person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a □registered professional engineer□within the meaning of this standard when approving designs for □manufactured protective systems□or □tabulated data□to be used in interstate commerce.

Sheeting means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield (Shield system) means a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either premanufactured or job-built in accordance with □1926.652 (c)(3) or (c)(4). Shields used in trenches are usually referred to as □trench boxes□or □trench shields.□

Shoring (Shoring system) means a structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

Sides. See □Faces.□

Sloping (Sloping system) means a method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Stable rock means natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

Structural ramp means a ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock are not considered structural ramps.

Support system means a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Tabulated data means tables and charts approved by a registered professional engineer and used to design and construct a protective system.

Trench (Trench excavation) means a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.

Trench box. See "Shield."

Trench shield. See "Shield."

Uprights means the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called "sheeting."

Wales means horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

§ 1926.651 Specific excavation requirements.

(a) Surface encumbrances. All surface encumbrances that are located so as to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees.

(b) Underground installations. (1) The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

(2) Utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations, the employer may proceed, provided the employer does so with caution, and provided detection equipment or other acceptable means to locate utility installations are used.

(3) When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by safe and acceptable means.

(4) While the excavation is open, underground installations shall be protected, supported or removed as necessary to safeguard employees.

(c) Access and egress — (1) Structural ramps. (i) Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.

(ii) Ramps and runways constructed of two or more structural members shall have the structural members connected together to prevent displacement.

(iii) Structural members used for ramps and runways shall be of uniform thickness.

(iv) Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping.

(v) Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments on the top surface to prevent slipping.

(2) Means of egress from trench excavations. A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

(d) Exposure to vehicular traffic. Employees exposed to public vehicular traffic shall be provided with, and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

(e) Exposure to falling loads. No employee shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped, in accordance with □1926.601(b)(6), to provide adequate protection for the operator during loading and unloading operations.

(f) Warning system for mobile equipment. When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

(g) Hazardous atmospheres □ (1) Testing and controls. In addition to the requirements set forth in subparts D and E of this part (29 CFR 1926.50□1926.107) to prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions, the following requirements shall apply□

(i) Where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation shall be tested before employees enter excavations greater than 4 feet (1.22 m) in depth.

(ii) Adequate precautions shall be taken to prevent employee exposure to atmospheres containing less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include providing proper respiratory protection or ventilation in accordance with subparts D and E of this part respectively.

(iii) Adequate precaution shall be taken such as providing ventilation, to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 20 percent of the lower flammable limit of the gas.

(iv) When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to ensure that the atmosphere remains safe.

(2) Emergency rescue equipment. (i) Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, shall be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment shall be attended when in use.

(ii) Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, shall wear a harness with a life-line securely attached to it. The lifeline shall be separate from any line used to handle materials, and shall be individually attended at all times while the employee wearing the lifeline is in the excavation.

(h) Protection from hazards associated with water accumulation. (1) Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

(2) If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.

(3) If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person and compliance with paragraphs (h)(1) and (h)(2) of this section.

(i) Stability of adjacent structures. (1) Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

(2) Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted except when□

(i) A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or

(ii) The excavation is in stable rock; or

(iii) A registered professional engineer has approved the determination that the structure is sufficently removed from the excavation so as to be unaffected by the excavation activity; or

(iv) A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

(3) Sidewalks, pavements, and appurtenant structure shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

(j) Protection of employees from loose rock or soil. (1) Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.

(2) Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet (.61 m) from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

(k) Inspections. (1) Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.

(2) Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

(l) Walkways shall be provided where employees or equipment are required or permitted to cross over excavations. Guardrails which comply with □1926.502(b) shall be provided where walkways are 6 feet (1.8 m) or more above lower levels.

[54 FR 45959, Oct. 31, 1989, as amended by 59 FR 40730, Aug. 9, 1994□

§ 1926.652 Requirements for protective systems.

(a) Protection of employees in excavations. (1) Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with paragraph (b) or (c) of this section except when□

(i) Excavations are made entirely in stable rock; or

(ii) Excavations are less than 5 feet (1.52m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

(2) Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

(b) Design of sloping and benching systems. The slopes and configurations of sloping and benching systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (b)(1); or, in the alternative, paragraph (b)(2); or, in the alternative, paragraph (b)(3), or, in the alternative, paragraph (b)(4), as follows:

(1) Option (1)— Allowable configurations and slopes. (i) Excavations shall be sloped at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal), unless the employer uses one of the other options listed below.

(ii) Slopes specified in paragraph (b)(1)(i) of this section, shall be excavated to form configurations that are in accordance with the slopes shown for Type C soil in appendix B to this subpart.

(2) Option (2)— Determination of slopes and configurations using Appendices A and B. Maximum allowable slopes, and allowable configurations for sloping and benching systems, shall be determined in accordance with the conditions and requirements set forth in appendices A and B to this subpart.

(3) Option (3)— Designs using other tabulated data. (i) Designs of sloping or benching systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(ii) The tabulated data shall be in written form and shall include all of the following:

(A) Identification of the parameters that affect the selection of a sloping or benching system drawn from such data;

(B) Identification of the limits of use of the data, to include the magnitude and configuration of slopes determined to be safe;

(C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(iii) At least one copy of the tabulated data which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) Option (4)— Design by a registered professional engineer. (i) Sloping and benching systems not utilizing Option (1) or Option (2) or Option (3) under paragraph (b) of this section shall be approved by a registered professional engineer.

(ii) Designs shall be in written form and shall include at least the following:

(A) The magnitude of the slopes that were determined to be safe for the particular project;

(B) The configurations that were determined to be safe for the particular project; and

(C) The identity of the registered professional engineer approving the design.

(iii) At least one copy of the design shall be maintained at the jobsite while the slope is being constructed. After that time the design need not be at the jobsite, but a copy shall be made available to the Secretary upon request.

(c) Design of support systems shield systems and other protective systems. Designs of support systems shield systems, and other protective systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (c)(1); or, in the alternative, paragraph (c)(2); or, in the alternative, paragraph (c)(3); or, in the alternative, paragraph (c)(4) as follows:

(1) Option (1)— Designs using appendices A, C and D. Designs for timber shoring in trenches shall be determined in accordance with the conditions and requirements set forth in appendices A and C to this subpart. Designs for aluminum hydraulic shoring shall be in accordance with paragraph (c)(2) of this section, but if manufacturer's tabulated data cannot be utilized, designs shall be in accordance with appendix D.

(2) Option (2)— Designs Using Manufacturer's Tabulated Data. (i) Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data shall be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

(ii) Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer shall only be allowed after the manufacturer issues specific written approval.

(iii) Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations shall be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy shall be made available to the Secretary upon request.

(3) Option (3)— Designs using other tabulated data. (i) Designs of support systems, shield systems, or other protective systems shall be selected from and be in accordance with tabulated data, such as tables and charts.

(ii) The tabulated data shall be in written form and include all of the following:

(A) Identification of the parameters that affect the selection of a protective system drawn from such data;

(B) Identification of the limits of use of the data;

(C) Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

(iii) At least one copy of the tabulated data, which identifies the registered professional engineer who approved the data, shall be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data shall be made available to the Secretary upon request.

(4) Option (4)— Design by a registered professional engineer. (i) Support systems, shield systems, and other protective systems not utilizing Option 1, Option 2 or Option 3, above, shall be approved by a registered professional engineer.

(ii) Designs shall be in written form and shall include the following:

(A) A plan indicating the sizes, types, and configurations of the materials to be used in the protective system; and

(B) The identity of the registered professional engineer approving the design.

(iii) At least one copy of the design shall be maintained at the jobsite during construction of the protective system. After that time, the design may be stored off the jobsite, but a copy of the design shall be made available to the Secretary upon request.

(d) Materials and equipment. (1) Materials and equipment used for protective systems shall be free from damage or defects that might impair their proper function.

(2) Manufactured materials and equipment used for protective systems shall be used and maintained in a manner that is consistent with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards.

(3) □hen material or equipment that is used for protective systems is damaged, a competent person shall examine the material or equipment and evaluate its suitability for continued use. If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then such material or equipment shall be removed from service, and shall be evaluated and approved by a registered professional engineer before being returned to service.

(e) Installation and removal of support □ (1) General. (i) Members of support systems shall be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.

(ii) Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.

(iii) Individual members of support systems shall not be subjected to loads exceeding those which those members were designed to withstand.

(iv) Before temporary removal of individual members begins, additional precautions shall be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.

(v) □emoval shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.

(vi) Backfilling shall progress together with the removal of support systems from excavations.

(2) *Addit.onal requirements or suppor. systems or tre.ch excavations.* (i) Excavation of material to a level no greater than 2 feet (.□1 m) below the bottom of the members of a support system shall be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

(ii) Installation of a support system shall be closely coordinated with the excavation of trenches.

(f) *Sloping and benching systems.* Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

(g) *Shield systems* □ (1) *General.* (i) Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.

(ii) Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

(iii) Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

(iv) Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.

(2) *Additional requirement for shield systems used in trench excavations.* Excavations of earth material to a level not greater than 2 feet (.□1 m) below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

Appendix A to Subpart P of Part 1926—Soil Classification

(a) *Scope and application* □ (1) *Scope.* This appendix describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

(2) *Application.* This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in □1□2□□□2(b)(2) as a method of protection for employees from cave-ins. This appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with appendix C to subpart □ of part 1□2□, and when aluminum hydraulic shoring is designed in accordance with appendix D. This appendix also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in □1□2□□□2(c), and the use of the data is predicated on the use of the soil classification system set forth in this appendix.

(b) *Definitions.* The definitions and examples given below are based on, in whole or in part, the following:

American Society for Testing Materials (ASTM) Standards D□□3□□□ and D24□□; The □nified Soils Classification System, The □.S. Department of Agriculture (□SDA) Textural Classification Scheme; and The □ational Bureau of Standards □eport BSS□121.

Cemented soil means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand-size sample cannot be crushed into powder or individual soil particles by finger pressure.

Cohesive soil means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical sideslopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

Dry soil means soil that does not exhibit visible signs of moisture content.

Fissured means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

Granular soil means gravel, sand, or silt, (coarse grained soil) with little or no clay content. □ranular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. □ranular soil cannot be molded when moist and crumbles easily when dry.

Layered system means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

Moist soil means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

Plastic means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

Saturated soil means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or sheer vane.

Soil classification system means, for the purpose of this subpart, a method of categorizing soil and rock deposits in a hierarchy of Stable □ock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the environmental conditions of exposure.

Stable rock means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

Submerged soil means soil which is underwater or is free seeping.

Type A means cohesive soils with an unconfined compressive strength of 1.□ ton per square foot (tsf) (144 k□a) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. □owever, no soil is Type A if:

(i) The soil is fissured; or

(ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or

(iii) The soil has been previously disturbed; or

(iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4□:1□) or greater; or

(v) The material is subject to other factors that would require it to be classified as a less stable material.

Type B means:

(i) Cohesive soil with an unconfined compressive strength greater than □□ tsf (4□ k□a) but less than 1.□ tsf (144 k□a); or

(ii) □ranular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.

(iii) □reviously disturbed soils except those which would otherwise be classed as Type C soil.

(iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or

(v) Dry rock that is not stable; or

(vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4□:1□), but only if the material would otherwise be classified as Type B.

Type C means:

(i) Cohesive soil with an unconfined compressive strength of □□ tsf (4□ k□a) or less; or

(ii) □ranular soils including gravel, sand, and loamy sand; or

(iii) Submerged soil or soil from which water is freely seeping; or

(iv) Submerged rock that is not stable, or

(v) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4□:1□) or steeper.

Unconfined compressive strength means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

Wet soil means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. □ranular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

(c) *Requirements* □ (1) *Classification of soil and rock deposits.* Each soil and rock deposit shall be classified by a competent person as Stable □ock, Type A, Type B, or Type C in accordance with the definitions set forth in paragraph (b) of this appendix.

(2) *Basis of classification.* The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis. Such analyses shall be conducted by a competent person using tests described in paragraph (d) below, or in other recognized methods of soil classification and testing such as those adopted by the America Society for Testing Materials, or the □.S. Department of Agriculture textural classification system.

(3) *Visual and manual analyses.* The visual and manual analyses, such as those noted as being acceptable in paragraph (d) of this appendix, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits.

(4) *Layered systems.* In a layered system, the system shall be classified in accordance with its weakest layer. □owever, each layer may be classified individually where a more stable layer lies under a less stable layer.

(□) *Reclassification.* If, after classifying a deposit, the properties, factors, or conditions affecting its classification change in any way, the changes shall be evaluated by a competent person. The deposit shall be reclassified as necessary to reflect the changed circumstances.

(d) Acceptable visual and manual tests □ (1) Visual tests. Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

(i) Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material.

(ii) Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.

(iii) Observe the side of the opened excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

(iv) Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.

(v) Observe the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.

(vi) Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.

(vii) Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

(2) Manual tests. Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

(i) Plasticity. Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as1/8-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of1/8-inch thread can be held on one end without tearing, the soil is cohesive.

(ii) Dry strength. If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.

(iii) Thumb penetration. The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. (This test is based on the thumb penetration test described in American Society for Testing and Materials (ASTM) Standard designation D2488□ □Standard Recommended Practice for Description of Soils (Visual□ Manual Procedure).□) Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a miminum the effects of exposure to drying influences. If the excavation is later exposed to wetting influences (rain, flooding), the classification of the soil must be changed accordingly.

(iv) Other strength tests. Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand-operated shearvane.

(v) Drying test. The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately one inch thick (2.54 cm) and six inches (15.24 cm) in diameter until it is thoroughly dry:

(A) If the sample develops cracks as it dries, significant fissures are indicated.

( ) Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as a unfissured cohesive material and the unconfined compressive strength should be determined.

(C) If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

Appendix B to Subpart P of Part 1926—Sloping and Benching

(a) Scope and application. This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in 1 2 . 52(b)(2).

(b) Definitions.

Actual slope means the slope to which an excavation face is excavated.

Distress means that the soil is in a condition where a cave-in is imminent or is likely to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and ravelling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (:V).

Short term exposure means a period of time less than or equal to 24 hours that an excavation is open.

(c) Requirements (1) Soil classification. Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1 2 .

(2) Maximum allowable slope. The maximum allowable slope for a soil or rock deposit shall be determined from Table 1 of this appendix.

( ) Actual slope. (i) The actual slope shall not be steeper than the maximum allowable slope.

(ii) The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least1/2horizontal to one vertical (1/2 :1V) less steep than the maximum allowable slope.

(iii) hen surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with 1 2 . 51(i).

(4) Configurations. Configurations of sloping and benching systems shall be in accordance with Figure 1.

TABLE B-1
MAXIMUM ALLOWABLE SLOPES

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V)[1] FOR EXCAVATIONS LESS THAN 20 FEET DEEP[3]
STABLE ROCK	VERTICAL (90°)
TYPE A (2)	3/4:1 (53°)
TYPE B	1:1 (45°)
TYPE C	1½:1 (34°)

NOTES:

1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
2. A short-term maximum allowable slope of 1/2H:1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53°).
3. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

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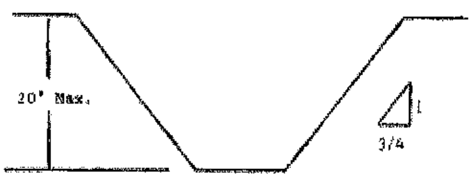
Figure B-1

Slope Configurations

(All slopes stated below are in the horizontal to vertical ratio)

B-1.1 Excavations made in Type A soil

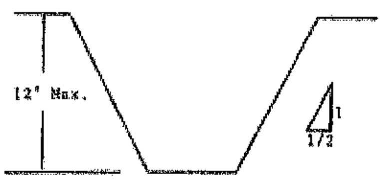
1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of /4:1.



View or download PDF

Simple Slope□ eneral

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of1/2:1.



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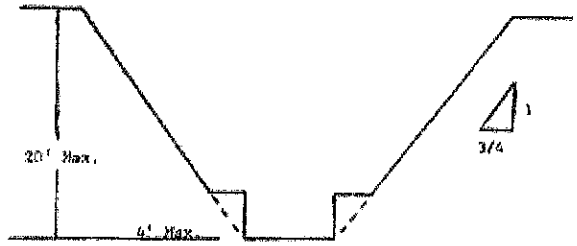
Simple Slope□ Short Term

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of /4to 1 and maximum bench dimensions as follows:



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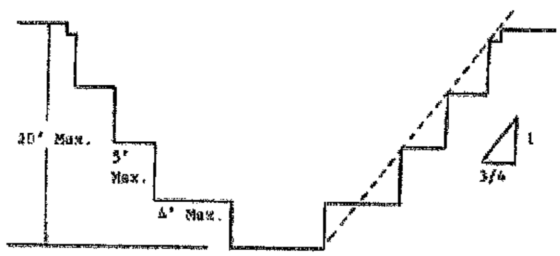

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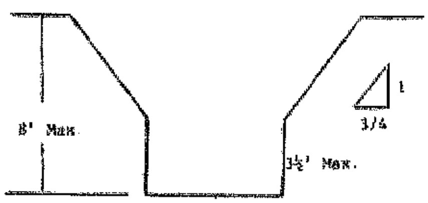
Multiple ench

. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 1/2feet.



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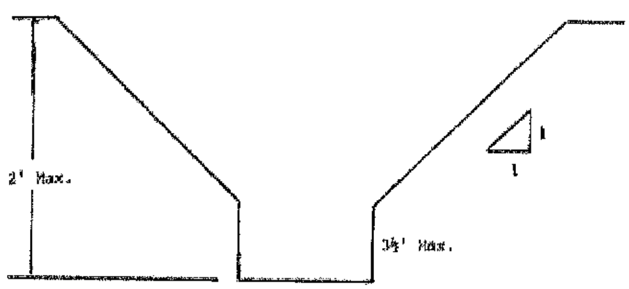
nsupported Vertically Sided ower Portion Maximum 8 Feet in Depth

All excavations more than 8 feet but not more than 12 feet in depth which unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 1/2feet.



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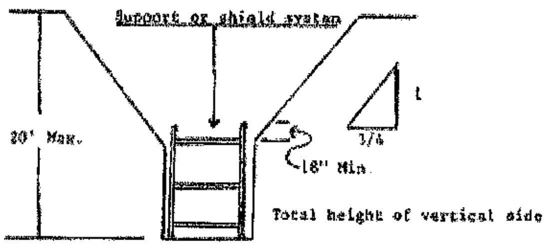
nsupported Vertically Sided ower Portion□ Maximum 12 Feet in Depth

All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of /4:1. The support or shield system must extend at least 18 inches above the top of the vertical side.



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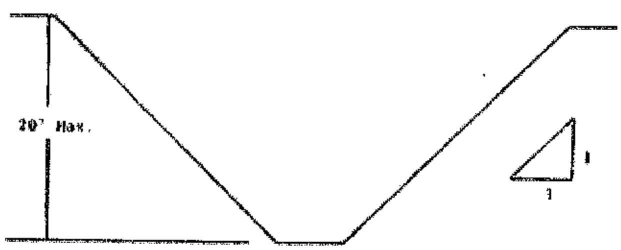
Supported or Shielded Vertically Sided ower Portion

4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under 1 2 . 52(b).

☐-1 2 Excavations Made in Type ☐ Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.



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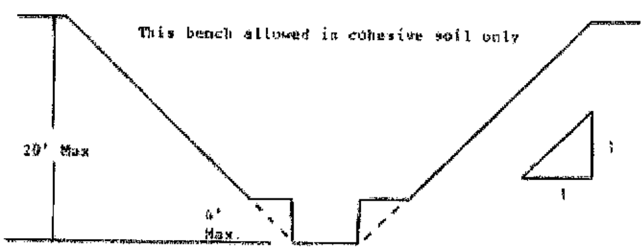
Simple Slope

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:



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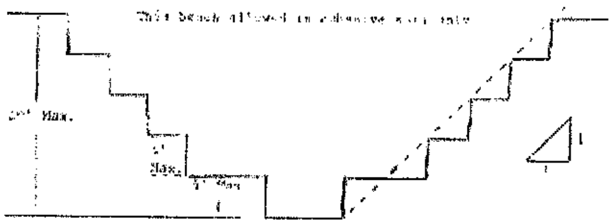
Single ench



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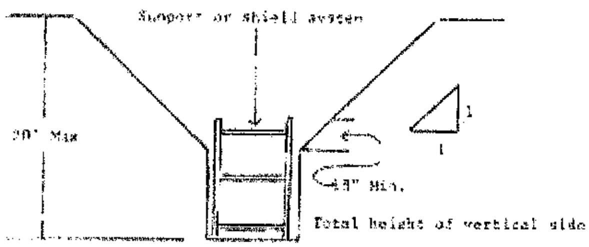
Multiple Bench

3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.



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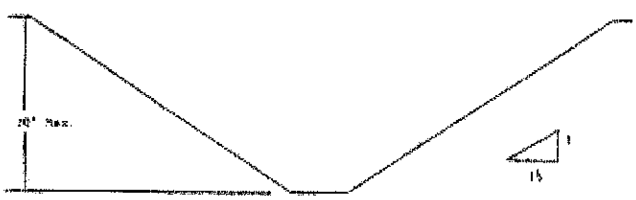
Vertically Sided Lower Portion

4. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

B-1.3 Excavations Made in Type C Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 11/2:1.



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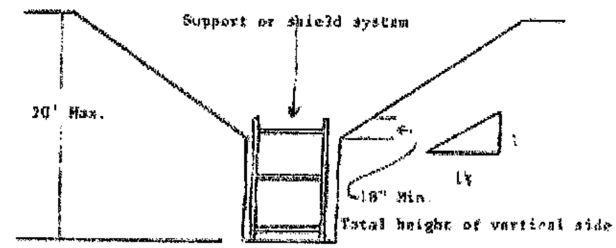
Simple Slope

2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 11/2:1.



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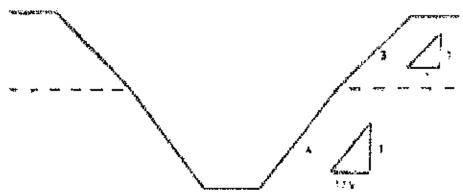
Vertical Sided Lower Portion

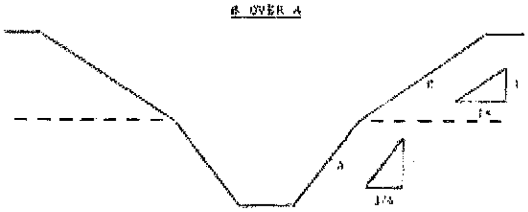
3. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

B-1.4 Excavations Made in Layered Soils

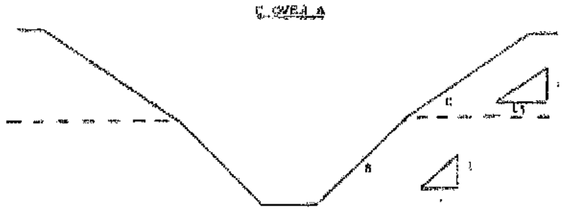
1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.



B OVER A



C OVER A



C OVER B

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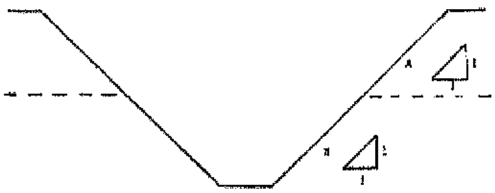
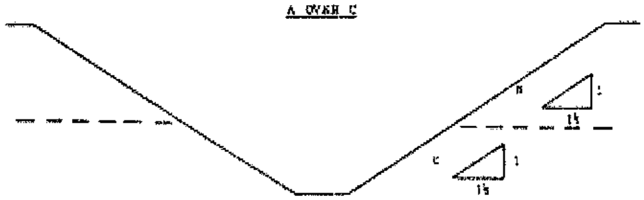


A OVER B

A OVER C



B OVER C

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2. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

Appendix C to Subpart P of Part 1926—Timber Shoring for Trenches

(a) *Scope.* This appendix contains information that can be used timber shoring is provided as a method of protection from cave-ins in trenches that do not exceed 20 feet (6.1 m) in depth. This appendix must be used when design of timber shoring protective systems is to be performed in accordance with §1926.652(c)(1). Other timber shoring configurations; other systems of support such as hydraulic and pneumatic systems; and other protective systems such as sloping, benching, shielding, and freezing systems must be designed in accordance with the requirements set forth in §1926.652(b) and §1926.652(c).

(b) *Soil Classification.* In order to use the data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil classification method set forth in appendix A of subpart P of this part.

(c) *Presentation of Information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables C-1.1, C-1.2, and C-1.3, and Tables C-2.1, C-2.2 and C-2.3 following paragraph (g) of the appendix. Each table presents the minimum sizes of timber members to use in a shoring system, and each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. The data are arranged to allow the user the flexibility to select from among several acceptable configurations of members based on varying the horizontal spacing of the crossbraces. Stable rock is exempt from shoring requirements and therefore, no data are presented for this condition.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix, and on the tables themselves.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations regarding Tables C-1.1 through C-1.3 and Tables C-2.1 through C-2.3 are presented in paragraph (g) of this Appendix.

(d) Basis and l ~itations of t~e data □ (1) Dimensions of t ~ber members. (i) □he si□es of the timber members listed in □ables □□1.1 through □□1.3 are ta□en from the □ational Bureau of Standards (□BS) report□□ecommended □echnical Provisions for □onstruction Practice in Shoring and Sloping of □renches and □xcavations.□□ addition□where □BS did not recommend specific si□es of members□ member si□es are based on an analysis of the si□es re□uired for use by existing codes and on empirical practice.

(ii) □he re□uired dimensions of the members listed in □ables □□1.1 through □□1.3 refer to actual dimensions and not nominal dimensions of the timber. □mployers wanting to use nominal si□e shoring are directed to □ables □□2.1 through □□2.3□or have this choice under §1926.652(c)(3)□and are referred to □he □orps of □ngineers□□he Bureau of □eclamation or data from other acceptable sources.

(2) Limitation o~ application. (i) □ is not intended that the timber shoring specification apply to every situation that may be experienced in the field. □hese data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be designed as specified in §1926.652(c).

(ii) □ hen any of the following conditions are present□the members specified in the tables are not considered ade□uate. □ither an alternate timber shoring system must be designed or another type of protective system designed in accordance with §1926.652.

(A) □ hen loads imposed by structures or by stored material ad□acent to the trench weigh in excess of the load imposed by a two□foot soil surcharge. □he term □ad□acent□as used here means the area within a hori□ontal distance from the edge of the trench e□ual to the depth of the trench.

(B) □ hen vertical loads imposed on cross braces exceed a 240□pound gravity load distributed on a one□ foot section of the center of the crossbrace.

(□) □ hen surcharge loads are present from e□uipment weighing in excess of 20□000 pounds.

(D) □ hen only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched unless: □he sloped portion is sloped at an angle less steep than three hori□ontal to one vertical□or the members are selected from the tables for use at a depth which is determined from the top of the overall trench□and not from the toe of the sloped portion.

(e) Use of Tables. □he members of the shoring system that are to be selected using this information are the cross braces□the uprights□and the wales□where wales are re□uired. Minimum si□es of members are specified for use in different types of soil. □here are six tables of information□two for each soil type. □he soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. □sing the appropriate table□the selection of the si□e and spacing of the members is then made. □he selection is based on the depth and width of the trench where the members are to be installed and□in most instances□the selection is also based on the hori□ontal spacing of the crossbraces. □nstances where a choice of hori□ontal spacing of crossbracing is available□the hori□ontal spacing of the crossbraces must be chosen by the user before the si□e of any member can be determined. □ hen the soil type□the width and depth of the trench□and the hori□ontal spacing of the crossbraces are □nown□the si□e and vertical spacing of the crossbraces□the si□e and vertical spacing of the wales□and the si□e and hori□ontal spacing of the uprights can be read from the appropriate table.

(f) Examples to Illustrate the Use of Tables C–1.1 through C–1.3

(1) Example 1.

A trench dug in □ype A soil is 13 feet deep and five feet wide.

From Table C–1.1 for acceptable arrangements of timber can be used.

Arrangement #B1

Space 4□4 crossbraces at six feet hori□ontally and four feet vertically.

□ ales are not re□uired.

Space 3□8 uprights at six feet hori□ontally. □his arrangement is commonly called □s□p shoring.□

Arra¬geme¬t #32

Space 4□6 crossbraces at eight feet hori□ontally and four feet vertically.

Space 8□8 wales at four feet vertically.

Space 2□6 uprights at four feet hori□ontally.

Arra¬geme¬t #33

Space 6□6 crossbraces at 10 feet hori□ontally and four feet vertically.

Space 8□10 wales at four feet vertically.

Space 2□6 uprights at five feet hori□ontally.

Arra¬geme¬t #34

Space 6□6 crossbraces at 12 feet hori□ontally and four feet vertically.

Space 10□10 wales at four feet vertically.

Spaces 3□8 uprights at six feet hori□ontally.

(2) Example 2.

A trench dug in □ype B soil in 13 feet deep and five feet wide. From □able □□1.2 three acceptable arrangements of members are listed.

Arra¬geme¬t #31

Space 6□6 crossbraces at six feet hori□ontally and five feet vertically.

Space 8□8 wales at five feet vertically.

Space 2□6 uprights at two feet hori□ontally.

Arra¬geme¬t #32

Space 6□8 crossbraces at eight feet hori□ontally and five feet vertically.

Space 10□10 wales at five feet vertically.

Space 2□6 uprights at two feet hori□ontally.

Arra¬geme¬t #33

Space 8□8 crossbraces at 10 feet hori□ontally and five feet vertically.

Space 10□12 wales at five feet vertically.

Space 2□6 uprights at two feet vertically.

(3) Example 3.

A trench dug in □ype □ soil is 13 feet deep and five feet wide.

From □able □□1.3 two acceptable arrangements of members can be used.

Arrangement #31

Space 8×8 crossbraces at six feet horizontally and five feet vertically.

Space 10×12 wales at five feet vertically.

Position 2×6 uprights as closely together as possible.

If water must be retained use special tongue and groove uprights to form tight sheeting.

Arrangement #32

Space 8×10 crossbraces at eight feet horizontally and five feet vertically.

Space 12×12 wales at five feet vertically.

Position 2×6 uprights in a close sheeting configuration unless water pressure must be resisted. Tight sheeting must be used where water must be retained.

(4) Example 4.

A trench dug in Type C soil is 20 feet deep and 11 feet wide. The size and spacing of members for the section of trench that is over 15 feet in depth is determined using Table C□1.3. Only one arrangement of members is provided.

Space 8×10 crossbraces at six feet horizontally and five feet vertically.

Space 12×12 wales at five feet vertically.

Use 3×6 tight sheeting.

Use of Tables C□2.1 through C□2.3 would follow the same procedures.

(g) Notes for all Tables.

1. Member sizes at spacings other than indicated are to be determined as specified in §1926.652(c), □Design of Protective Systems.□

2. When conditions are saturated or submerged use Tight Sheeting. Tight Sheeting refers to the use of specially-edged timber planks (e.g., tongue and groove) at least three inches thick, steel sheet piling, or similar construction that when driven or placed in position provide a tight wall to resist the lateral pressure of water and to prevent the loss of backfill material. Close Sheeting refers to the placement of planks side-by-side allowing as little space as possible between them.

3. All spacing indicated is measured center to center.

4. Wales to be installed with greater dimension horizontal.

5. If the vertical distance from the center of the lowest crossbrace to the bottom of the trench exceeds two and one-half feet, uprights shall be firmly embedded or a mudsill shall be used. Where uprights are embedded, the vertical distance from the center of the lowest crossbrace to the bottom of the trench shall not exceed 36 inches. When mudsills are used, the vertical distance shall not exceed 42 inches. Mudsills are wales that are installed at the toe of the trench side.

6. Trench jacks may be used in lieu of or in combination with timber crossbraces.

7. Placement of crossbraces. When the vertical spacing of crossbraces is four feet, place the top crossbrace no more than two feet below the top of the trench. When the vertical spacing of crossbraces is five feet, place the top crossbrace no more than 2.5 feet below the top of the trench.

TABLE C-1.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE A $P_a = 25 \times H + 72$ psf (2 Ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 4	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				2X6	
	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	Not Req'd						2X8
	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			2X6		
	UP TO 12	4X6	4X6	4X6	6X6	6X6	4	8X8	4				2X6	
10 TO 15	UP TO 4	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				2X6	
	UP TO 6	4X6	4X6	4X6	6X6	6X6	4	8X8	4		2X6			
	UP TO 10	6X6	6X6	6X6	6X8	6X8	4	8X10	4			2X6		
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	10X10	4				2X6	
15 TO 20	UP TO 6	6X6	6X6	6X6	6X8	6X8	4	6X8	4	3X6				
	UP TO 8	6X6	6X6	6X6	6X8	6X8	4	8X8	4	3X6				
	UP TO 10	8X8	8X8	8X8	8X8	8X10	4	8X10	4	3X6				
	UP TO 12	8X8	8X8	8X8	8X8	8X10	4	10X10	4	3X6				
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.

** Manufactured members of equivalent strength may be substituted for wood.

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TABLE C-1.2

TIMBER TRENCH SHORING — MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE B P_a = 45 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	CROSS BRACES: HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET): UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15	VERT. SPACING (FEET)	WALES: SIZE (IN)	VERT. SPACING (FEET)	UPRIGHTS: MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET): CLOSE	2	3		
5 TO 10	UP TO 6	4X6	4X6	6X6	6X6	6X6	5	6X8	5			2X6		
	UP TO 8	6X6	6X6	6X6	6X6	6X8	5	8X10	5			2X6		
	UP TO 10	6X6	6X6	6X6	6X8	6X8	5	10X10	5			2X6		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5		2X6			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5		2X6			
	UP TO 10	8X8	8X8	8X8	8X8	8X10	5	10X12	5		2X6			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	3X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X8	5	10X12	5	3X6				
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may be substituted for wood.

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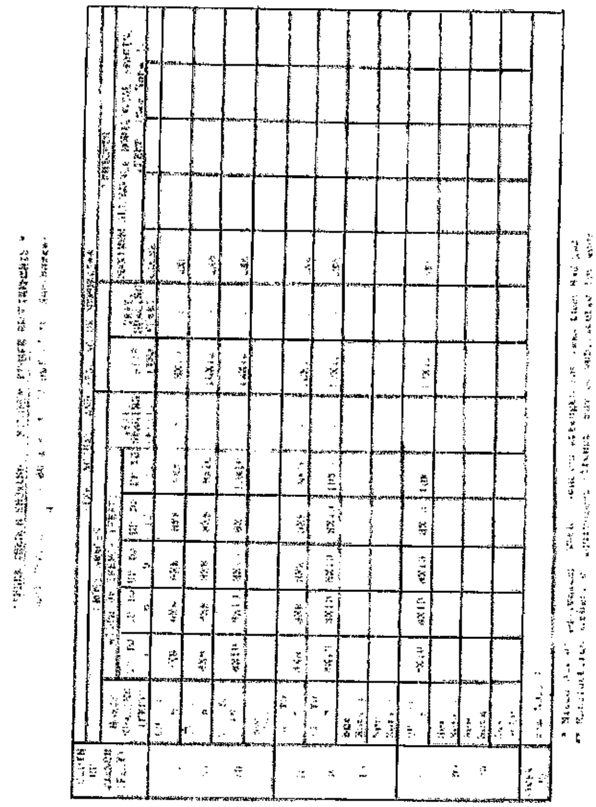

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TABLE C-2.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *
SOIL TYPE A P_a = 25 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4X4	4X4	4X4	4X4	4X6	4	Not Req'd	Not Req'd				4X6	
	UP TO 8	4X4	4X4	4X4	4X6	4X6	4	Not Req'd	Not Req'd					4X8
	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			4X6		
	UP TO 12	4X6	4X6	4X6	6X6	6X6	4	8X8	4				4X6	
10 TO 15	UP TO 6	4X4	4X4	4X4	6X6	6X6	4	Not Req'd	Not Req'd				4X10	
	UP TO 8	4X6	4X6	4X6	6X6	6X6	4	6X8	4		4X6			
	UP TO 10	6X6	6X6	6X6	6X6	6X6	4	8X8	4			4X8		
	UP TO 12	6X6	6X6	6X6	6X6	6X6	4	8X10	4		4X6		4X10	
15 TO 20	UP TO 6	6X6	6X6	6X6	6X6	6X8	4	6X8	4	3X6				
	UP TO 8	6X6	6X6	6X6	6X6	6X8	4	8X8	4	3X6	4X12			
	UP TO 10	8X8	8X8	8X8	8X8	8X8	4	8X10	4	3X6				
	UP TO 12	8X8	8X8	8X8	8X8	8X8	4	8X12	4	3X6	4X12			
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.
** Manufactured members of equivalent strength may be substituted for wood.

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TABLE C-1.2

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE B P_a = 45 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3	4	6
5 TO 10	UP TO 6	4X6	4X6	6X6	6X6	6X6	5	6X8	5			3X12 4X8		4X12
	UP TO 8	4X6	4X6	6X6	6X6	6X6	5	8X8	5		3X8		4X8	
	UP TO 10	4X6	4X6	6X6	6X6	6X8	5	8X10	5			4X8		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5	3X6	4X10			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5	3X6	4X10			
	UP TO 10	8X8	8X8	8X8	8X8	8X8	5	10X12	5	3X6	4X10			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	3X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X8	5	10X12	5	3X6				
	UP TO 10	8X8	8X8	8X8	8X8	8X8	5	12X12	5	3X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

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TABLE C-1.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE C P_a = 80 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE				
5 TO 10	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	2X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6				
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6				
	See Note 1													
10 TO 15	UP TO 6	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6				
	UP TO 8	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6				
	See Note 1													
	See Note 1													
15 TO 20	UP TO 6	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6				
	See Note 1													
	See Note 1													
	See Note 1													
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

TABLE D - 1.1
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE A

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 15 UP TO 20	7	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g).
Note (1): See Appendix D, Item (g) (1).
Note (2): See Appendix D, Item (g) (2).

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TABLE D - 1.2
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	6.5				
OVER 15 UP TO 20	5.5				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g) (1)
Note (2): See Appendix D, Item (g) (2)

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TABLE D - 1.3
ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)						MAX HORIZ SPACING (ON CENTER)		
	VERTICAL SPACING (FEET)	SECTION MODULUS* (IN³)	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15		SOLID SHEET	2 FT	3 FT
			HORIZ SPACING	CYLINDER DIAMETER	HORIZ SPACING	CYLINDER DIAMETER	HORIZ SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	8.0	2 IN	8.0	2 IN NOTE (2)	6.0	3 IN	—	—	3x12
		7.0	9.0	2 IN	9.0	2 IN NOTE (2)	9.0	3 IN			
		14.0	12.0	3 IN	12.0	3 IN	12.0	3 IN			
OVER 10 UP TO 15	4	3.5	6.0	2 IN	6.0	2 IN NOTE (2)	6.0	3 IN	—	3x12	—
		7.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 15 UP TO 20	4	3.5	5.5	2 IN	5.5	2 IN NOTE (2)	5.5	3 IN	3x12	—	—
		7.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
		14.0	9.0	3 IN	9.0	3 IN	9.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Notes (1): See Appendix D, Item (g) (1)
Notes (2): See Appendix D, Item (g) (2)
* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales

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TABLE D - 1.4
ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE C

DEPTH OF TRENCH	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
	VERTICAL SPACING	SECTION MODULUS*	WIDTH OF TRENCH (FEET)						MAX.HORIZ.SPACING (ON CENTER)		
			UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15		SOLID SHEET	2 FT.	3 FT.
(FEET)	(FEET)	(IN³)	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN	3x12	—	—
		7.0	6.5	2 IN	6.5	2 IN NOTE(2)	6.5	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 10 UP TO 15	4	3.5	4.0	2 IN	4.0	2 IN NOTE(2)	4.0	3 IN	3x12	—	—
		7.0	5.5	3 IN	5.5	3 IN	5.5	3 IN			
		14.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
OVER 15 UP TO 20	4	3.5	3.5	2 IN	3.5	2 IN NOTE(2)	3.5	3 IN	3x12		
		7.0	5.0	3 IN	5.0	3 IN	5.0	3 IN			
		14.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Notes (1): See Appendix D, item (g) (1)
Notes (2): See Appendix D, Item (g) (2)
* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales

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Appendix F to Subpart P of Part 1926—Alternatives to Timber Shoring

Figure 1. Aluminum Hydraulic Shoring

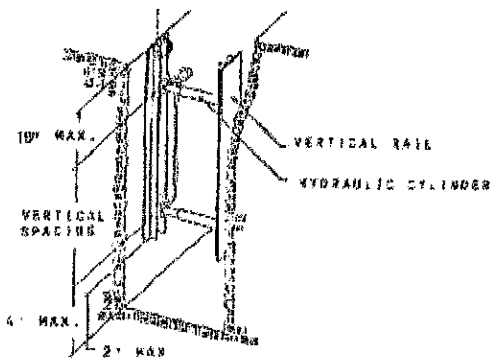

Figure 2. Pneumatic/hydraulic Shoring

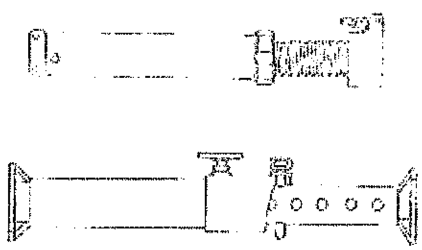

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Figure 3. Trench Jacks (Screw Jacks)

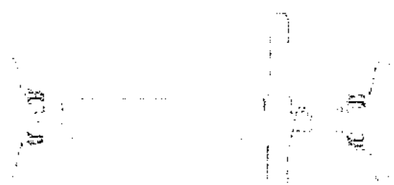
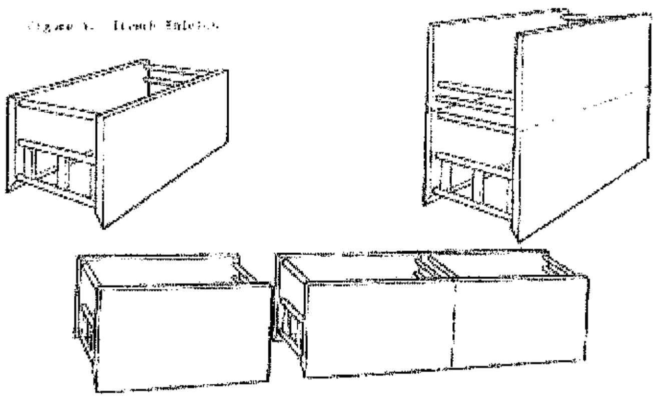


Figure 4. Trench Shields



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Appendix to Subpart P of Part 1926—Sele tion of Prote tive S stems

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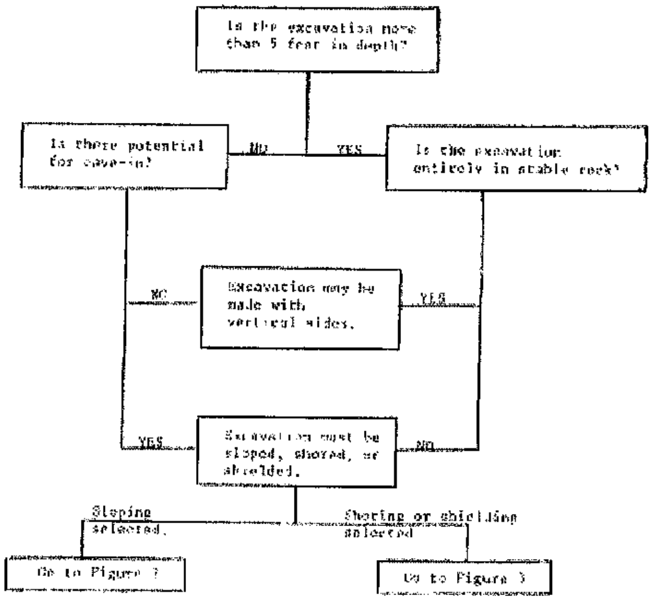

FIGURE 1 - PRELIMINARY DECISIONS

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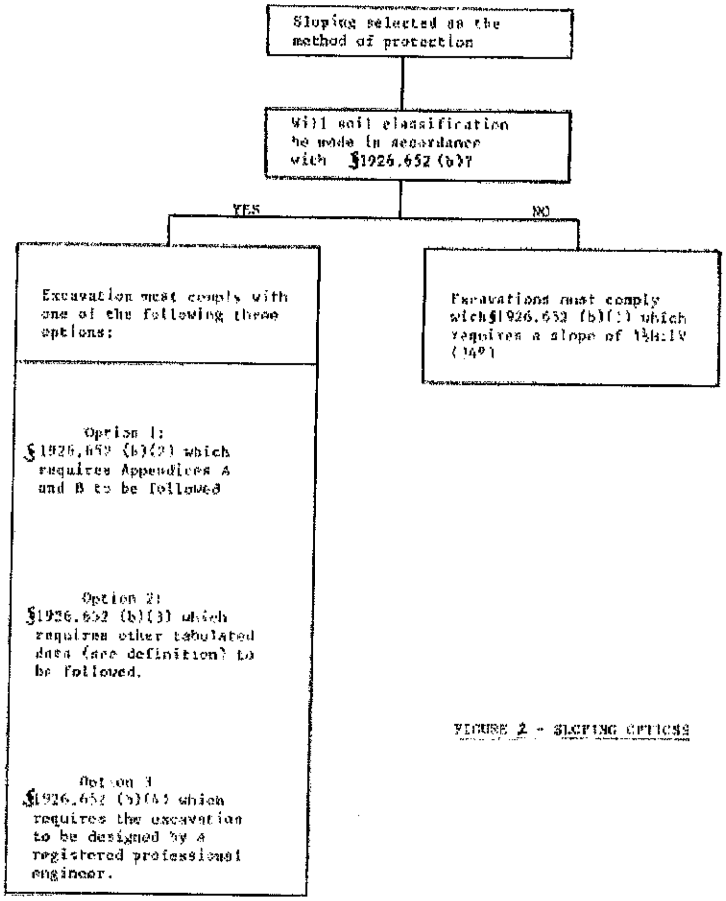

FIGURE 2 - SLOPING OPTIONS

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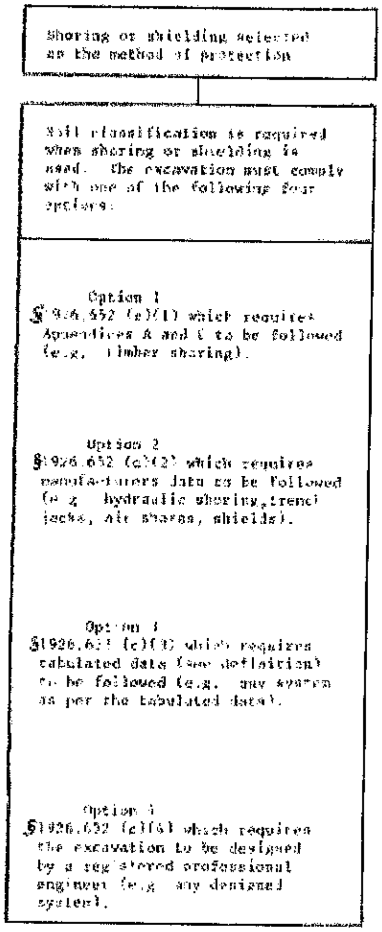

FIGURE 3 SHORING AND SHIELDING OPTIONS

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Appendix A-8

Exide Technologies, Frisco
Contractors Handbook

FRISCO, TEXAS FACILITY

GENERAL ENVIRONMENTAL, HEALTH & SAFETY

RULES AND REGULATIONS FOR

CONTRACTORS AND SUBCONTRACTORS

WORKING AT

EXIDE TECHNOLOGIES

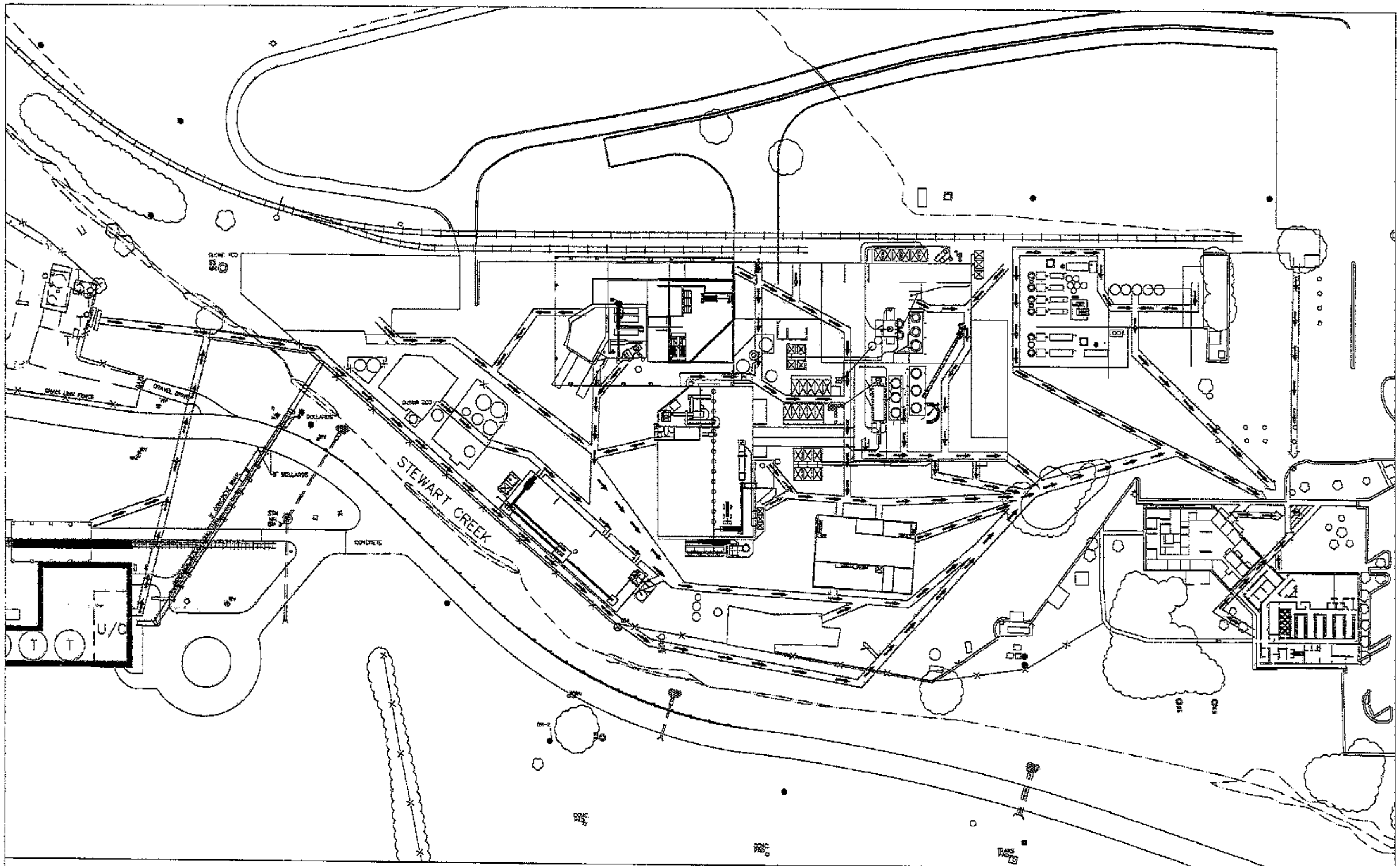
ORIGINAL DATE 09/01/2011
REVISION DATE 05/24/2012

TABLE of CONTENTS

It is Exide Technologies goal to maintain the highest standards of Environmental, Health and Safety protection. We will always strive to:

- Operate in a manner that protects the health and safety of our neighbors in the communities where we operate.
- Operate in a manner that protects the safety and health of all employees, contractors, and visitors to Exide facilities.
- Protect the environment and properly respond to any adverse environmental impacts caused by Exide operations.
- Operate in compliance with applicable environmental, health and safety laws.
- Integrate sound environmental, health & safety practices into daily business operations.
- Improve product safety and reduce the environmental impact of our products and manufacturing processes.
- Examine and continually improve Exide's environmental, health & safety management systems.

Continue to develop the environmental, health and safety expertise of all Exide employees. We are committed to meeting customer expectations in an environmentally sensitive manner in everything we do and everywhere we do it.



EXIDE TECHNOLOGIES

EVACUATION ROUTES

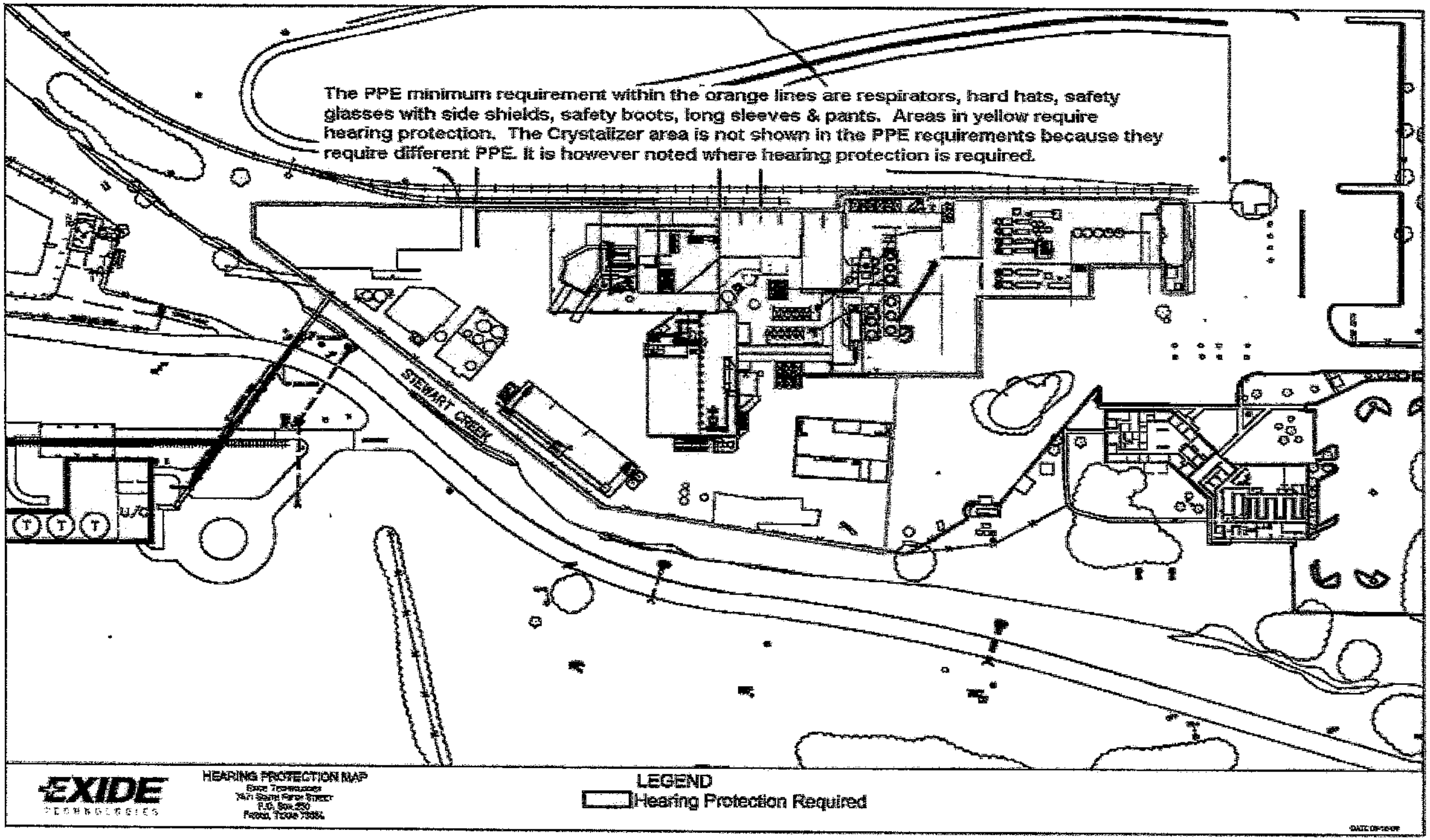
LEGEND

Evacuation Routes

Severe Weather Shelter

Primary Staging Area

DATE 02/11/05


The PPE minimum requirement within the orange lines are respirators, hard hats, safety glasses with side shields, safety boots, long sleeves & pants. Areas in yellow require hearing protection. The Crystalizer area is not shown in the PPE requirements because they require different PPE. It is however noted where hearing protection is required.
STEWART CREEK
EXIDE
HEARING PROTECTION MAP
LEGEND
Hearing Protection Required

INTRODUCTION

Environmental, Health & Safety rules and regulations stated herein are minimum health & safety and environmental requirements for contractors and subcontractors working at Exide.

Additional health & safety and environmental rules and regulations may be required according to the nature of work performed.

To be considered for work at Exide, a bidding contractor must submit with a bid a signed copy of this booklet for his or her company and every proposed subcontractor. Once a signed copy has been received by Exide, future bids are not required to have a signed copy attached.

This submission will become part of any contract agreement and will certify that all contractor and subcontractor personnel have been informed and will comply with these requirements.

The cost of abiding by these requirements, including all required PPE, must be included in the bid and any contract price. No claims for added compensation arising from compliance will be considered by Exide after a contract for the work is made effective.

GENERAL CONTRACTOR RESPONSIBILITIES

1.0 COMPLIANCE AGREEMENT

1.1 Prior to executing work for Exide, a contractor must agree to comply with the following:

1.1.1 All Federal, State and Local safety and environmental requirements and regulations which apply to the work to be performed;

1.1.2 All requirements detailed in this document; and,

1.1.3 All additional requirements submitted in the documentation package including: Standard Articles for Fixed Price Construction Contract or Weighted Hourly Time and Materials Contract, whichever is applicable, the Notice to Third-Party employers at a Multi-Employer Work site and any Additional Rules, Regulations or Requirements of the **Frisco, TX Site.**

2.0 CONTRACTOR COMPLIANCE RESPONSIBILITIES

2.1 Contractors are responsible for all training and supervision of personnel necessary to comply with safety requirements described in Sections 1 and 9 of these rules.

2.2 Contractors are responsible for ensuring that all subcontractor personnel are trained and supervised to comply with safety requirements described in Sections 1 and 9 of these rules.

2.3 Contractor obligations to comply with the safety and environmental requirements described in Section 1 of these rules may be modified, only if, in the opinion of the Exide plant manager or designee, the work is sufficiently separated from existing Exide facilities and personnel so as to pose no danger to personnel or property. Any modifications must provide an equivalent degree of safety to contractor/subcontractor personnel and comply with all regulatory requirements. These modifications must be agreed to before any work begins and be documented as part of the contract agreement.

2.4 Contractors will immediately notify the appropriate Exide representative in the event of a regulatory inspection.

2.5 Contractors will immediately correct any safety and/or environmental discrepancies noted by Exide personnel. Failure to do so may result in work stoppage without additional compensation.

2.6 Contractors are responsible for providing all the equipment necessary to complete work specified by the contract. This requirement includes all safety equipment as well as equipment for completing the work.

3.0 EMERGENCY EVACUATION & SITE SECURITY

3.1 Emergency Evacuation staging areas is the Flag Pole in front of the Main Office - see map

3.2 The Secondary Staging area will be decided of there is a need to move after headcount is taken.

3.3 After the head count has been completed, stay in the area until you are released by your Exide Rep.

3.4 Stay away from the road leading into the plant so the emergency vehicles will have unobstructed access to the plant.

3.5 If the situation is determined to be false alarm, the all clear will be given and employees, etc will be allowed to return to work.

3.6 Do not block fire exits, fire extinguishers or emergency equipment such as eye wash stations, spill kits, etc.

3.7 The Tornado Shelter is located in the Men Shower room – see map

3.8 Contractor/subcontractor personnel will register daily at site entrance designated by Exide.

  3.1.1. Sign-in of visitors is mandatory. Records are to be retained for a minimum of one year.

  3.1.2. All visitors must sign out when leaving the premises.

3.9 Contractor/subcontractor personnel will park vehicle(s) in the space(s) assigned by Exide.

3.10 Firearms and ammunition are not allowed on Exide sites.

3.11 Cameras are permitted on site only with prior permission of the Exide Plant Manager and/or Assistant Plant Manager.

3.12 Contractors shall be responsible for securing their equipment and material and will not hold Exide liable for losses.

3.13 Contractors will not block exit doors or emergency equipment with their vehicles, trailers, etc.

4.0 PERSONAL PROTECTIVE EQUIPMENT

4.1 Contractor/subcontractor personnel are required to wear ANSI approved (Z87.1) industrial safety glasses with attached side shields at all times. If work will be outside, tinted glasses that meet the ANSI requirements will be permitted. It must be understood that upon entrance into any Exide production building or Maintenance Shop non-tinted glasses are required.

4.2 Clothing must consist of long sleeves and long pants are consistent with plant requirements for its employees.

4.3 Contractor/subcontractor personnel must wear substantial boots meeting the following requirements:

4.3.1 Meets or exceeds ANSI Z41-1991, MI/75, C/75 (maximum Impact and compression strength). Footwear meeting this requirement will be so marked on the inside of the upper or tongue.

4.3.2 All Contractor/subcontractor personnel working within the Plant or Laboratory areas, including outdoor areas of the Plant, will be required to wear steel-toed boots as a minimum.

4.4 The Exide representative will inform the contractor / sub contractor of any additional personal protective equipment which must be used to protect contractor personnel from the hazards of specific work prior to the bid process. (i.e., NFPA 70E energized work PPE, Permit Confined Space, etc.)

4.5 Respiratory protection equipment is required for work by contractor/subcontractor personnel in certain areas. All personnel wearing respiratory protection equipment must be clean-shaven at the start of the shift and free of facial hair that interferes with the proper sealing of a respirator. The only permissible facial hair is sideburns and mustaches which do not extend further than past the ends of the mouth or down to the upper portion of the jaw bone. The contractor is responsible for complying with governmental regulations with regard to training and fit-testing of contractor employees. Documentation will be provided prior to beginning the assignment for individuals that are medically approved to wear a respirator in accordance with 29 CFR1910.134. Also refer to EHS-NA-106.

4.6 The contractor/subcontractor is responsible for providing all personal protective equipment for their personnel.

5.0 ALCOHOLIC BEVERAGES AND CONTROLLED SUBSTANCES

5.1 Contractors will abide by Exide's policy to maintain a drug free work environment. The presence on the job site of employees of the contractor or subcontractor who are under the influence of drugs or alcohol is inconsistent with, and a violation of, the contractor's obligation to complete work in a safe and efficient manner.

5.2 The contractor will notify its employees, subcontractors and material/delivery personnel that contractors and their employees are not permitted to bring on to any Exide work site any alcoholic beverage or controlled dangerous substance, as that term is defined in the "Controlled Dangerous Substance Act", nor to enter any Exide work site while under the influence of alcohol or any controlled dangerous substances

5.3 The contractor will not permit or condone its employees or employees of its subcontractors and material/delivery personnel to bring any alcoholic beverage or any controlled dangerous substance onto any Exide work site, or to work while under the influence of alcohol or any controlled dangerous substance.

5.4 The contractor will remove from Exide's work site any of its employees found to be in possession of, or under the influence of any alcoholic beverage or any controlled dangerous substance while on Exide's work site, and will cause its subcontractors and material/delivery personnel to take similar action with respect to their employees. Any employee removed from an Exide work site pursuant to this provision shall not thereafter be allowed to enter an Exide work site.

5.5 Any contractor employee who has been seriously (OSHA Recordable or Lost Time) injured or who has caused serious injury to others shall be asked to test for the presence of drugs (including alcohol). Failure of the contractor employee to submit to the drug/alcohol test is grounds for termination of that employee from work the Exide facility, and may result in termination of the contract.

5.6 The contractor's failure to comply with the provisions of Section 5 of this Standard shall constitute grounds for termination of this contract or purchasing agreements. As used herein, Exide's work site includes not only the portion of Exide 's property on which the contractor is performing services hereunder, but also all of Exide's adjacent property, including other areas of its plant, access roads, parking lots, etc.

6.0 ACCIDENTS AND INJURIES

6.1 The contractor is responsible for providing emergency first aid treatment for his or her personnel and must assure same for all subcontractor personnel.

6.2 In the event that an injury is beyond minor first aid there is a staffed plant dispensary where contractors can go for additional medical supplies or emergency services.

6.3 The contractor must immediately report all injuries, spills, fires, incidents which include property damage and potentially serious incidents including near misses to the Exide representative. The contractor must investigate all reportable cases and implement the steps necessary to prevent a recurrence. All investigations of reportable cases must be documented in writing and copies of investigation reports submitted to the Exide representative. A review meeting will be required with the Exide representative.

6.4 Injury records maintained by the contractor will include:

OSHA Form 301 -	Supplementary Record of Occupational Injuries and Illnesses;
OSHA Form 300 -	Log and Summary of Occupational Injuries and Illnesses.

7.0 PERMITS

7.1 A Safe Work Permit is required to keep track of all contractor and subcontractor work in all areas. Permits will be issued by an Exide Authorized Signer for the area where work is to be performed to ensure a safe and efficient job. Typically the area supervisor who has been trained is the appropriate authorized signer but if the work will be completed outside of a manufacturing area or is part of an engineering project, and project engineer(s) can act as the authorized signer if trained. All authorized signers shall serve to inform non-Exide personnel of the known fire, explosion, or toxic release hazards or other special conditions related to the work area and equipment. Failure to comply with the permit regulation shall be cause for immediate dismissal from the job site.

7.2 Additional permits are required for any contractor-subcontractor work in operating areas of the plant. Some specific examples for which additional work permits are required include, but are not limited to:

7.2.1 Confined Space Entry Permit

7.2.2 Hot Work Permit required

7.2.3 Energized Permit

7.2.4 Line Breaking Permit

7.2.5 Excavation/ Digging Permit

7.2.6 Lockout / Tagout will generate Safe Work Permit.

7.2.7 Overhead crane will generate a Safe Work Permit

7.2.8 Non SOP task

7.2.9 Fire Impairment

7.3 Safety Work permits will be issued on a shift basis. Generally, Exide's work shifts are from 7 AM to 3 PM, 3 PM to 11 PM and 11 PM to 7 AM. Adjustments to these hours may be made on a case by case basis, but in no case is a safety work permit valid for more than one shift.

7.4 It is imperative that the conditions noted on the permit(s) are exactly identical to the job conditions. When the nature or conditions of a job change in any way, or when new tools are required or different methods are employed to do the job other than those originally covered in the initial permit, **WORK SHALL STOP IMMEDIATELY** because the permit is invalid. The permit is only good for what it describes - no more and no less. Work cannot progress until the situation can be carefully analyzed and a new permit issued for the new conditions.

7.5 Communication is the key to enhancing the effectiveness of the work permit system. Operators, plant supervisors, contractor employees, contractor supervision and the Exide representative should all be aware of the permit process and the specific requirements of each permit. This then allows each to review the ongoing work and look for possible changing conditions or deviations during their daily work routine. Permits will be issued to contractor supervision only. The contractor supervision will distribute the permit to contractor employees performing that work. Contractor supervisors should also make sure contractor employees read the permit requirements. These permits must be posted in the work area. If the permit cannot be posted, it should be carried by one of the contractor workers in that area.

7.6 The contractor will comply with the specific Exide Frisco, TX site standards for Safety Work Permits, Energized Work, Lockout/Tagout, Hot Work, Line breaking and Confined Space Entry. Copies of these are available from the Exide representative.

7.7 All permits shall be turned into the H & S department at the end of each shift.

8.0 FIRE PROTECTION AND PREVENTION

8.1 When in or near an operating facility, Exide fire extinguishers may be employed by trained personnel in an emergency. Any use of extinguishing equipment shall be promptly reported to the Exide representative.

8.2 The contractor shall be responsible for the development of a fire protection program to be followed throughout all phases of the work and shall provide for the fire fighting equipment in accordance with regulations, these specifications and the requirements appropriate to the type of work being performed. This shall include, but not be limited to:

8.2.1 All fire fighting equipment provided by the contractor shall be conspicuously located, accessible, periodically inspected and maintained in good operating condition. Defective equipment shall be replaced immediately. The contractor shall give particular attention to training contractor personnel in the use of fire extinguishers and their limitations.

8.2.2 All compress gas cylinders shall be secured with bar or 2 chains and stored properly

8.2.3 Additional employees, as needed, for fire watch.

8.2.4 Contactor shall have Maintenance or Project Manager or H & S cell number in case of emergency.

9.0 SAFETY TRAINING AND EDUCATION

9.1 The contractor shall instruct each employee in the recognition and corrections of at risk behaviors and at risk conditions.

9.2 The contractor shall acquaint each contractor employee with the safety and emergency equipment available and the procedures to be followed in each type of accident occurrence.

9.3 The Contractor shall provide its employees, agents and subcontractors training prior to starting the job. The training must, at a minimum, include the hazards of lead and the precautions necessary to prevent lead absorption. At a minimum up to date training documentation will be provided such as permit confined space, lockout/tagout, forklift, respirator training, etc. to the Health and Safety representative.

9.4 All contractor personnel must receive an initial orientation by Health and Safety staff covering the safety and environmental procedures and the requirements of Exide. Contractor personnel will be required to sign a statement when they have received this orientation which states they will abide by all safety and environmental rules and regulations.

9.5 If, deemed necessary all contractor personnel shall attend a meeting to allow Exide to inform workers of present or expected plant conditions and safety related items.

10.0 SAFETY INSPECTIONS

10.1 At a minimum, the contractor shall check the work area daily at the beginning and at the end of each work shift (and after an extended break period such as lunch) to ensure safe working conditions (i.e., stable shoring, safe access and egress; all flames are extinguished, etc.).

10.2 The Exide representative and the contractor's supervisor will conduct and document periodic audits of the work area for unsafe acts and conditions.

11.0 HOUSEKEEPING AND HYGIENE

11.1 During the course of work, the contractor shall be responsible for properly organizing all activities on the job site to the extent that good housekeeping shall be practiced at all times. These shall include, but not be limited to:

11.1.1 As the job progresses, work areas must be kept clean at all times.

11.1.2 All materials, tools and equipment must be stored in a stable position to prevent rolling or falling. Materials and supplies shall be kept away from edges of floors, hoist ways, stairways and floor openings.

11.1.3 A safe access way to all work areas and storage areas must be maintained. All stairways, corridors, ladders, catwalks, ramps, passageways and work platforms shall be kept clear of loose material and trash.

11.1.4 Forms and scrap lumber with protruding nails and all other debris shall be cleared from work areas, passageways, and stairs and in and around buildings or other structures.

11.1.5 Combustible scrap and debris shall be removed at regular intervals. Safe means shall be provided to facilitate such removal.

11.1.6 If necessary, the contractor shall supply an adequate number of dumpsters to ensure a clean working area at all times. The contractor shall load and transport all refuse and debris to a suitable disposal site assigned by the Environmental Manager.

11.1.7 The contractor parking areas shall be maintained clean and free of paper and other debris at all times.

11.1.8 Beverages and Eating is prohibitted in Production or Maintenance work areas or existing operating plant process areas. Drinking water is restricted except as specified by the Exide H & S representative.

11.1.9 Cords and hoses shall be strung at least 7' overhead when allowable or laid flat outside of walkways.

11.1.10 Tools and equipment shall not be strewn about where they might cause tripping or falling hazards and shall, at the end of each workday, be collected and stored in the tool room or craft gang boxes.

11.1.11 Each employee shall be instructed to practice required housekeeping as part of assigned duties.

11.1.12 The Contractor's employees, agents or subcontractors shall not leave the premises wearing this clothing. The Contractor shall make arrangements to properly package, transport, dispose or launder work clothing worn in the plant. If laundering, the persons or service provider that handles and launders the clothing shall be properly informed by Contractor of potential hazards.

11.1.13All of Contractor's employees, agents and subcontractors must take a shower at the end of the workday, including washing their hair, prior to changing into clean clothing and leaving the premises.

11.1.14All of Contractor's employees, agents and subcontractors must wash their hands and faces prior to eating and drinking. Tobacco products <u>are prohibited on the facility</u> they must remain in their vehicle. Food or drinks are prohibited in the work area at any time. Food and drink may be present and consumed only in designated break rooms.

11.1.15 All of Contractor's employees, agents and subcontractors shall adhere to all Exide plant rules, including those set forth above, for entering break rooms and office areas, and rules.

11.1.16 Contractors are prohibited in the break room with contaminated uniforms or clothing or safety boots or PPE – they are required to change to clean uniforms, etc.

11.1.17 D Lead your safety glasses daily to remove dust / contamination prior to leaving the facility.

11.1.18 D Lead your hard hat daily to remove dust / contamination prior to leaving the facility.

11.1.19 All individuals shall wash their hands and face along with their neck to prevent contaminating the hands while accidently rubbing the neck area prior to entering break or offices areas.

11.1.20 At any time your uniform becomes grossly contaminated, change your uniform.

11.1.21 D Lead soap, showers and towels will be provided to the employee at no charge.

11.1.22 Each individual when entering a clean area such as the break room, offices, training rooms, etc. shall wear a smock, hair net, boot covers or slip-on shoes to prevent possible lead contamination in these areas.

11.1.23 The break room is an exception where all individuals are required to wear hair nets whether you have been in a contaminated area or not.

11.1.24 Personal cell phones / mobile radios shall not be permitted in the lead contaminated areas unless company issued.

11.1.25 Company issued cell phones / mobile radios shall be periodically D leaded.

11.1.26 In leaded areas, Do Not dry sweep. Vacuuming is the primary desired method of cleaning. Wet scrubbing is permissible where possible. Sweeping after the application of sweeping compound is the least desirable method and should only be used where vacuuming and/ or wet scrubbing is not possible. Regardless of whether you are working in a department requiring the wearing of respirators or not, it mandatory to wear a respirator when sweeping. All work surfaces, equipment, vents, and floors must be kept free of dust accumulation.

11.1.27 It is recommended to clean interior and exterior of your vehicle at least once a month.

12.0 MATERIAL HANDLING, STORAGE AND DISPOSAL

12.1 The contractor shall be responsible for using safe and environmentally sound methods of handling, storage, use and disposal of materials on the site. These shall include, but not be limited to:

12.1.1 All materials stored shall be stacked, braced, racked, blocked, interlocked or otherwise secured to prevent sliding, rolling, falling or collapse.

12.1.2 Rigging equipment for material handling shall be of the proper size and rating. All rigging equipment shall be inspected prior to use on each shift and as necessary during its use to ensure that it is safe. Defective rigging equipment shall be removed from service. All rigging equipment not in use shall be properly secured.

12.1.3 Disposal of debris or waste materials such as chemicals, oil, carcinogens, etc., shall comply with applicable plant environmental procedures, local ordinances and state regulations.

12.1.4 Storage locations for flammable materials (such as gasoline) for use by contractor(s) shall be in areas agreed to by the Exide representative. These areas shall be diked to retain spilled material and have an appropriately placed fire extinguisher.

12.1.5 The contractor shall take steps necessary to prevent discharging of lubricating oils and cleaning solvent onto the ground and/or into sewers and sewage disposal systems to prevent contaminating rivers, streams and the environment. These fluids (after use) shall be stored in properly labeled appropriate containers and disposed of in a legal manner conforming to all applicable regulations.

13.0 ELEVATED WORK

13.1.1 The use and erection of ladders and scaffolds shall comply with governmental regulations.

13.1.2 Approved full body safety harnesses must be worn when performing unprotected elevated work. (Note: Safety belts are no longer acceptable).

13.1.3 Unprotected, elevated work that is 6□or more above the lower level requires a personal fall arrest system.

14.0 EXCAVATIONS, TRENCHING AND SHORING

14.1 Excavations must be shored or sloped before entering, and protected according to governmental regulations.

14.2 Contact must be made with Exide Representative prior to any excavation.

14.3 The location and identification of underground utilities is the responsibility of Exide.

15.0 CONCRETE FORMS AND SHORING

15.1 All equipment and materials used in concrete construction and masonry work shall meet the appropriate requirements such as those in ANSI A10.9 Wall shoring shall also be designed to meet applicable federal and state codes, including OSHA 1926.701 in the U.S.

16.0 CRANE WORK

16.1 Contractors and/or subcontractors will be responsible for providing their Exide representative with a copy of a lift plan prior to the commencement of any rigging activities.

16.2 Mobilization of any sky track or crane must be communicated and coordinated through the Exide representative prior to arriving on site.

17.0 MISCELLANEOUS PROVISIONS

17.1 The contractor shall ensure that construction areas, aisles, stairs, ramps, runways, corridors, offices, shapes and storage areas where work is in progress shall be adequately lighted with either natural or artificial illumination.

17.2 All hand and power tools and similar equipment, whether furnished by the contractor or contractor employees, must be equipped with a GFCI and shall be maintained in a safe operating condition with all guards in place. Damaged tools shall be immediately repaired or replaced. Tools shall be used only for the purpose for which they were designed.

17.3 Loose clothing, rings and other jewelry shall not be worn around operating tools or machines. Sleeves will be kept buttoned.

17.4 The contractor is solely responsible for contractor equipment and goods. Exide Technologies is not responsible for any losses by theft or any other reason of the contractor's property.

17.5 The contractor will ensure no aluminum cans are brought onto the facility.

17.6 Any equipment moved or removed in the course of performing Work must be returned to its original condition/position prior to completion of the job, to include but not be limited to, guardrails, machine guards, doors, covers, seals, gaskets, lids, and the like.

17.7 Barricade tape in the plant consists of two colors, yellow and red. Yellow tape is caution tape. Yellow caution tape can be crossed if hazards are known. Red tape is danger tape. Red tape cannot be crossed until approval has been granted by the authorized signer or supervisor of the crew by informing you of hazards inside.

17.8 Pedestrian traffic shall be limited to only the assignment area of job task. Roaming around is restricted to avoid forklift, front end loaders, semi traffic, etc.

17.9 Gambling, fighting and horseplay are not permitted on Exide property.

17.10 Medical Blood Monitoring: The Contractor is solely responsible for arranging for and paying for medical monitoring of its employees, agents and subcontractors that work at Exide. Upon request, Exide may provide a list of then known medical monitoring service providers in the local area. By providing this list Exide is in no way certifying the suitability of the service providers to meet applicable requirements. A blood sample must be taken at regular intervals to indicate and document the amount of lead a worker has absorbed. Contractor shall provide a monthly update on Form EHSNA-106-B, to the Exide Plant H & S Manager to document blood lead levels of the Contractor's employees, agents and subcontractors.

EXIDE RESPONSIBILITIES

1.0 ASSIGNMENT OF AN EXIDE REPRESENTATIVE

1.1 The name and contact information for the assigned Exide Representative will be the contact to all contractors and provide their cell number in case of emergency.

2.0 PRE-WORK AND WORK IN PROGRESS REQUIREMENTS

2.1 Prior to the start of work, the Exide representative will introduce and explain the following:

2.1.1 The requirements described in this booklet;

2.1.2 Any additional rules, regulations or requirements of the worksite;

2.1.3 The Notice to Third-Party Employers provided in the bid package;

2.1.4 Coordinating the issuing of safety work permits;

2.1.5 Completing the pre-work safety and environmental checklist;

2.2 During the course of work, the Exide representative will ensure the following:

2.2.1 Complete weekly audit of contractor and subcontractor safety and environmental performance; and,

2.2.2 Review all injuries, spills, fires and potentially serious incidents and including near miss incidents sustained by contractor personnel.

3.0 HAZARD COMMUNICATION

3.1 It is the Contractor's duty to comply with all federal, state, local and Exide environmental, health and safety regulations, including OSHA safety and health standards including, but not limited to, the OSHA Lead Standard, 29 CFR §1910.1025.

3.2 The contractor will provide a hazardous chemical inventory for contractor-supplied hazardous materials and corresponding Material Safety Data Sheets. Contractors are required to inform the Exide representative prior to bringing hazardous substances on site and to update the hazardous chemical inventory.

3.3 Contractors are required to strictly enforce container labeling. Labels are to include the identity of the substance and the appropriate hazard warning on all containers of hazardous substances as detailed in OSHA's Hazard Communication Standard 29CFR 1910.1200

4.0 PRE-WORK MEETING

4.1 Before work begins, the Exide Plant HS Manager, or a designated representative, shall meet with the Contractor and agree with the Contractor on the tasks to be performed at the facility, the number of employees, the potential exposures to lead and other hazardous materials, the time to be spent at the facility, protective equipment required, the medical monitoring program and reporting required, and other regulations and policies that apply to the Contractor□s work.

5.0 TRAINING, PPE and MONITORING

5.1 Contractors are required to perform their own training, provide their own personal protective equipment, and conduct their own monitoring as required by the applicable standards. In exceptional situations where an independent contractor cannot practicably provide certain hygiene services such as showers, lockers or laundered work clothing, and it is performing work which may involve exposure to lead, arsenic, cadmium or other hazardous materials, Exide may provide use of its locker room, shower facilities and laundry service in exchange for the indemnities given in the Independent Contractor Agreement and for a monetary charge □ the amount or rate for which shall be documented in the original contract; or, before work begins in a document similar to Form EHS-NA-106-C. Personal protective equipment, such as respirators, hard hats and eye protection, are required to be provided by the Contractor to its employees, agents and subcontractors. Unlike hygiene services such as showers and lockers, personal protective equipment shall never be provided (including, but not limited to, rental, sale or loan) by Exide to a Contractor, its agents, employees or subcontractors.

5.2 The Plant Engineering Manager or equivalent, shall ensure that an Exide representative of Supervisor level or higher, designated by the Engineering Manager, shall be present on-site at all times when Contractor□s employees, agents or subcontractors are provided access to an Exide worksite.

6.0 ALUMINUM MATERIALS AND AEROSOL CANS

6.1 Large quantities of scrap materials from within Exide plants are transported and recycled at secondary lead smelters. When aluminum materials and aerosol cans come in contact with the high temperatures of smelting furnaces, an explosive condition can result. To ensure that these materials do not enter the feed material at smelters, Exide facility-wide standard safety rules generally prohibit Contractors from bringing aluminum materials and materials in aerosol cans onto the facility premises. This includes liquid beverage cans that may be brought in with personal lunches. By signing the Independent Contractor Agreement, Contractors working onsite at Exide facilities acknowledge that they have been notified and have notified their employees, agents and subcontractors that aluminum materials and aerosol cans are prohibited. Contractors who claim their employees, agents or subcontractors must work with Aluminum materials and do not have an alternative must give notice of this in writing to the Exide location manager prior to bringing such materials onsite. This notification shall certify that the Contractor will bear responsibility for and will maintain control of and segregate any and all scrap aluminum materials and will place them in the accumulation area designated by Exide.

6.2 Contractors whose employees, agents or subcontractors are working with necessary materials in aerosol cans that do not have non-aerosol alternatives must obtain a written exception approval, prior to commencement of such Contractor services, to allow them to bring the aerosol cans onto the Exide premises. Contractors using approved materials in aerosol cans must incorporate their materials into the facility inventory and exchange program.

Please complete the information below certifying that you have received a copy of the contractor handbook and that you understand and will communicate the Environmental, Health & Safety and security requirements of the Exide Technologies, Frisco, Texas site.

Company Name: ______________________

Signature: ______________________

Print Name: ______________________

Title: ______________________

Date: ______________________

(Authorized representative of contractor or subcontractor)

DUST CONTROL PLAN
(REMEDIATION SERVICES, INC.)

APPENDIX B

DUST CONTROL PLAN

for

Response Actions

at

Class 2 Non-Hazardous Waste Landfill

Exide Technologies, Inc.

Frisco, Texas

Prepared by:

Remediation Services, Inc.

&

ENVIRON International Corp.

December 7, 2012

Reviewed by:

W&M Environmental Group, Inc.

Table of Contents

1.0 INTRODUCTION

The purpose of the dust control and air monitoring plans are to identify the measures that will be taken to minimize and monitor emissions associated with remediation activities at Exide Technologies' Class 2 Landfill (Site). Specifically, this Dust Control Plan outlines the requirements and methods for minimizing dust generation during planned slag excavation and treatment activities. This plan works in conjunction with the Air Monitoring Plan which describes the air monitoring activities that will be performed during the work.

The purpose of this plan is to identify the steps that will be taken to reduce particulate emissions during implementation of the *Response Action Work Plan*, and includes site specific air monitoring criteria and dust suppression procedures. Best management practices (BMPs) will be implemented throughout the project. BMPs will include wetting active remediation areas, minimizing or ceasing activity during periods of high wind (greater than 20 miles per hour), sweeping or wetting paved areas, wetting unpaved areas, application of dust suppressant materials as well as covering stockpiles. The *Dust Control Plan* provides specific information about the generation and control of dust emissions during excavation, milling, stockpiling, stabilization, back filling and associated activities during the implementation of the *Response Action Work Plan*. This plan is to be used in conjunction with the *Site Safety and Health Plan*, the *Perimeter Air Monitoring Plan*, and the *Waste Stabilization Plan* developed for the remedial activities. The following sections detail potential dust sources and dust control means and methods.

1.1 Project Overview

The overall project consists of the retreatment of approximately 4,000 cubic yards of slag that does not meet the universal treatment standard. As described in the *Response Action Work Plan*, the objective of the proposed response action is to remove discrete areas of waste containing concentrations of lead and/or cadmium that exceed the Universal Treatment Standard (UTS), re-treat the excavated material until laboratory analysis indicates regulatory compliance (below the UTS), redeposit it in the cells, and collect confirmation samples of the in-place treated slag to ensure that excavation has removed all wastes that exceed the UTS and no land ban or hazardous wastes remain in the cells. Excavated material will be stockpiled and re-treated within the boundaries of the active landfill. Dust control is a high priority during the project.

1.2 Wind Monitoring and Dust Prevention Team

These Contractor points of contact have the authority to implement additional dust control provisions and stop work provisions based on the air monitoring program described herein. These team members are also responsible for maintenance and revisions of the plan.

Employee Name	Employee Title	Designated Air Monitoring Program Responsibility
Rusty Wood	Project Manager	Onsite project manager responsible to insure Dust Control and Air Monitoring Plans are followed by all project team members.
John Gillman II	Air Monitoring Technician	Responsible for wind speed and direction monitoring and data recordation; and setup, calibration, maintenance, monitoring, and data recordation for the E-BAM portable particulate monitors. Also responsible for collecting air samples as described in the Perimeter Air Monitoring Plan.
John Gillman	Principal in Charge	Senior management authority; provide corporate support to ensure availability of necessary resources to maintain compliance with this plan.
Dan Roth	Director of Corporate Health and Safety	Qualified Individual; review and modify the plan to keep it current; ensure record keeping; ensure air monitoring program action level and stop work level requirements are implemented.

2.0 DUST CONTROL

Dust control is a high priority during remediation activities. The primary mechanism for dust control will be the use of water trucks with a spray bar and spray hose(s). In addition, one or more large area misters (e.g., Dust Boss DB 60 with oscillation or equivalent equipment) will be utilized as an airborne dust wet suppression system to ensure full, overlapping coverage of active work areas, mitigating fugitive emissions. The airborne dust wet suppression system resembles a snow making machine and can cover a large area (approximately ½-acre per machine) with a fine mist of water, effectively controlling dust. Descriptive literature on the Dust Boss DB 60 is included in Attachment 1. Only potable water will be used for dust control purposes.

Proactive controls will be instituted to reduce the amount of dust generation during site activities, including enforcement of low speed limits for vehicular traffic and the application of water to access/haul roads.

If enhanced dust suppression is required by ambient conditions, emulsifiers or surfactants may be added to improve the "wettability" of water spays, and paper mulch mixed with a tackifier may be used on slag stockpiles. Section 3.0 describes the additional dust control measures to be used. Information on the surfactants and paper mulch materials is provided in Attachment 2.

If the sustained wind speed (the wind speed obtained by averaging the measured values over a one minute period) exceeds 20 miles per hour, it is a "high wind condition." When there is a high wind condition, all waste-disturbing activities must cease until the sustained wind speed declines to 20 miles per hour or lower for at least 15 consecutive minutes. Non-dust producing activities (equipment maintenance, etc.) may still be conducted during these periods.

2.1 Training of Personnel

RSI will implement a dust control training program for all Site personnel. This training program will review the potential sources of dust, individual responsibilities, and actions for controlling dust as described in this plan. The training will emphasize the importance of dust control to the overall success of the remediation activities and familiarize Site personnel with the air monitoring requirements and appropriate dust control procedures that must be adhered to in accordance with this plan.

2.2 Inspection and Maintenance

Dust suppression equipment will be inspected at least once a week and properly maintained. The Contractor will maintain records of the weekly inspections.

3.0 POTENTIAL DUST GENERATION ACTIVITIES AND PROPOSED CONTROLS

Site remediation activities will have the potential to generate emissions in the form of fugitive dust. Dust control methods will vary based on the activities occurring at the site. Dust control methods are summarized by source below. Table 3-1 describes the activities to be conducted during the remedial activities which have the potential to generate dust and the respective dust control measures.

Table 3-1
Potential Dust Generation Activities and Proposed Control

Activity	Proposed Controls
General Dust Suppression – All Activities	Water spray/mist, adjust excavation rate. Suspend work under high wind conditions until sustained wind speed is below 20 mph for at least 15 consecutive minutes. Use of airborne dust wet suppression system as needed.
Truck Traffic	Wet down unpaved haul roads. Keep paved roads clean or wet down if damaged and cracked and cannot be kept clean.
Excavation	Water spray/mist, adjust excavation rate, suspend work under high wind conditions. Use of airborne dust wet suppression system.
Slag Milling	Installation and use of water spray/mist equipment on the milling equipment. Use of airborne dust wet suppression system.
Stabilization Reagent Unloading	Use of super sacks eliminates dust issue.
Stabilization Reagent Placement	Use of super sacks with bottom opening minimizes risk of dust issues. Use of airborne dust wet suppression system for additional protection.
Slag Stabilization	Installation of water spray/misting equipment on the mixer. Use of airborne dust wet suppression system as additional protection.
Stabilized Slag Stockpiling	Water spray/mist. Use of airborne dust wet suppression system as needed. Cover stockpiles at the end of each day and when not in active use.
Stabilized Slag Loading, Hauling and Placement	Use of airborne dust wet suppression system and water spray mist as needed.
Stabilized Waste Placement	Use of airborne dust wet suppression system and water spray mist as needed.

3.1 Dust Suppression Measures

3.1.1 Particulate Take Action Levels

If the thirty-minute (30-minute) average PM_{10} concentration exceeds the applicable Take Action Level set forth in Table 1 of the Air Monitoring Plan, the Contractor will immediately implement increased dust suppression activities. These increased dust suppression adjustment activities may include, but are not limited to the following:

- Increased wetting/misting of work area
- Adding surfactant to the water used for dust control
- Applying temporary cover (paper mulch with tackifier) to areas not being actively worked
- Adjusting the rate/speed and/or quantity of equipment in the work area
- Covering active stockpiles with plastic sheeting during high wind

3.1.2 Particulate Stop Work Levels

If the one-hour (60-minute) average or thirty-minute (30-minute) average PM_{10} concentration exceeds the applicable Stop Work Level set forth in Table 1 of the Air Monitoring Plan, the Contractor will immediately stop all waste-disturbing work. During the work stoppage period (minimum 15 minutes), the Contractor must make dust suppression adjustments to reduce airborne particulate matter concentrations below the Take Action Level concentration for particulate. The dust suppression adjustment activities may include, but are not limited to the following:

- Increased wetting/misting of work area
- Adding surfactant to the water used for dust control
- Applying temporary cover (paper mulch with tackifier) to areas not being actively worked
- Adjusting the rate/speed and/or quantity of equipment in the work area
- Covering active stockpiles with plastic sheeting or tarps during high wind
- Stopping specific dust-generating activities until wind directions and/or wind speeds are more conducive to reduced dust levels
- Mobilize additional dust suppression equipment and initiate its use

3.2 On-Site Transportation

Vehicle travel on unpaved access roads will be limited to 10 miles per hour. Project personnel are required to obey posted speed limits to prevent wind turbulence and associated dust generated at higher vehicle and equipment velocities. Off road travel on unimproved roads will be limited to construction equipment, support vehicles and material delivery trucks.

Unpaved roads will be sprinkled using a water truck during working hours. Paved roads will be cleaned twice a day by Exide staff or by the Contractor if Exide staff is not available.

3.3 Slag Milling

A milling machine mounted on an excavator will be used to remove approximately 450 cubic yards of slag greater than two feet below the existing surface. Proactive controls for dust mitigation during milling and excavation activities include operation of the onboard dust control system, operation of the airborne dust suppression system, as well as directly applying water spray to the milling and excavation areas. Information on the milling equipment is included in the *Waste Stabilization Plan*.

3.4 Stabilization Reagent Unloading

The stabilization reagent that will be utilized in the remediation activities, Free Flow 100®, will be delivered to the Site in 2,000-pound bulk bags. The use of the super sacks will eliminate dust issues associated with the unloading process.

3.5 Stabilization Reagent Spreading

The bulk bags are equipped with lifting straps and a bottom opening discharge chute. The bags will be lifted with a front end loader and transported to the grid requiring stabilization. The bag will be lowered so that the discharge chute is almost on the ground. The chute will then be opened and the reagent applied to the grid. The dust generated during this activity is expected to be minimal and will be controlled by the airborne dust wet suppression system.

3.6 Slag Treatment

The treatment reagent will be mixed with the slag utilizing a pulvimixer. The pulvimixer will use a dust suppression system with a spray bar mounted on the back of the unit to control dust which may be generated during the mixing process. Information on the pulvimixer and the onboard dust control system is included in the *Waste Stabilization Plan.*

3.7 Retreated Slag Stockpiling

Some of the material will require loading into an off-road haul truck for transport to the stockpile area depending upon the distance to be traveled. Controls for dust mitigation during loading and stockpiling include a water spray/mist from a water truck and operation of the airborne dust wet suppression system. The height of stockpiles will be kept to a minimum (<10 feet), with a maximum volume of 50 cubic yards each. Each stockpile will be covered with poly sheeting and weighted down by sandbags at the end of each day and when the stockpile is not in active use.

3.8 Retreated Slag Loading, Hauling and Placement

Controls for dust mitigation during slag loading, hauling and placement of the retreated slag will include using a water mist/spray hose from a water truck during loading and placement as necessary to control dust and operation of the airborne dust wet suppression system.

ATTACHMENTS

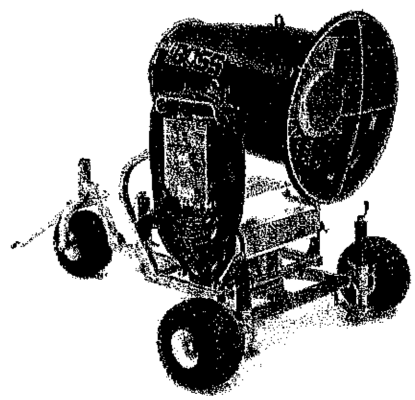
ATTACHMENT 1

Descriptive Literature on Dust Boss Misting Equipment

DUST BOSS®

www.dustboss.com

DB-60 SPECS >



GENERAL SPECIFICATIONS

> 30,000 CFM (849.50 CMM) generated by 25 HP fan.

> 21,000 square feet (1,950 square meters) coverage. Up to 84,000 square feet (7,804 square meters) coverage available with optional 180° oscillation.

> Oscillator gives 0–40° of movement on standard unit. Unit can also be equipped with optional 180° oscillation.

> Adjustable angle of throw 0–50° of height adjustment.

ELECTRICAL SPECIFICATIONS

> U.S.: 3 Phase / 25 HP fan / 480 Volt / 60 Hertz.
Full load current is 46 amps. 60 Kw gen set is recommended.
Motor is designed with a 1.15 service factor capable of operating at +/- 10% of design voltage.

> Other motor options available, including all international electrical motors:
- 3 Phase / 25 HP fan /380 Volt / 50 Hz (Europe, Middle East, N. Japan, Latin America)
- 3 Phase / 25 HP fan /400 Volt / 50 Hz (Europe, Japan, New Zealand, Australia)
- 3 Phase / 25 HP fan /415 Volt / 50 Hz (Europe, New Zealand, Australia)
- 3 Phase / 25 HP fan /575 Volt / 60 Hz (Canada)
- 3 Phase / 25 HP fan /380 Volt / 60 Hz Korea)
- 3 Phase / 25 HP fan /440 Volt / 60 Hz (Mexico)

> 380, 400, 415 volt / 50 Hz motors are designed with a 1.00 service factor capable of operating at +/- 10% of design voltage.

> 10 HP (7.5 Kw) high-pressure booster pump with no lift.

> 1/8 HP (0.10 Kw) oscillator.

> 150 foot (45.72 meters) 6/4 electrical cord. Other options available.

> No male plug, "bare wired" is standard. Any plug is extra cost.

> Cabinet with control panel.

WATER SPECIFICATIONS

> 10PSI (0.69 BAR) constant pressure needs to be delivered to booster pump. Maximum inlet water pressure should not exceed 100 PSI (6.89 BAR) when operating the booster pump.

> Maximum PSI delivered by booster pump is 200 PSI (13.79 BAR).

> Filter is included and should be used at all times. Contact us for recommendations when using nonpotable water.
(Filter system in-line 30 mesh 595 micron).

> 1-1/2" (38.10 mm) cam-and-groove quick disconnect female coupling for fire hose provided on machine.

> 30 brass nozzles (also available in stainless and nylon).

> Droplet size of 50–200 microns.

> Throw 200 feet (60 meters).

ENGLISH UNITS	WITHOUT BOOSTER PUMP				WITH BOOSTER PUMP		
Water Pressure, psi	40	60	80	100	160	180	200
Water Flow, gpm	12	14.8	16.9	18.9	23.9	25.4	26.7
METRIC UNITS							
Water Pressure, bar	2.8	4.14	5.5	6.89	11	12.4	13.8
Water Flow, lpm	45.3	55.4	64.0	71.6	90.5	96.0	101.2
1-1/2" FIRE HOSE WATER SUPPLY							

NOISE LEVELS

WITH BOOSTER PUMP	CONTROL PANEL SIDE	BACK SIDE OF FAN	OPPOSITE SIDE	DISCHARGE
0 feet	92	103	92	100
12 feet	86	89	84	88
WITHOUT BOOSTER PUMP	CONTROL PANEL SIDE	BACK SIDE OF FAN	OPPOSITE SIDE	DISCHARGE
0 feet	86	101	88	96
12 feet	80	87	80	84

DIMENSIONS

ON STANDARD WHEELED CARRIAGE

> 6.75 feet (81 inches; or 2.06 meters) wide.

> 9.75 feet (117 inches; or 2.97 meters) long.

> 7.17 feet (86 inches; or 2.19 meters) tall.

> 1800 lbs. (816.50 kilograms).

MAINTENANCE

> If using potable water, nozzles need to be inspected once a year.

> Fan motor and high pressure pump should be greased every 10,000 hours.

> Oscillator bearing should be greased on a regular maintenance schedule, or as needed.

CHEMICAL ADDITIVES

> Can be used with surfactant to improve binding of dust particles or with tackifying agents to seal the ground to prevent dust from becoming airborne.

> Odor control chemicals can be used to help eliminate odor.

OPTIONS

> Unit is available with optional 180° oscillation. Standard oscillation provides 0–40° of movement.

> Available on frame with skid mount. Unit comes standard on wheeled carriage.

> Dosing pump can be added to unit for chemical applications.

WARRANTY

> Unit is covered by a 3-year/3,000-hour warranty.

ATTACHMENT 2

Additional Dust Suppression Materials

XP 355

DESCRIPTION AND USE

XP 355 is a liquid dust suppressant that can be added to dry material at any point in the operation.

XP 355 is effective at low dosage levels providing superior performance and economical treatment.

TYPICAL PROPERTIES

These properties are typical. Refer to the MSDS for the most current data.

Appearance:	Red Liquid
pH:	NA
Solubility in water:	Low

FEED METHOD & DOSAGE

XP 355 dosage varies depending on plant conditions. Your Plymouth Technology representative will conduct a series of on site testing to determine optimal feed rates for your application.

Typical dosage rates are 20-40 ounces per ton.

The most effective method of application is to spray the liquid through multiple nozzles on the dry material as it is being conveyed.

MATERIALS OF COMPATIBILITY

Compatible: Tanks – HPDE, PP, XLPE
Fittings – PVC, CPVC, EDPM, Viton

Non-Compatible: Fittings –Copper, Aluminum

PACKAGING

Packaging is standard in bulk, one way intermediate bulk containers (totes) and 55-gallon drums.

STORAGE

Recommended storage periods:
Material as supplied: 12 months

Protect from freezing.

HANDLING

For complete safety information, please refer to the Material Safety Data Sheet.

CHEMICAL EMERGENCY NUMBER:

1-800-535-5050

Plymouth Technology, Inc.
2925 Waterview • Rochester Hills • MI • 48309 USA
(248) 537-0081 • Fax (248) 537-0088
www.PlymouthTechnology.com

MATERIAL SAFETY DATA SHEET

PLYMOUTH TECHNOLOGY

DATE PREPARED: 03/31/11
MSDS No: XP 355
XP 355

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Identifier: XP 355

MANUFACTURER:
PLYMOUTH TECHNOLOGY, INC.
2925 Waterview Drive
Rochester Hills, MI 48309
Customer Service: 248-537-0081

24 HR. EMERGENCY TELEPHONE NUMBERS:
Emergency Phone 800-535-5053

	Health	Flammability	Reactivity
HMIS	0	1	0
NFPA	0	1	0

2. COMPOSITION/INFORMATION ON INGREDIENTS

	wt.%	CAS Registry
Trade Secret	99%	NA

OSHA HAZARDOUS COMPONENTS (29 CFR 1910.1200)

EXPOSURE LIMITS		
OSHA PEL	ACGIH TLV	Supplier

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
Not expected to present a hazard under anticipated conditions of use. If ingestion occurs, do not induce vomiting since aspiration into the lungs may create a hazard.

POTENTIAL HEALTH EFFECTS

EYES:
No significant health hazards identified.

SKIN:
No significant health hazards identified.

INGESTION:
Negligible effect; may act as a laxative.

MATERIAL SAFETY DATA SHEET

INHALATION:
No significant health hazards identified.

4. FIRST AID MEASURES

Inhalation: Seek fresh air. If irritations persist, seek medical attention.

Ingestion: May act as a laxative seek medical attention. Do not induce vomiting.

Eye Contact: Flush eyes immediately and thoroughly with water. If irritation persists, seek medical attention.

Skin Contact: Wash exposed skin with water and mild soap. Seek medical attention in all cases of skin irritation and rash.

5. FIRE FIGHTING MEASURES

Flash Point: 280°F Minimum (138°C) Cleveland Open Cup Method

Flammable Limits: LEL (% vol. in air): 0.9%
UEL (% vol. in air): 7.0%

Flammability Classification: Slight hazard. Material must be preheated before ignition will occur (OSHA Class III B)

Extinguishing Media: Agents approved for Class B Hazards (e.g. dry chemical, carbon dioxide, foam, steam or water fog). Do not use streams of water as this will scatter the liquid and may spread the fire. A water spray may be used to keep fire-exposed containers and surroundings cool.

Unusual Fire And Explosives Hazards: May create dense smoke during combustion. Mild fire hazard when heated above its flash point.

Firefighting equipment: Firefighters should wear full bunker gear, including a positive pressure selfcontained breathing apparatus.

Hazardous Combustion Products: Incomplete burning can produce carbon monoxide and/or carbon dioxide and other toxic gases.

6. ACCIDENTAL RELEASE MEASURES

GENERAL PROCEDURES:
Accidental release: Remove all sources of ignition. Dike around spilled liquid to contain. Use absorbent material such as dry sand or earth.

MATERIAL SAFETY DATA SHEET

PLYMOUTH TECHNOLOGY

7. HANDLING AND STORAGE

Handling: No special requirements.

Storage: Store in a cool well-ventilated area in sealed containers. Do not store in open or unlabeled containers. Store away from strong oxidizing agents or combustible materials.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye Protection: None required; however, use of safety glasses, goggles or face shield is just good industrial practice.

Skin Protection: None required; however, use of protective gloves/clothing is good industrial practice.

Respiratory Protection: Avoid breathing mist. If local ventilation is not adequate, use a NIOSH/MSHA approved respirator that will protect against dust/mist. A respiratory protection program in accordance with OSHA Standard 29 CFR 1910.134 must be implemented whenever workplace conditions warrant use of a respirator.

Exposure guidelines: OSHA PEL: 5 mg/m³ (oil mist)

ACGIH TLV: 5 mg/m³ (oil mist)

ACGIH TLV STEL: 5 mg/m³ (oil mist)

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Red, oily liquid. Slight odor.
PH: Not Determined
Vapor Density (Air = 1): >1
Boiling Point: Not Determined
Vapor Pressure: <1.0 mmHg @ 68°F (20°C)
Specific Gravity (Water = 1): About 0.875
Solubility in Water: Negligible in water (below 0.1%); soluble in hydrocarbons
Melting Point: Not Applicable

10. STABILITY AND REACTIVITY

Stability: Stable

Hazardous Decomposition: None identified

Hazardous Polymerization: Will not occur.

Conditions to avoid: Avoid excessive heat and open flames.

Incompatibility: Avoid chlorine, fluorine, and other strong oxidizers.

11. TOXICOLOGICAL INFORMATION

Eye Irritation: Testing not conducted. See other toxicity Data.

Skin Irritation: Testing not conducted. See other toxicity Data.

Dermal LD50: Testing not conducted. See other toxicity Data.

Oral LD50: Testing not conducted. See other toxicity Data.

Inhalation LC50: Testing not conducted. See other toxicity Data.

Other Toxicity Data:
Specific toxicity tests have not been conducted on this product. The hazard evaluation is based on information from similar products, the ingredients, technical literature, and/or professional experience. A similar product produced a Primary Eye Irritation Score (PEIS) of less than 10/110.0 (rabbits), a Primary Skin Irritation Score (PDIS) of less than 4.0/8.0 (rabbits), a Dermal LD50 greater than 2000 mg/kg (rabbits) and an Oral LD50 score greater than 5000 mg/kg (rats). Also, a similar product was not a skin sensitizer when tested.

Oil Mist: Repeated exposure to levels of oil mists in excess of the exposure limits may result in accumulation of oil droplets in pulmonary tissue and may lead to irritation of the nose and throat. No adverse health effect is expected to occur at or below the exposure limits.
No component of this product present at levels greater than 0.1% is identified as a carcinogen by the U.S. National Toxicology Program, the U.S. Occupational Safety and Health Act, or the International Agency on Research on Cancer (IARC).

12. ECOLOGICAL INFORMATION

Ecological testing has not been conducted on this product.

13. DISPOSAL CONSIDERATIONS

Disposal of the Material should be in accordance with the applicable federal, state and local laws and regulations.
The above applies to materials as sold by Plymouth Technology. The material may be contaminated during use, and it is the responsibility of the user to assess the appropriate disposal of the used material.

14. TRANSPORT INFORMATION

General Transport Statement: This product does not require classification by DOT.

MATERIAL SAFETY DATA SHEET

PLYMOUTH TECHNOLOGY

15. REGULATORY INFORMATION

TSCA: (Toxic Substance Control Act): Listed on inventory. All components comply with TSCA.

CERCLA: Comprehensive Environmental Response Compensation and Liability Act (CERCLA), 40 CFR §302.4 Not Reportable.

Emergency Planning and Community Right to Know Act (EPCRA:

Sara Title III Section 302. Not regulated as an extremely hazardous substance. (40 CFR Part 355).

Sara Title III Section 311/312 Hazardous Categorization. Not a toxic chemical. (40 CFR Part 370)

Sara Title III Section 313. Not regulated. (40 CFR Part 372)

OSHA Hazard Communication Standard: Listed by ACGIH. Listed by OSHA.

Food contact Status:

FDA: This product is approved for use by the FDA under the following sections of 21 CFR.
Part 178.3620 as a component of nonfood articles in contact with food when used in accordance with the specifications of this subpart.

Part 573.680 in animal feed, subject to the provisions of this subpart.
USDA: H1 Status: This product is acceptable to the SDA as a lubricant with incidental food contact in official meat and poultry establishments.

16. OTHER INFORMATION

Approval date: 03/31/11

MANUFACTURER DISCLAIMER:
This information is furnished without warranty, expressed or implied, except that it is accurate

to the best knowledge of manufacturer. The data on this sheet relates only to the specific material designated herein. Manufacturer assumes no legal responsibility for use or reliance upon this data.

Conwed Fibers®

Family of Hydraulic Mulch Products

Setting the Standards for Erosion Control Since 1965

CONWED FIBERS®

■ Conwed Fibers® Is Your Insurance Policy Against the Storm of Phase II

Nothing is changing the face of erosion control more dramatically than the Clean Water Act. Noncompliance with the National Pollution Discharge Elimination System (NPDES) Phase II storm water regulations is subject to administrative orders, civil actions and/or criminal prosecutions on federal, state, county and/or local level. Conwed Fibers® can help ensure you'll be in compliance by helping you calculate the Revised Universal Soil Loss Equation (RUSLE) and select the most effective mulches for your site. Don't leave anything to chance. Ask the Conwed Fibers experts.

■ ■ ■ ■

■ Select the Right Mulch for Your Specific Job

A broad range of Conwed Fibers hydraulic mulches is available for today's hydro-seeder. Each has properties and performance characteristics that make them best suited to different types of sites. You can customize each to meet your specific site requirements.

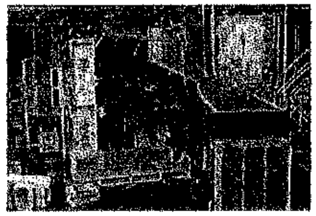
PRODUCT	APPLICATION	SLOPE	CONTINUOUS MAX. SLOPE LENGTH* (without slope interruption devices)	CONDITIONS	RATE/LBS PER ACRE
Hydro-Blanket® BFM	Erosion Control	≤ 1:1 ≤ 2:1 ≤ 3:1	75 ft	Critical Sites	4,000 3,500 3,000
Conwed Fibers® 2000	Erosion Control	≤ 2:1 ≤ 3:1 ≤ 4:1	30 ft	Moderate	3,000 2,500 1,500-2,000
Conwed Fibers® 1000	General Seeding	≤ 2:1 ≤ 3:1 ≤ 4:1	28 ft	Moderate	3,000 2,500 1,500-2,000
EnviroBlend® with Tack	General Seeding	≤ 3:1 ≤ 4:1	25 ft	Mild	2,500 1,500-2,000
EnviroBlend®	General Seeding	≤ 3:1 ≤ 4:1	23 ft	Mild	2,500 1,500-2,000
Cellulose with Tack	General Seeding	≤ 4:1	20 ft	Mild	1,500-2,000
Cellulose	General Seeding/ Reclamation/ Straw Tacking	≤ 4:1	18 ft	Mild	1,500-2,000

*Maximum slope length is based on a 4H:1V slope (BFM is 3H:1V). For applications on steeper slopes, the maximum slope length may need to be reduced based on actual site conditions.

The #1 Choice of Hydro-Seeders

More hydro-seeders choose Conwed Fibers® wood and wood/cellulose hydraulic mulches than any other brands.

Conwed Fibers set the standard for erosion control excellence when it began operations in 1965. Our wood-fiber hydraulic mulch stood head and shoulders above all other mulches at that time, and it still does. Continual research, thorough testing at leading universities, and the commitment to remain the premium mulch producer has kept Conwed Fibers on top of the competition for all of these years. And now we've introduced the first wood and blended products with a new flocculating agent that takes hydraulic mulch performance to an even higher level.



Manufacturing advancements have gone hand-in-hand with advancements in Conwed Fibers' ingredients and mulch performance.

New ProPlus SLIKSHOT™ Makes Mulch Shoot Better, Work Better

Conwed Fibers offers the only wood and blend products in the industry with the added value of ProPlus® SlikShot™. It's a proven flocculant that acts as a lubricant to slicken the hose and prevent hose clogs common with competitors' mulches. This innovative, proprietary formulation helps mulch:

- Shoot easier and farther for improved productivity
- Adhere on impact to provide more uniform ground coverage
- Increase water holding capacity to maximize germination and revegetation
- Increase yield to provide an outstanding value

The addition of SlikShot to our mix is just the latest in a long line of new ingredients designed to deliver optimum performance. No matter what type of mulch – wood, blend or cellulose, our unsurpassed expertise in the industry and commitment to total quality continue to make Conwed Fibers hydraulic mulch second to none.

Superior Fibers Deliver Superior Results for Fewer Callbacks

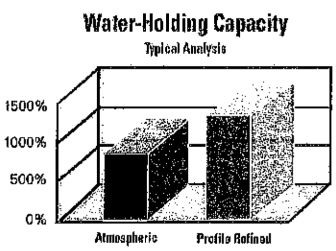
Nothing illustrates Conwed Fibers superior quality than a comparison of our wood fibers to those of our competitors.

Fibers magnified 45 times by independent lab specializing in fiber analysis.

Conwed Fibers' Thermally Refined wood fiber holds 13.5 times its weight in water to promote faster, more complete germination. Say goodbye to callbacks due to washouts or poor turf establishment.

Competitors use atmospherically refined wood fiber which results in up to 50% less water holding capacity and less yield. It's one reason you need extra bales of competitive mulch to equal the performance of Conwed Fibers.

Thermally Refined® wood fiber holds up to 50% more water than atmospherically refined wood fiber – a critical factor in seed germination.



Thermally Refined wood utilizes heat and pressure that breaks wood down into more fibrous material with greater surface area that results in mulch with:

- Greater yield – reduces the number of bales you buy and load
- Greater coverage – reduces callbacks due to washouts
- Greater water retention – reduces callbacks due to poor turf establishment
- Greater productivity – eliminates clogs from the coarse fiber found in competitive mulches
- Lower total project cost

Ask your Conwed Fibers representative to conduct a side-by-side demonstration that leaves no doubt: Thermally Refined fiber performs better!

The Best Mulch for Any Job

Conwed Fibers* mulch products are ideal for a wide range of applications including turf establishment, golf courses, landfills, highway work, reclamation projects, airports and recreational areas.

Convenient 50-lb Bales

BFM

Hydro-Blanket® BFM

- The industry's leading Bonded Fiber Matrix (BFM) from Profile Products delivers a much higher level of performance than any standard hydraulic mulch or competitive BFM on the market today.
- Independent testing and years in the field prove Hydro-Blanket is effective on the steepest, roughest sites — a critical consideration for Phase II compliance.
- Hydro-Blanket is ideal for projects where blankets are impractical and/or too expensive, and conventional hydraulic mulches are ineffective.
- Produced from Thermally Refined* wood fiber and combined with 10% cross-linked hydro-colloid tackifier, Hydro-Blanket applies more easily, promotes faster germination and minimizes sediment and water runoff. Its performance is comparable to blankets, yet its cost is significantly less.

WOOD

Conwed Fibers wood and wood with tack products are ideal choices for critical sites with up to 2:1 slopes. Contractors report that our Thermally Refined fiber delivers up to 30% more yield than competitive products, which means money in their pockets.

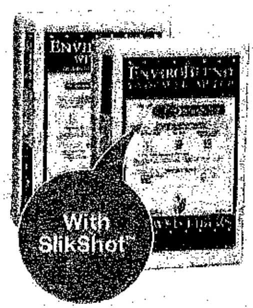
Conwed Fibers® 1000 with SlikShot™

- Contains 100% of the highest quality wood fiber.
- Now with SlikShot for better yield, better shooting and better ground coverage.
- Thermally Refined wood fiber delivers up to 50% more water holding capacity than atmospherically refined wood mulches.

Conwed Fibers® 2000

- 100% wood fiber just like Conwed 1000 but with a premium tackifier included.
- Tackifier is a pre-blended high-viscosity, organic guar-gum tackifier.
- Eliminates the extra step and mess of field mixing.

BLEND



Conwed Fibers' EnviroBlend® and EnviroBlend® with Tack combine 100% Thermally Refined wood fiber with the highest quality cellulose mulch in the industry.

- Delivers up to 15% greater yield to contractors versus competitive blend products.
- Covers up to 20% more ground than cellulose and provides superior erosion control and more complete germination without a big jump in price.

EnviroBlend with SlikShot

- The #1 selling blend in the industry.
- Now with SlikShot for better yield, less hose clogging and better ground coverage.

EnviroBlend with Tack

- Same quality wood and cellulose blend as EnviroBlend but with a pre-blended 3% polymer tackifier for a stronger bond and added holding power.
- Eliminates the extra step and mess of field-mixing tackifier.

CELLULOSE

Conwed Fibers® Cellulose
Conwed Fibers® Cellulose with Tack

- Exclusive defibration process and new manufacturing process improves water holding capacity by 22%.
- Less percentage of fines greatly reduces maché effect.
- High-quality, clean 100% cellulose fiber mixes in water at an accelerated rate and stays in suspension for more uniform consistency.
- Provides erosion control that is superior to straw for nearly the same cost □ making them ideal for general seeding.
- Darker, richer green color than competing brands gives your work a more professional look from the very beginning.
- Shoots great, allowing hydraulic machinery to run efficiently while providing excellent ground coverage.

Conwed Fibers Cellulose with Tack

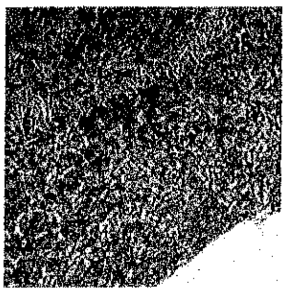
- Comes pre-blended with 3% polymer tackifier to increase protection from seed washout and erosion.
- Eliminates the extra step and mess of field-mixing tackifier.

We've Got You Covered

No matter what the site or what the type of hydro-mulch equipment you use, wherever bare soil needs to be covered, Conwed Fibers® has the material best suited to the job. Our complete line provides you with every option you need.

Jet Spray® with FiberMax™– Pourable Mulch Flakes Save You Time and Money

- Holds more water for enhanced seed germination and more effective erosion control for more water holding capacity and a stronger bond
- Delivers 50% of FiberMax™ for greater yield and better coverage, which means you buy and load less material
- Flocculating tackifier helps increase yield and gives the mulch matrix greater loft
- Designed specifically for the smaller tank openings of jet-agitated hydraulic machines, loads up to 90% faster than traditional hydraulic mulch
- Increases productivity while delivering professional results



Seed Aide®– Perfect for Small Jobs

- Expanding cellulose/wood fiber mulch granules are ideal for small areas
- Can be applied with a high volume drop spreader, large-opening broadcast spreader or by hand
- Great leave behind for touch ups after hydro-seeding to help eliminate callbacks
- Tests prove that granular properties and texture result in greater water absorption and soil coverage than competing brands for superior seed protection
- Organic tackifier reduces soil erosion, water runoff and seed washout

Futerra® Revegetative Blankets

- Futerra® F4 Netless® and EnviroNet® blankets are proven to keep soil in place with 99.9% effectiveness, providing better slope protection with faster, thicker vegetative establishment than traditional blankets and nets
- Designed to minimize danger to wildlife or maintenance equipment
- Costs less than half the price of installed sod, including seed and fertilizer
- Takes just one man-hour to lay 3,000 square feet of Futerra versus one man-hour to lay 500 square feet of sod
- Improves site logistics—one truckload of Futerra EnviroNet covers eight acres, compared to a truckload of sod that only covers one-quarter of an acre

So Effective, It's Almost Perfect

	C-Factor[1]	Effectiveness Rating	Soil Loss/ Plot[2]
Futerra® F4 Netless®	0.001	99.9%	0.4 lb
Futerra® EnviroNet™	0.003	99.7%	1.4 lb
Single-Net Straw Blanket	0.073	92.7%	28.9 lb
Single-Net Excelsior Blanket	0.075	92.5%	29.8 lb
Bare Soil Control	1.000	0.0%	397.0 lb

[1]Test Conditions — UWRL Rainfall Simulator, Slope Gradient — 2.5H:1V Soil Type — sandy loam, Rainfall Event — 5"/hr, Test Duration — 1 hr

[2]Plot size 4' by 19.5'

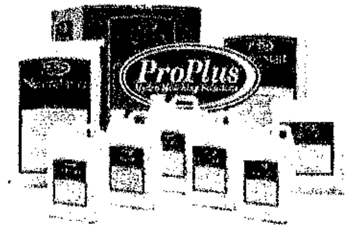
Superior Germination

Futerra® Revegetative Blankets are ideally suited for areas where conventional practices are inadequate for establishing rapid and uniform vegetation. Through its patented design, Futerra is capable of absorbing and holding more water, thereby creating a moisture reservoir that ensures improved germination—nearly double that of straw!

Get all the Facts

Log on to www.profileproducts.com.

▪ Put Added Value in Every Tank with ProPlus® Hydro Mulch® Solutions



Conwed Fibers® offers you the industry's most comprehensive line of hydraulic mulch additives to achieve maximum performance under virtually every condition. These accessory products are specifically designed to solve real-world seeding challenges that contractors face every day. Your Conwed Fibers distributor can help you analyze site conditions and recommend the best mix for the job. ProPlus® hydraulic mulch additives include:

Soil Amendments

NEW • **Aqua-pHix™ Hydro** – Proprietary liquid formula of non-hazardous and non-corrosive, self buffering, chelated organic and inorganic acids that immediately lower pH of alkaline soils. Dramatically enhances seed germination.

Packaging: 2-2.5 gal jugs per case

NEW • **JumpStart™** – Proprietary liquid reformulation with long-term penetrating agent added to humic acid and beneficial bacteria solution. Proven to promote faster germination and vegetation establishment.

Packaging: 2-2.5 gal jugs per case

NEW • **BioPrime™** – Granular formulation containing biostimulant, 18-0-0 slow release nitrogen, humic acid and Endo Mycorrhizae. Designed to sustain long-term plant vitality.

Packaging: 40-lb bag

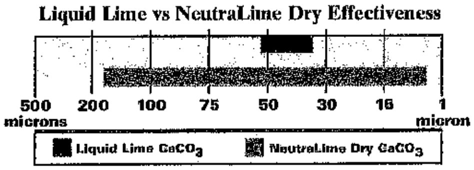
• **NeutraLime™ Dry** – Nothing balances soil pH faster – within 6-10 days of application – with the added plus of longer control – up to 18 weeks. Contains 50% more active ingredients than liquid lime.

Packaging: 4-10 lb bags per case, 40-lb bag

• **NeutraLime™ Liquid** – Balances soil pH and is effective in 7-10 days.

Packaging: 2-2.5 gal jugs per case

Liquid Lime vs NeutraLime Dry Effectiveness



Graduated particle sizing extends minimum effectiveness from 12 to 18 weeks.

• **JumpStart™ 5** – Jump start turf establishment with the industry's most complete package of growth stimulants and added polymers.

Packaging: 4-10 lb bags per case, 40-lb bag

• **AquaGel™ A, B, C, D** – Four ways to hold 400 times the water in a variety of applications, making it an excellent water management tool.

Packaging: 6-5 lb pails per case (A and C only), 2-16 lb jugs per case, 25-lb bag and 50-lb drum

Fiber Mulch Amendments

• **FiberBond Ultra™** – Enhances the performance of hydraulically applied fiber mulch materials.

Packaging: 4-7.5 lb bags per case

• **FiberMax™** – Maximize yield and mulch performance with a stronger bond and the added plus of better shooting.

Packaging: 6-5 lb bags per case

• **FiberLock™** – Patented, crimped fibers are your key to increased yield and sure success on the really long slopes.

Packaging: 10-lb case

• **SlikColor™** – The only dye marker with the added plus of a slickifier to improve shooting – now in water soluble bags.

Packaging: 2-11 lb jugs per case, 11-1 lb bags per case (water soluble bags)

Soil Stabilization & Dust Control

• **TackDown™** – The binder you need to make sure you've got the job nailed.

Packaging: 2-2.5 gal jugs per case, 250 gal tote

• **FlocLoc™ (PAM) Dry** – A flocculating soil stabilizer that coagulates suspended soil particles, dropping them from runoff. It reduces soil erosion and improves water infiltration into the seedbed.

Packaging: 6-3 lb jugs per case, 40-lb pail

Tackifiers

• **ConTack®** – 100% guar-based organic tackifier reduces the need for reseeding and minimizes soil erosion by stabilizing mulch and straw. It also helps increase the flow and pumping properties of mulch.

Packaging: 8-5 lb bags per case, 50-lb bag

• **ConTack® AT** – A starch-based agricultural tackifier, ConTack AT is an economical choice for tacking straw or hay mulch to enhance germination by holding seed in place and preventing washouts.

Packaging: 50-lb bag

• **Tacking Agent 3®** – Requires no cure time to be effective! University tests and field use prove it effectively reduces soil erosion and water runoff immediately after hydro-seeding. Also increases the water holding capacity of all types of hydraulic mulches.

Packaging: 4-8 lb bags per case, 25- and 50-lb bag, 7-3 lb bags per case (water soluble bags)

• **MPT™ Tack** – A combination of poly-acrylamide and hydro-colloid polymers, MPT is highly viscous and dries to form a strong chemical bond. Ideal for fiber mulch binding, straw and hay mulch tacking.

Packaging: 4-12 lb bags per case, 50-lb bag

Please refer to the ProPlus brochure for specific application rates and conditions.

Conwed Fibers® • www.conwedfibers.com • 800-508-8681 • Fax 847-215-0577

PROFILE Products LLC • 750 Lake Cook Road • Suite 440 • Buffalo Grove, IL 60089

CF-12
1/09

PERIMETER AIR MONITORING PLAN (REMEDIATION SERVICES, INC.)

APPENDIX C

PERIMETER AIR MONITORING PLAN

for

Response Actions

at

Class 2 Non-Hazardous Waste Landfill
Exide Technologies, Inc.
Frisco, Texas

Prepared by:

Remediation Services, Inc.

&

ENVIRON International Corp.

December 7, 2012

Reviewed by:

W&M Environmental Group, Inc.

Table of Contents

1.0 INTRODUCTION

The purpose of the air monitoring and dust control plans are to identify the measures that will be taken to monitor and minimize emissions associated with remediation activities at Exide Technologies' Class 2 Landfill (Site). Specifically, this *Perimeter Air Monitoring Plan* outlines the requirements and methods for monitoring ambient air quality during planned slag excavation and treatment activities for particulate matter (dust), lead and cadmium. This plan works in conjunction with the *Dust Control Plan,* which describes operational controls to reduce dust emissions during slag excavation and treatment activities.

As described in the *Response Action Work Plan*, the objective of the proposed response action is to remove discrete areas of waste containing concentrations of lead and/or cadmium that exceed the Universal Treatment Standard (UTS), re-treat the excavated material until laboratory analysis indicates regulatory compliance (below the UTS), redeposit it in the cells, and collect confirmation samples of the in-place treated slag to ensure that excavation has removed all wastes that exceed the UTS and no land ban or hazardous wastes remain in the cells. Excavated material will be stockpiled and re-treated within the boundaries of the active landfill. Approximately 4,000 cubic yards of lead and cadmium-impacted slag will be excavated and re-treated on-site. If, based upon sampling results, additional materials require treatment, such materials will be treated in the same manner as the initial quantities of slag. Air quality monitoring will consist of exposure monitoring by NIOSH Method 7300 for on-site workers[1] and ambient air monitoring to measure off-property impacts. Air quality will be monitored by Remediation Services, Inc. (RSI).

The primary objectives of the perimeter air monitoring are to:

- Develop a relationship between particulate (dust) levels and concentrations of lead and cadmium, so that the particulate measurements can be used as a surrogate;
- Determine if concentrations of lead and cadmium and particulate emissions are in excess of air Take Action or Stop Work Levels established for the Site; and
- Ensure that engineering controls and work practices help minimize potential off-site impacts. The monitoring plan will help ensure that RSI reacts quickly and makes appropriate changes to dust control measures as needed.

Air quality will be measured and documented at air quality monitoring stations during excavation and treatment activities in accordance with this plan.

2.0 ORGANIZATION OF PLAN

This plan addresses continuous perimeter monitoring for particulates (PM_{10}), explains how the relationship between particulate, lead, and cadmium will be established and describes how the "Take Action" and "Stop Work" Levels will be identified and implemented for particulates. In addition, the plan describes how samples will be collected to directly measure lead and cadmium and how that data will be used.

3.0 PARTICULATE MONITORING

3.1 Equipment

Real-time particulate air monitors (e.g., E-BAM Particulate Monitor or equivalent) equipped with an omni-directional air intake device and a "PM_{10}" impactor head will be used at the Site to monitor dust levels at or near the property boundaries during remediation activities that could generate dust. Attachment 1 provides specific information regarding the E-BAM Particulate Monitors that will be utilized at the Site.

[1] Worker exposure monitoring is described in detail in the *Health and Safety Plan.*

3.2 Monitoring Locations

One upwind and three downwind monitoring locations will be established each day and monitors placed at or near the property line for each location to ensure adequate coverage to minimize the potential for off-site impacts. RSI will utilize National Weather Service forecasts and review current conditions and recent trends from an onsite meteorological station to position the monitors each morning prior to start of work. Monitor locational information will be determined by GPS and recorded. Wind speed and direction will be recorded and the data sent to onsite personnel as described in Section 3.6. If there is a 180 degree change in the prevailing wind direction during the work day, the downwind monitors will be appropriately relocated and waste disturbing work will be suspended until the monitors resume operation.

3.3 Take Action and Stop Work Levels Using Particulates as a Surrogate for Lead and Cadmium

The 2008 National Ambient Air Quality Standards (NAAQS) standard for lead has been utilized to establish Take Action and Stop Work Levels for real-time particulate monitoring based on lead (AL^{Pb}) that will help minimize off-site property impacts associated with Site remediation activities. Take Action and Stop Work Levels for real-time particulate monitoring based on cadmium (AL^{Cd}) will also be established. The lead and cadmium levels will be calculated based upon correlations derived from project monitoring data and the more stringent of the two used to establish the ongoing Take Action and Stop Work Levels for PM_{10} (AL^{PM}).

3.3.1 Establishing Particulate Take Action and Stop Action Levels for Lead

The target level for lead on a one-hour basis, TPb, has been derived from the current (2008) NAAQS for Pb, 0.15 µg/m^3, which is expressed as three-month rolling average. The AL^{Pb} derived from the NAAQS will be implemented on the basis of 30-minute and 60-minute block-averaged particulate readings. The particulate Take Action Level notification will be based on a 30-minute downwind block average. The particulate Stop Work Level will be set on 30-minute and 60-minute downwind block averages.

According to Appendix D, "Averaging Period Concentration Estimates" in EPA-454/R-92-024 "Workbook of Screening Techniques for Assessing Impacts of Toxic Air Pollutants (Revised)" December 1992, the appropriate multiplying factor in converting one-hour averaged concentrations to three-month averages is 0.1. Therefore, to set an equivalent one-hour allowable concentration consistent with the three-month averaged Pb NAAQS, the NAAQS value of 0.15 µg/m^3 is divided by 0.1, yielding 1.5 µg/m^3 = 0.0015 mg/m^3 Pb = TPb.

The AL^{Pb} will be calculated by the following method:

The lead content fraction (FPb), taking into account downwind sampling stations, will be determined from project-collected particulate and lead concentration data based upon the following relationship in the measured downwind monitor data. Any sample results for lead which are reported from the laboratory as being below the detection limits will be entered into this calculation as ½ of the reported detection limit rather than as zero. The calculation of FPb will be completed for the averaged data from each of the three downwind particulate matter and sampler pairs.

$$\frac{\text{mg Pb/m}^3}{\text{mg Dust/m}^3} = \text{FPb}$$

The highest of the calculated values from the three downwind monitor and sampler pairs will be the FPb. The AL^{Pb} for the dust monitors for the action levels described above will be then be calculated as follows:

$$\frac{(TPb)\ (mg/m^3)}{FPb} = AL^{Pb}\ mg/m^3$$

3.3.2 Establishing Particulate Take Action and Stop Work Levels for Cadmium

The Texas Commission on Environmental Quality (TCEQ) short-term Effects Screening Level (ESL) for cadmium is 0.0001 mg/m^3. In order to derive a comparable PM_{10} Take Action Level, the AL for cadmium based upon the content of cadmium in the measured dust (FCd) is determined from the downwind project-collected particulate and cadmium concentration data by the following equations. Any sample results for cadmium which are reported from the laboratory as being below the detection limits will be entered into this calculation as ½ of the reported detection limit rather than as zero. The calculation of FCd will be completed for the averaged data from each of the three downwind particulate matter and sampler pairs.

$$\frac{mg\ Cd/m^3}{mg\ Dust/m^3} = FCd$$

The highest of the calculated values from the three downwind monitor and sampler pairs will be the FCd. The AL^{Cd} for the dust monitors for the action levels described above will be then be calculated as follows:

$$\frac{(ESL\ Cd\ 0.0001)\ mg/m^3}{FCd} = AL^{Cd}\ mg/m^3$$

3.3.3 Take Action and Stop Work Levels for PM_{10} as Surrogate

The 30-minute block average Take Action Level and 60-minute block average Stop Action Level for PM_{10} are referred to as the AL^{PM}. The AL^{PM} will be the LOWER of the calculated AL^{Pb} and AL^{Cd}. The 30-minute block average Stop Action Level will be two times the AL^{PM}. In no event will the AL^{PM} be greater than 0.15 mg/m^3.

During the pilot study work described in Section 6, AL^{PM} will be 0.1 mg/m^3 a level more conservative than the NAAQS for PM_{10} (0.15 mg/m^3). Site-specific data regarding the relationship between PM10, Pb, and Cd concentrations in the air related to this remediation project will be used after the results of the initial pilot test have been verified to set the AL^{PM} and to update the AL^{PM} at least every two weeks thereafter based upon the site-specific measured relationships. Extenuating circumstances may be addressed by changes to, or accommodations within, this plan made in consultation with and upon approval of the TCEQ Executive Director.

3.4 Stop Work Level for Wind

A wind speed Stop Work Level notification will be set on a one-minute block average using data from the on-site meteorological station. If the sustained wind speed (the wind speed obtained by averaging the measured values over a one minute period) exceeds 20 miles per hour, all waste-disturbing activities must cease until the sustained wind speed declines to 20 miles per hour or lower for at least 15 consecutive minutes. Non-dust producing activities (equipment maintenance, etc.) may still be conducted during these periods.

3.5 Particulate Monitors and Wind Speed Data Monitoring and Notifications

3.5.1 Particulate Monitors

The particulate monitors will be monitored at a remote location by Field Data Solutions (FDS). FDS hosts and manages a computer based monitoring system which will provide Take Action and Stop Work Level notifications to both field and management personnel on a real time basis as well as provide real time access to values from each instrument. Each of the E-BAM monitors will be equipped with a wireless modem. A cellular communication gateway will be installed at the site to act as a central communications hub.

3.5.2 Wind Speed Data Monitoring

The onsite weather system, used to monitor wind speed and direction will be equipped with a wireless modem or access will be obtained over the internet from the existing onsite weather station. This system will be integrated with the FDS data system to provide Stop Work Level notifications to both field and management personnel on a real time basis as well as provide real time access to the current wind speed and direction.

3.5.3 Notifications

Notifications of particulate or wind speed Take Action or Stop Work Levels will be sent via text message or SMS to field personnel. Notifications to the field office will be sent via email. The notifications will be sent to RSI's site onsite Project Manager, Dust Control Technician, and the W&M Onsite Oversight Person. The notifications will be sent as a Take Action Level notification or a Stop Work Level notification. The Dust Control Technician will be the primary individual responsible for monitoring the notifications and ordering implementation of response actions. However, all of these individuals will have the authority to order implementation of the response actions, if needed.

3.5.4 Stop Work Criteria for Monitors

If the signal from either the downwind particulate monitors or the onsite weather system are lost for five minutes or more, all waste-disturbing activities will be suspended until the downwind particulate monitors and the onsite weather system are operational and the signal to the Field Data Solutions system is re-established.

3.6 Dust Suppression Measures

3.6.1 Particulate Take Action Levels

If the 30-minute average PM_{10} concentration exceeds the Take Action Levels presented in Table 1, the Contractor will immediately implement increased dust suppression activities. These increased dust suppression adjustment activities may include, but are not limited to the following:

- Increased wetting/misting of work area
- Adding surfactant to the water used for dust control
- Applying temporary cover (paper mulch with tackifier) to areas not being actively worked
- Adjusting the rate/speed and/or quantity of equipment in the work area
- Covering active stockpiles with plastic sheeting or tarps

3.6.2 Particulate Stop Work Levels

If the one-hour (60-minute) average or thirty-minute (30-minute) average PM_{10} concentration exceeds the applicable Stop Work Level presented in Table 1, the Contractor will immediately stop all waste-disturbing work. During the work stoppage period (minimum 15 minutes), the Contractor must make dust suppression adjustments to reduce airborne particulate matter concentrations below the Take Action Level concentration for particulate. The dust suppression adjustment activities may include, but are not limited to the following:

- Increased wetting/misting of demolition area
- Adding surfactant to the water used for dust control
- Applying temporary cover (paper mulch with tackifier) to areas not being actively worked
- Adjusting the rate/speed and/or quantity of equipment in the work area
- Covering active stockpiles with plastic sheeting or tarps
- Stopping specific dust-generating activities until wind directions and/or wind speeds are more conducive to reduced dust levels
- Mobilize additional dust suppression equipment and initiate its use

After the Contractor dust suppression adjustments have been implemented (minimum 15-minute period), the Contractor may resume work. During the first 30 minutes after resumption of work activities, the air monitoring technician will continuously monitor the dust levels utilizing the real time data sent to the onsite computer to ensure the dust suppression adjustments are effective. Adjustments to dust suppression activities will be made if needed. If particulate concentration Stop Work Levels are exceeded twice in one work day, the Contractor must immediately stop work for the remainder of that work day and design and implement a more effective dust control program prior to resuming work the following work day. During this period, the contractor may perform equipment maintenance and other non dust-producing activities.

4.0 PERIMETER AIR SAMPLES COLLECTED FOR LABORATORY ANALYSES

4.1 Metals Analyses

Air samples will be collected upwind and downwind at the property boundaries (at the same location as the E-BAM monitors) for laboratory analyses of both lead and cadmium during waste-disturbing activities using a low volume particulate sampler. This analytical data will be correlated with the real-time particulate concentration data collected by the E-BAM monitors at least every two weeks. The lowest correlated particulate Take Action Level for cadmium and lead will be utilized for the dust monitors, AL^{PM}.

Air samples for these metals analyses will be collected by the Contractor at least three times weekly (every other day) during active waste disturbing activities. Samples will not be collected on days when waste disturbing activities are not occurring. If milling and waste treatment activities occur during a given week, that week's sampling will include each activity. For example, if milling occurs during only two days of a six day period, one of the samples collected will be during that two day period.

Air samples for metals analyses will be collected over a full working shift (typically eight – ten hours) using a Model Gilian Model GilAir5 air sampling pump, or equal. The air sampling interval may be less than eight hours in the event of inclement weather during the air sampling period (such as severe thunderstorms). Air samples will be collected by attaching laboratory-provided air sample filter cartridges (0.8- micrometer mixed cellulose ester membrane filter cartridge) to the pump, and setting the air sample filter cartridges approximately five feet above ground level at the E-BAM monitor locations, which are at or near the property lines both upwind and downwind. When the samplers are relocated with the E-BAM monitors due to a 180 degree change in the prevailing winds, the samplers will be shut off during the relocation and started in the new location without a filter change. The air sample pumps will be set at a flow rate of approximately two to three liters per minute, thereby resulting in an air sample volume of approximately 1200 liters per air sample.

Following air sample collection, the air sample cartridges/tubes will be securely capped, labeled, and delivered with chain of custody documentation to an independent analytical laboratory (TBD) for metals (i.e. both lead and cadmium) analyses. Laboratory analyses on an expedited 24-hour turnaround will be requested. Metals will be analyzed using NIOSH Method 7303. Test method details are provided in Attachment 2.

Laboratory data will be validated by Exide's consultants and provided to the TCEQ within two business days of receipt of validated analytical results, excluding the day that the results are received. If data is received that cannot be validated, an email notification will be provided to the TCEQ within two business days with a brief description of the issue(s). Upon receipt of the corrected data from the laboratory, Exide's consultant will validate and provide to TCEQ as described above.

4.2 Metals Concentrations Take Action Levels

Following receipt of the lead and cadmium analytical laboratory reports, the analytical data will be compared to the lead and cadmium Take Action Levels shown on Table 1 (revised as appropriate based on sample results). If either concentration in the downwind samples exceeds the relevant Take Action Level, the Contractor will immediately implement increased dust suppression activities. These increased dust suppression adjustment activities may include, but are not limited to the following:

- Increased wetting/misting of work area
- Adding surfactant to the water used for dust control
- Applying temporary cover (paper mulch with tackifier) to areas not being actively worked
- Adjusting the rate/speed and/or quantity of equipment in the work area
- Covering active stockpiles with plastic sheeting or tarps
- Mobilizing additional dust suppression equipment and initiating its use

4.3 Metals Concentrations Stop Work Levels

Following receipt of the lead and cadmium analytical laboratory reports, the analytical data will be compared to the Stop Work Levels shown on Table 1. The Stop Work Level for lead has been derived from the current (2008) NAAQS for Pb, adjusted as appropriate to address the differences in averaging periods. According to Appendix D "Averaging Period Concentration Estimates" in EPA-454/R-92-024 "Workbook of Screening Techniques for Assessing Impacts of Toxic Air Pollutants (Revised)" December 1992, the appropriate multiplying factor in converting eight-hour averaged concentrations to three-month averages is 0.14. Accordingly, the NAAQS value of 0.15 $\mu g/m^3$ is divided by 0.14, yielding 1.05 $\mu g/m^3$ average concentration as the lead Stop Work Level. For cadmium, the TCEQ short term ESL of 0.1 $\mu g/m^3$ average concentration is the Stop Work Level. The Take Action Levels for the lead and cadmium sample results are set at 75% of the Stop Work Levels.

If the Lead or Cadmium Stop Work Levels are exceeded, the Contractor will immediately stop all waste disturbing activities and design and implement a more effective dust control program prior to resuming work. The additional dust suppression activities may include but are not limited to the following:

- Increased wetting/misting of work area
- Adding surfactant to the water used for dust control
- Applying temporary cover (paper mulch with tackifier) to areas not being actively worked
- Adjusting the rate/speed and/or quantity of equipment in the work area
- Covering active stockpiles with plastic sheeting or tarps
- Stopping specific dust-generating activities until wind directions and/or wind speeds are more conducive to reduced dust levels
- Mobilizing additional dust control equipment

Table 1 provides, in chart form, the initial action levels and responses for particulates, lead and cadmium. Table 1 will be updated based upon the relationship of dust and lead concentrations utilizing the formulas in Section 3.3.1 and based upon the dust and cadmium concentrations utilizing the formulas in Section 3.3.2 once the initial pilot waste treatment in Section 6 has been completed and at least every two weeks thereafter based upon the relationship between dust and metals levels measured.

TABLE 1

Initial Action Levels and Response

Contaminant of Concern	Monitoring Method	Frequency of Monitoring	Take Action Level to Increase Dust Suppression / Emission Controls	Stop Work Level
Particulate Matter	Visual		Visible dust within the active Work Zone – Implement additional dust control measures.	Dust leaving the Work Zone perimeter – Stop Work. Implement additional dust control measures.
	PM_{10} Particulate Monitors	30-minute block average	0.1 mg/m^3 30-minute concentration – Implement additional dust control measures.	0.2 mg/m^3 (or, subsequently, two times AL^{PM}) 30-minute concentration – Implement additional dust control measures.
	PM_{10} Particulate Monitors	60-minute block average		0.1 mg/m^3 hourly concentration – Stop Work. Implement additional dust control measures.
Lead	Low Volume Particulate Samplers	Three days per week	0.78 $\mu g/m^3$ – Implement additional dust control measures.	1.05 $\mu g/m^3$ average concentration.
Cadmium	Low Volume Particulate Samplers	Three days per week	0.075 $\mu g/m^3$ – Implement additional dust control measures.	0.1 $\mu g/m^3$ average concentration (TCEQ short term Cd ESL).

5.0 REPORTS

5.1 Daily Dust Concentration and Wind Speed and Direction Summary Reports

Daily Dust Concentration and Wind Speed and Direction summary reports will be prepared by FDS. These summary reports will include the average 30-minute net block average results for each E-BAM instrument and the 30-minute block average wind speed and direction data. Take Action or Stop Work level exceedances and the dust suppression adjustment activities implemented in response will be documented in the summary reports.

Summary reports must be completed within two business days of the monitoring day being reported. The data will be validated by Exide's consultants. Summary reports of the validated data will be provided to the TCEQ within two business days of receipt of verifiable results, excluding the day that the results are received. If data is received that is not able to be validated, an email notification will be provided to the TCEQ with a brief description of the issue(s). The summary report with the corrected data will be resubmitted to Exide's consultant followed by validation. The summary report with validated data will then be submitted to TCEQ as described above.

6.0 PILOT STUDY – WASTE TREATMENT AND WASTE MILLING

Prior to commencing full scale excavation and waste treatment activities, a pilot study will be performed over a three-day initial period using the same means and methods to be utilized during full scale excavation and treatment. In addition, a second pilot study will be performed over a three day period prior to commencing full scale milling activities. The primary objective of each pilot study is to develop the relationship between particulate (dust) levels and the lead and cadmium metal fractions in the particulate. Particulate measurements can then serve as a surrogate for the lead and cadmium concentrations in the air. TCEQ will be notified at least two business days before each pilot test commences.

During the pilot studies' work activities, both the upwind and downwind particulate air samplers and the full shift air samplers for metals will be operated. When the laboratory results have been received and the relationship between the air samples for lead and cadmium in air and the real time particulate air monitors for the excavation and waste treatment or milling activities has been established, this data will be submitted to the TCEQ. Within two business days after such submission, TCEQ will inform Exide if Exide cannot commence full scale waste excavation and treatment or milling due to off-site air quality concerns arising from the pilot study's results that are not sufficiently addressed by the current project design.

7.0 QUALITY ASSURANCE / QUALITY CONTROL

Quality assurance (QA) refers to the planned and systematic actions necessary to provide adequate confidence that a product or service will satisfy a given requirement for quality. QA is applied to location and equipment selection, equipment acquisition and installation, routine site operation, and data processing and reporting.

Quality control (QC) refers to the operational techniques and activities that are used to fulfill requirements for quality. QC procedures applied at each step provide checks for acceptable conditions with corrective procedures specified when necessary.

The purpose of QC procedures is to assess and document data quality and to define remedial corrective actions when operating conditions exceed pre-established limits. Routine QC procedures are designed to focus on areas most likely to have problems, based on experience and guideline documents. Table 2 shows the frequency of audits and routine QC measures for the air quality study. The following

Table 2 Schedule of Audits, Calibrations, and Quality Control Checks	
Frequency	**Activity**
Prior to Delivery, Prior to Start of Work, First Work Day of Each Week	Calibration of E-BAM Monitors
Weekly	Routine Checks of E-BAM Monitors (Tape, Clocks, Housekeeping) and Samplers
Every Two Weeks	Clean size selective inlets on E-BAM monitors and Samplers
Every Three Weeks	Flow Checks of E-BAM Monitors
At Least Monthly	Leak Check and Cleaning Nozzle and Vane of E-BAM Monitors
Weekly	Field Blanks Collected for Samplers
Monthly	Trip Blanks Collected for Samplers

7.1 Particulate Monitors

7.1.1 Quality Control

The E-BAM particulate monitor beta detectors are calibrated at the factory. The betadetector calibrations remain fixed for the life of the unit, and no user adjustments are required. Each unit has test membranes that are placed in the beta particle pathway to verify performance of the detector. The test membranes are thin sheets of material that absorb a fraction of beta particles equivalent to a known mass of particulate matter. Each instrument has an individually matched membrane, and the factory-provided equivalent mass reading is stored in the instrument. The reference membrane tests are performed automatically every hour by the E-BAM and will be manually performed prior to the start of the work (the manufacturer recommends a frequency of one or two times per year for the E-BAM). The units are also equipped with zero-check inserts that are used in the same manner as the reference membranes. The zero check insert test will be performed prior to the start of the work, and the first work day of each week.

QC flow checks will be made every three weeks to ensure that the correct sample flow rate is being maintained to provide proper particle size separation. The E-BAM particle size selective inlets are designed to function at a flow rate of 16.7 L/min to maintain proper particle separation. The flow checks of the E-BAM instruments will use a volumetric flow calibration kit (BGI deltaCal™). This calibrator includes flow, temperature and barometric pressure. As part of the flow check for the E-BAM, the reference temperature and barometric pressure readings will be compared to the corresponding readings produced by the E-BAM's internal sensors.

Periodic cleaning of the size selective inlets on the particulate monitors will be conducted every two weeks. The larger particles that are removed from the air flow are captured inside the PM_{10} inlet heads. To maintain proper operation of the inlets, the particle deposits must be cleaned periodically. A leak check will be performed at least once per month and prior to cleaning the nozzle and vane located beneath the filter tape. The nozzle and vane beneath the filter tape will be cleaned each time the tape is changed but at a minimum of once per month.

7.2 Low Flow Samplers

7.2.1 Quality Control

Field and trip blank quality control samples will be collected. Field blank samples assess the possible contamination introduced by field sampling procedures, sampling media, sampling equipment, or shipment of the samples. Trip blanks verify the cleanliness of the sampling media.

The field blank will be shipped to the field, prepared, and handled as the other samples, and returned to the laboratory, without drawing air through the sampler, for analysis. One field blank will be collected each week for metals analysis. The trip blank will be shipped to the field, left sealed in its packaging, and then returned to the laboratory for analysis. One trip blank will be analyzed per month.

7.2.2 Quality Assurance

Precision and accuracy checks are both elements of QA. Precision checks are a measure of agreement among individual measurements of the same parameter, usually under prescribed similar conditions. Accuracy is the degree of agreement between an accepted reference measurement and the field measurement. Accuracy may be expressed as a total difference, or as a percentage of the reference value, or as a ratio. Precision checks are performed as collocated measurements.

Accuracy of ambient air sampling equipment is measured in terms of the accuracy of the flow rate measurement. Accurate determination of the air volume drawn through the sampler is essential to the concentration calculation. Flow rates of the air samplers will be determined pre and post sampling using calibrated equipment appropriate to the sampling device.

Preventative maintenance will be part of the samplers' QA program. Preventive maintenance is a combination of preventive and remedial actions taken to prevent or correct failure of the monitoring systems. Preventive maintenance for the samplers includes inspection and cleaning of the inlets.

7.3 Laboratory Validation

Data validation is used to interpret the quality of the analytical data received from the laboratory. The quality of the data is determined through evaluation of both the field and laboratory quality control samples. Data validation procedures determine whether individual project data are useable, useable with qualification, or unusable. Data will be reviewed in accordance with guidelines presented in USEPA's *National Functional Guidelines for Inorganic Superfund Data Review* (2010) and/or *National Functional Guidelines for Organic Superfund Data Review* (2008).

The Laboratory will submit the analytical data and supporting quality assurance quality control data to Exide's consultant, W&M Environmental Group, Inc. for validation. The validation review will consist of a Level II review which includes the following: blank samples (i.e., trip, method, equipment, field, etc.) are reviewed for detections which may indicate whether field or laboratory handling may have cross-contaminated samples causing false positive or high-biased data; spike recovery samples (i.e., laboratory control sample, surrogate, or matrix spike) are reviewed to evaluate accuracy in the laboratory's ability to recover known concentrations that were intentionally spiked into the quality control samples; and, duplicate samples (field and/or laboratory-prepared) are evaluated to determine precision, which is the level of agreement among individual measurements. In addition to the above quality control samples, verification of appropriate analytical methods, reporting limits, sample preservation, and holding times are also reviewed to determine data usability.

Any potential bias (high or low) or cross-contamination observed as a result of the data review is usually addressed by addition of data qualifiers. These typically include one of the following: a non-detect (U) flag for blank detections resulting in potential cross-contamination; an estimated (J) flag for results that could be high or low biased due to accuracy or precision issues; rejection of data (R) due to results grossly outside their respective control limits or questionable data.

7.4 Dust Concentration, Wind Speed and Direction Report Validation

The Daily Dust Concentration and Wind Speed and Direction summary reports will be prepared by FDS. The summary reports will be reviewed by Exide's consultant, W&M Environmental Group, Inc. for validation. The review will include review of error reports, previous instrument flow and leak check information as well as review of the data received to insure the data being reported is from the instruments being used at the site,

7.5 Sample Information Management

The sample information management system for the study will be based on a uniform sample identification system. Each sample will receive a unique ID that is based on the unique combination of project, sampling date, sampling location and the Serial Number of the E-BAM Monitor that the sample is associated with.

The sample ID will be structured as follows:

EX-YYMMDD-LOC-XXX[-QQ], where

EX-LFWT	=	Project (Exide-Landfill Waste Treatment)
YYMMDD	=	Sampling date (e.g., 11/01/2012 = 121101)
LOC	=	Sample Location (e.g. UW = Upwind, DW = Downwind)
XXX	=	E-BAM Monitor Sample Association – Last 3 digits of Serial Number,
QQ	=	Optional QA sample flag (TB = trip blank, FB = field blank, SC = duplicate)

For example, a sample collected at a downwind station on 1 November 2012 would be identified as EX LFWT 121101 DW 123.

ATTACHMENTS

ATTACHMENT 1

E-Bam Particulate Monitors

E-BAM

E-BAM is a complete measurement system it comes with the following standard components:

- 8 Channel Datalogger
- Internal DC Vacuum Pump Standard
- Real-Time Concentration
- PM10 Inlet
- Aluminum Tripod
- Ambient Temperature Sensor
- Volumetric Flow Control
- Weatherproof Enclosure
- Filter Temperature Sensor
- Filter RH Sensor
- Filter Pressure Sensor
- Calibration Membrane

Specifications

Range	0 - 65 mg per cubic meter
Accuracy	2.5 µg or 10% in 24 hour period
Measurement Cycle	Hourly measurements with 1, 5, 10, 15, or 30 min real-time averages
Beta Source	C14, less than 75 microcurie, Half life of 5730 years
Detector:	Scintillation probe
Analog Output	0-1V, 0-2.5v, 0-5V, selectable hourly or real-time output
Filter Tape	Continuous glass fiber filter
Inlet	Compatible with EPA PM10 and PM2.5 inlets
Flow Rate:	16.7 liters per minute, adjustable
Flow accuracy	+/- 2% of reading, volumetric flow controlled
Sample Pump	Dual diaphragm type, DC powered, 4000 hr rating
Alarm Signals	Filter, flow, power and operation failure
Input Power	12 Volts DC @ 48 Watts max
Alarm Contact Closure	2 Amp @ 240 VAC max
Operating Temperature	-30 Deg C to 50 Deg C
Enclosure	41 cm x 36 cm x 20 cm, 13kg

Options and Accessories

- BX-302 Zero Calibration Kit
- BX-305 Leak check valve
- BX-307 Flow Calibrator
- BX-308 PM2.5 Sharp-Cut Cyclone
- BX-803 TSP Inlet
- EX-034 Wind speed and direction sensor
- EX-121 AC Power supply, 100-240 VAC, 12 VDC output
- EX-593 Ambient RH Sensor
- EX-996 Phone modem kit
- EX-911 Cell modem kit
- 460130 Filter tape, roll
- 9425 Wall mount bracket
- Airsis Satellite modem kit
- External AC Vacuum Pump
- MMP MicroMet Plus Software
- Solar Panel Array

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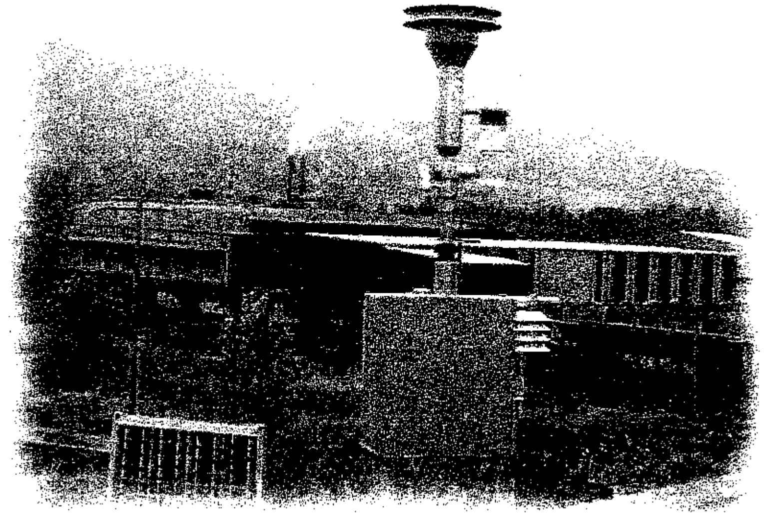
Rev. 08/09



The Met One E-BAM is a portable, real-time beta gauge which is comparable to U.S. EPA methods for $PM_{2.5}$ and PM_{10} particulate measurements.

The Met One E-BAM has been built to satisfy users, regulators and those from the health community by providing truly accurate, precise, real time measurement of fine particulate matter automatically. In addition, it is rugged, portable, battery operated, and deployable in 15 minutes.

The E-BAM offers the following advanced features:

1. Accuracy and precision consistent with U.S. EPA requirements for Class III $PM_{2.5}$ and PM_{10} measurement.
2. Real-time, accurate results without correction factors, regardless of season or geographic location.
3. True ambient sampling provides accurate measurement of semi-volatile nitrates and organic compounds.
4. Lightweight, rugged construction is easily mounted on a tripod in minutes.
5. All-weather construction allows for true ambient sampling.
6. Operates on AC or DC power. Battery and Solar options available upon request.

Met One Instruments, Inc.

Continuous Monitoring

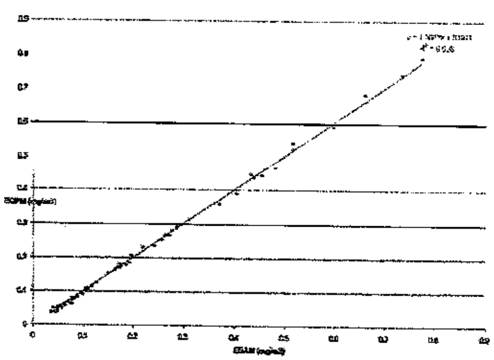
The E-BAM automates particulate measurement by continously sampling and reporting concentration data. Data records are updated every minute. E-BAM eliminates the old process of filter collection and manual filter weighing, and eliminates the need for more expensive, high maintenance instruments. Today, with the adaptation of Beta Attenuation to ambient monitoring this process became simple, streamlined, and inexpensive.

About Accuracy

Real-time accurate, reliable, and repeatable measurement of ambient fine particulate matter has been the elusive goal of environmental regulators and health professionals for many years. Met One Instruments has developed advanced particulate monitoring instrumentation which is reliable, and is easy to operate. It will also automatically report results in near real time, eliminating the need for high levels of human intervention.

Because sampling occurs under true ambient conditions semi-volatile organic compounds and nitrates are easily detected thereby avoiding under measurement.

EPA Designated Method EQPM-0798-122 VS EBAM



Continuous Sampling

E-BAM is a lightweight portable instrument that operates directly in hostile environments without an exterior enclosure. E-BAM is a very robust portable sampler system that is easily installed in less than 15 minutes. No other sampler matches the portability and flexibility of the E-BAM.

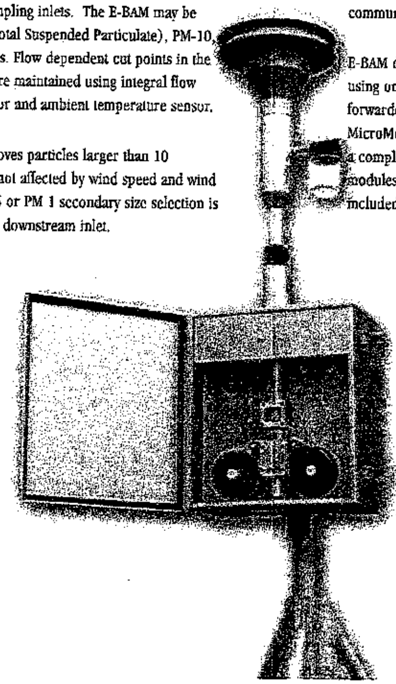
Set up

Quick setup of the E-BAM is assured with a series of prompts instructing the installer on the sequence to follow. Then the E-BAM performs a series of self test diagnostics and alerts the installer of any corrective action. Upon completion, the E-BAM automatically places itself in normal operate mode.

Particulate size selection

Size selective concentration measurements are made using a variety of sampling inlets. The E-BAM may be supplied with TSP (Total Suspended Particulate), PM-10, PM 2.5 or PM 1 inlets. Flow dependent cut points in the size selective inlets are maintained using integral flow meter, pressure sensor and ambient temperature sensor.

The PM-10 inlet removes particles larger than 10 microns, the inlet is not affected by wind speed and wind direction. For PM 2.5 or PM 1 secondary size selection is made using a second downstream inlet.



Construction etc.

The standard configuration of the E-BAM is a self-contained environmentally sealed aluminum enclosure placed on a rugged tripod. This system can be permanently placed on rooftops, near roads, at industrial sites, or rapidly deployed to monitor emergency situations.

'E- 'represents Environment Proof instrument, E-BAM has been specifically designed to work in hostile environments without additional protection.

Direct Field Reporting

Collecting real time or historical particulate data from a field site has never been easier. Advanced communication options include cellular phone, Line of Sight Radio, and for very remote sites, satellite communications are now available. E-BAM also supports the full line of standard MET ONE options, such as phone modem, and direct communications to a portable computer.

E-BAM data is recorded internally and may be retrieved using one of the communication options, or data may be forwarded to third party data acquisition system. MicroMet Plus Software supports the E-BAM and provides a complete communication, data base and reporting modules with charting. Comet data retrieved software is included.

Digital, Analog and Alarm Outputs

The E-BAM provides both continuous digital and analog outputs. Analog output is selectable to several full-scale voltages. Digital output is supplied as RS-232.

Reporting modes

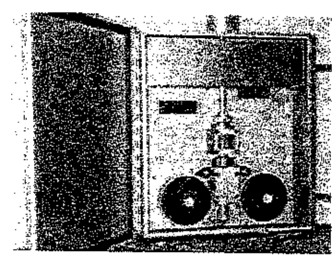
The internal data logger can store up over 182 days of concentration data at one hour sample times, and collect data from eight other measurements at the same time! Both digital and analog outputs are included to enable users to connect to other data recording systems.

Easy to Operate

E-BAM has been programmed to operate at all times, except during calibration verification. Current data, historical data, and status information are available at all times without interrupting normal E-BAM operation.

Data Validation

The operator may select various criteria for data validation, including deviation from rolling average, high value excursions, power failure and others. If an error occurs it is entered into the error log with date, time and type of error.



ATTACHMENT 2

NIOSH Method 7303

ELEMENTS by ICP (Hot Block/HCl/HNO_3 Digestion) 7303

MW: Table 1 CAS: Table 2 RTECS: Table 2

METHOD: 7303, Issue 1	EVALUATION: PARTIAL	Issue 1: 15 March 2003

OSHA: Table 2
NIOSH: Table 2
ACGIH: Table 2

PROPERTIES: Table 1

ELEMENTS:

aluminum	cadmium	indium	nickel	strontium	zinc
antimony*	calcium	iron	palladium	tellurium	
arsenic	chromium	lead*	phosphorus	thallium	
barium	cobalt	magnesium	platinum	tin*	
beryllium	copper	manganese	potassium	titanium	
bismuth*	gallium	molybdenum	selenium	vanadium	
boron	gold	neodymium	sodium	yttrium	

* With certain restrictions (see Table 3)

SAMPLING

SAMPLER:	FILTER (0.8-µm, cellulose ester membrane)
FLOW RATE:	1 to 4 L/min
VOL-MIN:	Table 1
-MAX:	Table 1
SHIPMENT:	Routine
SAMPLE STABILITY:	Stable
BLANKS:	2 to 10 field blanks per set

ACCURACY

RANGE STUDIED:	5,000 to 50,000 µg/sample
BIAS:	Not determined
OVERALL PRECISION:	Not determined
ACCURACY:	Not determined

MEASUREMENT

TECHNIQUE:	INDUCTIVELY COUPLED ARGON PLASMA, ATOMIC EMISSION SPECTROSCOPY
ANALYTE:	See element list above
REAGENTS:	Conc. HCl, 1.25 mL; and conc. HNO_3, 1.25 mL
FINAL SOLUTION:	5% HCl and 5% HNO_3, 25 mL
WAVELENGTH:	Element and instrument specific
BACKGROUND CORRECTION:	Spectral wavelength shift
CALIBRATION:	Elements in 5% HCl, 5% HNO_3
RANGE:	LOQ to 50,000 µg/sample [1]
ESTIMATED LOD:	Varies with element; Table 1
PRECISION ($\hat{S}_r$):	Not evaluated

APPLICABILITY: The working range of this method is up to 100 mg/m³ for each element in a 500-L sample (the minimum range depends on the LOD for each sample; see Table 1). The analysis is not compound specific. Certain elemental compounds are known to be acceptable or unacceptable by this method (see Table 3). For unverified compounds, a test run should be conducted using a known amount of the compound in question to determine acceptability.

INTERFERENCES: Interferences are spectral in nature and are accounted for by choosing appropriate wavelengths, applying interelement correction factors, and background correction.

OTHER METHODS: Alternative, more sensitive methods exist for some elements by graphite furnace atomic absorption spectroscopy. This method is similar to NIOSH Method 7301, differing only in the use of the hot block for digestion of the sampler.

REAGENTS:

1. Hydrochloric acid,* conc., ultra pure.
2. Nitric acid,* conc., ultra pure.
3. Calibration stock solutions, 50-1000 µg/mL. Commercially available single element solutions or multielement solutions prepared as instructed by the instrument manufacturer.
4. Argon, prepurified.
5. Distilled, deionized, Type II water.
6. Diluting solution: 5% HCl : 5% HNO_3. To about 600 mL of deionized water in a 1-L volumetric flask, slowly add 50 mL conc. HCl and 50 mL conc. HNO3. Dilute to the mark with deionized water.

* See SPECIAL PRECAUTIONS

EQUIPMENT:

1. Sampler: cellulose ester membrane filter, 0.8-µm pore size, 37-mm diameter; in cassette filter holder.
2. Personal sampling pump, 1 to 4 L/min, with flexible connecting tubing.
3. Inductively coupled argon plasma-atomic emission spectrometer, equipped as specified by the manufacturer for analysis of elements of interest.
4. Hot block apparatus at 95 °C.
5. Digestion vessels and caps, 50-mL.
6. Watchglasses.
7. Pipettes, electronic and mechanical.
8. Regulator, two-stage, for argon.
9. Forceps.

SPECIAL PRECAUTIONS: Concentrated acids are powerful oxidizers, toxic, and corrosive liquids. Wear protective clothing and work in a fume hood.

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Sample at an accurately known flow rate between 1 and 4 L/min for a total sample size of 200 to 2000 L for TWA measurements. Do not exceed a filter loading of approximately 2 mg total dust.

SAMPLE PREPARATION:

3. Open the cassette filter holder and with forceps remove the sample filter. Fold the filter into quarters taking care not to lose any sample, and transfer to a clean, 50-mL hot block digestion tube.
4. Add 1.25 mL HCl. Cover with a plastic watchglass. Place in the hot block and heat at an internal temperature of 95 °C for 15 minutes.
   NOTE: The internal temperature may vary from the digital readout. Calibrate the hot block prior to digestion.
5. Remove the sample from the hot block and cool for 5 minutes. Remove watchglass and add 1.25 mL HNO_3. Replace watchglass and return to hot block at 95 °C for 15 minutes.
6. Remove the sample from the hot block and cool for at least 5 minutes. Rinse watchglass into the sample container and discard watchglass.
7. Dilute to 25-mL final volume with distilled, deionized Type II water.

CALIBRATION AND QUALITY CONTROL:

8. Calibrate the spectrometer according to the manufacturer's recommendations. Use standards consisting of the same 5% HCl : 5% HNO_3 matrix as the samples.
9. Analyze a standard every 10 samples.
10. Analyze a media blank every 20 samples, and a reagent blank every 10 samples.
11. Analyze a set of two laboratory control samples every 40 samples of a given matrix for a given analyte.
12. Check recoveries with at least two spiked media blanks per ten samples.
    NOTE: In the determination of lead, there may be a measurement interference (for example, samples with high aluminum levels). More recent instruments have a correction for this.

MEASUREMENT:

13. Set spectrometer to conditions specified by manufacturer.
14. Analyze standards, samples and quality control checks.
    NOTE: If the elemental value for a sample is above the linear range of the element(s) in question, dilute the sample solution with 5% HCl : 5% HNO_3 diluting solution, reanalyze and apply the appropriate dilution factor in the calculations.

CALCULATIONS:

15. Obtain the solution concentrations for the sample, C_s (µg/mL), and the average media blank, C_b (µg/mL), from the instrument.
16. Using the solution volumes of sample, V_s (mL), and media blank, V_b (mL), calculate the concentration, C (mg/m^3), of each element in the air volume sampled, V (L):

$$C = \frac{C_s V_s - C_b V_b}{V}, mg/m^3$$

NOTE: µg/L ≡ mg/m^3

EVALUATION OF METHOD:

The method was evaluated for all elements and compounds listed in Table 1 and Table 2 between 1999 and 2001 using known amounts of bulk material [4]. Evaluation is ongoing for additional elements and compounds. The limits of detection and quantitation were also determined for each element. Two ICP instruments were used in the evaluation, a Thermal Jarrell Ash Model 61E [5] and a TJA IRIS [6], operated according to the manufacturer's instructions.

REFERENCES:

[1] WOHL [2001]. Metals validation using hot block digestion, Unpublished data. Wisconsin Occupational Health Laboratory, Madison, WI.
[2] NIOSH [1994]. Method 7300: Elements by ICP, NIOSH Manual of Analytical Methods, Fourth Edition, Issue 2, Aug. 15, 1994.
[3] WOHL [2001]. Metals Manual 2001, WOHL Internal Document, Updated Apr. 1, 2001. Wisconsin Occupational Health Laboratory, Madison, WI.
[4] WOHL [2001]. WOHL General Operations Procedures Manual, WOHL Internal Document, Updated 2001. Wisconsin Occupational Health Laboratory, Madison, WI.
[5] Thermal Jarrell Ash [1991]. ICAP 61E Plasma Spectrometer Operator's Manual, Thermal Jarrell Ash Corp., Part No. 128832-01, Feb., 1991.
[6] Thermal Jarrell Ash [1997]. IRIS Plasma Spectrometer User's Guide, Thermal Jarrell Ash Corp., Part No. 135811-0, Feb. 4, 1997.

METHOD WRITTEN BY:

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TABLE 1: ANALYTE INFORMATION FOR VALID ELEMENTS AND COMPOUNDS

Analyte	Properties		LOD (µg/mL)	LOQ (µg/mL)	Estimated LOQ (µg/sample)*	Minimum** air vol. (L)	Maximum*** air vol. (L)
	MW	MP (°C)					
Al	26.98	660	0.111	0.37	9.25	2	10,000
As	74.92	817	0.009	0.03	0.075	8	5,000,000
Au	196.97	10.63	0.015	0.05	1.25	1	3,300
B	10.81	2177	0.0094	0.0283	0.71	1	3,300
Ba	137.34	3.51	0.0018	0.006	0.15	1	100,000
Be	9.01	2178	0.00075	0.0025	0.062	35	25,000,00
Bi	208.98	271	0.025	0.085	2.12	1	10,000
Ca	40.08	842	0.099	0.33	8.25	2	10,000
CaO	56.08	2927	0.139	0.462	11.6	3	10,000
Cd	112.4	321	0.0037	0.012	0.30	3	500,000
Co	58.93	1495	0.003	0.011	0.27	3	500,000
Cr	52.00	1890	0.009	0.03	0.75	8	500,000
Cu	63.54	1083	0.020	0.060	1.50	15	500,000
Fe	55.85	1535	0.070	0.20	5.00	1	5,000
Fe_2O_3 (as Fe)	159.69	1462	0.070	0.20	5.00	1	5,000
Ga	69.72	29.75	0.03	0.09	2.25	1	3,300
In	114.82	156.3	0.015	0.05	1.25	15	500,000
Mg	24.31	651	0.047	0.14	3.50	1	10,000
MgO	40.32	2825	0.078	0.23	5.75	5	33,000
Mn	54.94	1244	0.0012	0.004	0.10	0.05	10,000
Mo	95.94	651	0.0072	0.024	0.60	0.5	10,000
Nd	92.906	2477	0.01	0.03	0.75	0.1	3,300
Ni	58.71	1453	0.012	0.039	0.98	1	50,000
P	30.97	44	0.3	1.0	25	250	500,000
Pb	207.19	328	0.023	0.07	1.75	35	100,000
Pd	106.4	1550	0.009	0.03	0.75	0.1	3,300
Pt	195.09	1769	0.0045	0.015	0.38	200	25,000,000
Sb	121.75	630.5	0.018	0.06	1.50	3	100,000
Se	78.96	217	0.021	0.064	1.60	8	250,000
Sn	118.69	232	0.015	0.05	1.25	1	25,000
Sr	87.62	769	0.002	0.006	0.15	300	100,000,000
Te	127.60	450	0.15	0.5	12.5	125	500,000
Ti	47.90	1675	0.005	0.016	0.40	0.1	10,000
Tl	204.37	304	0.044	0.133	3.32	35	500,000
V	50.94	1890	0.003	0.01	0.25	2.5	500,000
Y	88.91	1495	0.001	0.003	0.075	0.1	50,000
Zn	65.37	419	0.022	0.066	1.65	0.5	10,000
ZnO	81.37	1970	0.027	0.082	2.05	0.5	10,000

* Value based on a 25-mL sample volume.

** The minimum sampling volume needed to obtain the OSHA PEL at the LOQ for the element/compound at a sample digestion volume of 25 mL.

*** The maximum sampling volume for a given sample, calculated by taking 50,000 µg as the limit for the element/compound per sample.

NOTE: The LOD and LOQ values are dependent on the particular analytical instrument used. Also, LOD and LOQ values may vary for a particular element due to certain interelement interferences.

TABLE 2. EXPOSURE LIMITS, CAS #, RTECS

Element (Symbol)	CAS #	RTECS	Exposure Limits, mg/m³ (Ca = carcinogen)		
			OSHA	NIOSH	ACGIH
Silver (Ag)	7440-22-4	VW3500000	0.01 (dust, fume, metal)	0.01 (metal, soluble)	0.1 (metal) 0.01 (soluble)
Aluminum (Al)	7429-90-5	BD0330000	15 (total dust) 5 (respirable)	10 (total dust) 5 (respirable fume) 2 (salts, alkyls)	10 (dust) 5 (powders, fume) 2 (salts, alkyls)
Arsenic (As)	7440-38-2	CG0525000	varies	C 0.002, Ca	0.01, Ca
Barium (Ba)	7440-39-3	CQ8370000	0.5	0.5	0.5
Beryllium (Be)	7440-41-7	DS1750000	0.002, C 0.005	0.0005, Ca	0.002, Ca
Calcium (Ca)	7440-70-2	–	varies	varies	varies
Cadmium (Cd)	7440-43-9	EU9800000	0.005	lowest feasible, Ca	0.01 (total), Ca 0.002 (respir.), Ca
Cobalt (Co)	7440-48-4	GF8750000	0.1	0.05 (dust, fume)	0.02 (dust, fume)
Chromium (Cr)	7440-47-3	GB4200000	0.5	0.5	0.5
Copper (Cu)	7440-50-8	GL5325000	1 (dust, mists) 0.1 (fume)	1 (dust) 0.1 (fume)	1 (dust, mists) 0.2 (fume)
Iron (Fe)	7439-89-6	NO4565500	10 (dust, fume)	5 (dust, fume)	5 (fume)
Potassium (K)	7440-09-7	TS6460000	–	–	–
Lanthanum	7439-91-0	–	–	–	–
Lithium (Li)	7439-93-2	–	–	–	–
Magnesium (Mg)	7439-95-4	OM2100000	15 (dust) as oxide 5 (respirable)	10 (fume) as oxide	10 (fume) as oxide
Manganese (Mn)	7439-96-5	OO9275000	C 5	1; STEL 3	5 (dust) 1; STEL 3 (fume)
Molybdenum (Mo)	7439-98-7	QA4680000	5 (soluble) 15 (total insoluble)	5 (soluble) 10 (insoluble)	5 (soluble) 10 (insoluble)
Nickel (Ni)	7440-02-0	QR5950000	1	0.015, Ca	0.1 (soluble) 1 (insoluble, metal)
Phosphorus (P)	7723-14-0	TH3500000	0.1	0.1	0.1
Lead (Pb)	7439-92-1	OF7525000	0.05	0.05	0.05
Antimony (Sb)	7440-36-0	CC4025000	0.5	0.5	0.5
Selenium (Se)	7782-49-2	VS7700000	0.2	0.2	0.2
Tin (Sn)	7440-31-5	XP7320000	2	2	2
Strontium (Sr)	7440-24-6	–	–	–	–
Tellurium (Te)	13494-80-9	WY2625000	0.1	0.1	0.1
Titanium (Ti)	7440-32-6	XR1700000	–	–	–
Thallium (Tl)	7440-28-0	XG3425000	0.1 (skin) (soluble)	0.1 (skin) (soluble)	0.1 (skin)
Vanadium (V)	7440-62-2	YW240000	–	C 0.05	–
Tungsten	7440-33-7	–	5	5 10 (STEL)	5 10 (STEL)
Yttrium (Y)	7440-65-5	ZG2980000	1	N/A	1
Zinc (Zn)	7440-66-6	ZG8600000	–	–	–
Zirconium (Zr)	7440-67-7	ZH7070000	5	5, STEL 10	5, STEL 10

TABLE 3: VALIDATION SUMMARY

Analyte	Status[1]	Analyte	Status	Analyte	Status
Ag	Not Valid	CuO	Valid	S	Not Valid
Al	Valid	Fe	Valid	Sb	Partially Valid[4]
Al_2O_3	Not Valid	Fe_2O_3	Valid	Sb_2O_3	Partially Valid[5]
As	Valid	Ga	Valid	Se	Valid
Au	Valid	In	Valid	Si	Not Valid
B	Valid	KCl	Pending	Sn	Partially Valid[6]
Ba	Pending	Mg	Valid	SnO	Pending
BaO	Pending	MgO	Valid	SnO_2	Pending
BaO_2	Pending	Mn	Valid	Sr	Valid
$BaCl_2$	Valid	MnO	Valid	$SrCrO_4$	Valid (by Cr)
$BaSO_4$	Pending	Mo	Valid	Te	Valid
Be	Valid	NaCl	Pending	Ti	Valid
Bi	Partially Valid[2]	Nd	Valid	Tl	Valid
Ca	Valid	Ni	Valid	V	Valid
$CaCO_3$	Valid	P	Valid	V_2O_5	Valid
CaO	Valid	Pb	Partially Valid[3]	Y	Valid
Cd	Valid	$PbCrO_4$	Valid (by Cr)	Zn	Valid
Co	Valid	PbO	Valid	ZnO	Valid
Cr	Valid	Pd	Valid	Zr	Not Valid
Cu	Valid	Pt	Valid	ZrO	Not Valid

1 Status definitions

Valid: The method is suitable for samples up to at least 0.0500 g bulk material with recoveries of between 90 and 110 percent. This weight exceeds most expected levels encountered in work environments.

Partially Valid: The method is suitable with bulk-material recoveries of between 90 and 110 percent <u>under certain conditions</u> (as footnoted above).

Not Valid: The method procedure is not suitable for samples at any weight with recoveries of between 90 and 110 percent. An alternative method should be used.

2 Valid up to 10,000 µg/sample and within 7 days of sample digestion.
3 Valid up to 50,000 µg/sample and at least 24 hours after sample digestion; Valid up to 15,000 µg/sample within 24 hours of sample digestion.
4 Valid up to 25,000 µg/sample and within 7 days of sample digestion.
5 Valid up to 25,000 µg/sample and within 7 days of sample digestion.
6 Valid up to 30,000 µg/sample and within 7 days of sample digestion.

NOTE: The upper limits of the method can be extended by serial dilution of the samples at the time of analyses.

SAMPLING & ANALYSIS PLAN
QUALITY ASSURANCE PROJECT PLAN
(W&M ENVIRONMENTAL GROUP, INC.)

APPENDIX D

SAMPLING AND ANALYSIS PLAN & QUALITY ASSURANCE PROJECT PLAN CLASS 2 NON-HAZARDOUS WASTE LANDFILL

EXIDE TECHNOLOGIES
NORTH LANDFILL
7471 SOUTH 5TH STREET
FRISCO, COLLIN COUNTY, TEXAS

December 7, 2012

Prepared For:

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W&M Project No. 112.059.003

TABLE OF CONTENTS

EXECUTIVE SUMMARY

At the direction of Exide Technologies, Inc. (Exide), W&M Environmental Group, Inc. (W&M) developed this *Sampling and Analysis Plan (SAP)* to detail the organization, sampling activities, and quality control procedures for the proposed response actions at the Class 2 Non-Hazardous Waste Landfill (landfill) located at the north end of the Exide Technologies property at 7471 South 5th Street in Frisco, Texas (Site).

The SAP includes a *Quality Assurance Project Plan (QAPP),* and is intended to support the activities described in the revised *Response Action Work Plan (RAWP)* prepared by W&M and Remediation Services, Inc. (RSI). The goal of the response action is to remove treated slag material that has been identified as exceeding the Universal Treatment Standard (UTS) for lead and/or cadmium, re-treat the excavated material, collect confirmation samples, and return the re-treated materials to the active landfill.

The landfill has been characterized, and the SAP and QAPP focus on confirmation sampling that will be performed during slag re-treatment and confirmation sampling within the excavation. It will also address air sampling protocols and procedures.

1.0 INTRODUCTION

W&M Environmental Group, Inc. (W&M) developed this Sampling and Analysis Plan (SAP) to detail the organization, sampling activities, and quality control procedures for the proposed response actions at the Class 2 Non-Hazardous Waste Landfill (landfill) located at the north end of the Exide Technologies property in Frisco, Texas (Site).

1.1 Site Setting and Background

The Exide facility is approximately 260 acres in size and is located at 7471 South 5th Street in Frisco, Collin County, Texas. The study area consists of three active cells within a Class 2 Non-Hazardous Industrial Waste Landfill located at the north end of the Site. The Class 2 Non-Hazardous Industrial Waste Landfill is operated pursuant to the provisions of 30 Texas Administrative Code (TAC) Chapter 335.

The active cells, Nos. 10, 11 and 12, were constructed in 2009 and started to receive waste in approximately June 2009. The landfill cells receive treated slag material from Exide's lead recycling operations at the Site and no off-Site wastes are disposed in the landfill. Waste material from the blast furnace is crushed in the Slag Treatment Building then measured into a small concrete truck along with a stabilizing agent (currently Free Flow 100) along with cement and water. The materials are mixed in the concrete mixing truck while in transit and deposited at the landfill. Each load is deposited in a specific gridded pattern along the southern boundary of the active cells in a systematic manner that is based on the day of the week the material is placed in the landfill. The treated waste is flowable at the time of deposit due to added water when loaded and some wash out water at deposition, and spreads out across the surface of previously deposited material, resulting in a continuous buildup of the waste profile within the three active cells. Because the active face of the landfill is inclined, the material placed each day flows downhill and remains within the designated area for that day of the week. Over time the treated waste material hardens up into a very firm crust.

1.2 Environmental Concerns

The Texas Commission on Environmental Quality (TCEQ) conducted investigation inspections of the landfill on May 6, 12, 17-19, and June 28-29, 2011. During one of these investigations on May 19, 2011, two surface samples were collected within the landfill that failed applicable universal treatment standards (UTS) for lead and/or cadmium in the waste using the Toxicity Characteristic Leaching Procedure (TCLP) analysis. Exide conducted a review of analytical data and operational performance over a 3-year time period and determined that further evaluation of the in-place treated slag material in the active cells was warranted.

Between June 2011 and December 2011, Exide and W&M collected 195 additional samples of the in-place waste. Samples were collected in a gridded pattern and at various depths to fully evaluate the three active cells of the landfill. The investigations identified UTS exceedances of lead and cadmium concentrations, primarily in the upper 2 feet of the waste material. W&M's investigation also identified isolated areas in the landfill at a depth greater than 2 feet with TCLP lead concentrations greater than the UTS. A summary of the landfill investigations is provided in the *"Results of Class 2 Non-Hazardous Waste Landfill Investigation"* Report dated March 13, 2012.

Proposed remedial actions to address the unacceptable treated slag are described in the Revised *Response Action Work Plan (RAWP)* dated December 2012. The response actions will be completed within active cells 10, 11 and 12 of the landfill; previous cells have been closed and capped. The SAP includes a Quality Assurance Project Plan (QAPP), and is intended to support the activities described in the revised *RAWP* prepared by W&M, Remediation Services, Inc. (RSI) and ENVIRON International Corp. The goal of the response action is to remove treated slag material from the active cells that has been identified as exceeding the UTS for lead and/or cadmium, re-treat the excavated material, collect confirmation samples to ensure compliance, and return the re-treated materials to the active landfill.

2.0 SAMPLING OBJECTIVES

W&M's investigations indicate that areas of the treated slag in the active cells of the landfill do not meet the UTS criteria for land disposal. Analytical procedures used to evaluate UTS are the TCLP, a U. S. Environmental Protection Agency (EPA) method used to simulate the long-term leaching potential of wastes. Extensive sampling and testing shows that the chemicals of concern (COCs) in the TCLP leachate from the treated slag are lead and cadmium. Air emissions are a key issue of concern with the proposed excavation, re-treatment, and re-deposition of impacted waste material from the existing landfill. The COCs in air related to the proposed Site activities are total respirable dust (PM10), lead and cadmium.

The objectives of the sampling to be conducted during the response actions are:

- To confirm that re-treated wastes satisfy the UTS criteria;
- To confirm that subgrade material in the landfill after removal of material to be re-treated satisfies UTS criteria; and,
- To conduct testing of air for particulate matter (dust), lead and cadmium to ensure the safety of Site workers and the public in the vicinity of the Exide property.

3.0 SAMPLING LOCATIONS AND FREQUENCY

This section of the SAP presents a discussion of the sampling locations and sample frequency.

3.1 Sampling Locations

Sample locations and frequency are described in the RAWP, and include treated soil stockpiles, sidewalls and base of excavated areas, and air within the work zones and perimeter of the response area. Samples will be either of slag (solids) or dust/lead/cadmium (air monitoring equipment). Site COCs are lead and cadmium in slag, total dust (PM10), lead and cadmium in the air.

3.1.1 Slag Sampling

Stockpiles

Slag stockpiles will be generated as described in the Waste Stabilization Plan developed by RSI. Stockpiles will be segregated into 50 cubic yard sections for sampling. The volume and size of each stockpile will be determined by weighing the buckets on the front end loader with a totalizing bucket scale and determining volume using the unit weight of the slag.

Stockpiles will be numbered, flagged and covered pending sampling. One sample will be recovered from each stockpile by sampling the upper 12 inches from a random location and placing the material in a large plastic baggie. The material will then be homogenized and a sub-sample will be placed in laboratory-supplied four-ounce sample jars, labeled with the sample location, depth of sample, date, and time of collection. The soil samples will be hand delivered to Oxidor Laboratories for TCLP analysis of lead and cadmium on a rush turnaround basis. Duplicate samples for QA purposes will be sub-sampled from the baggie as discussed in this SAP.

Excavation Subgrade

Confirmation samples will be collected from the sidewalls and floor of each excavation area at the locations identified in the RAWP.

Confirmation samples will be collected at the following frequencies:

- one duplicate sample per 30 linear feet of the excavation sidewall, and
- one duplicate sample per 1,000 square feet of excavation base.

Each confirmation sample will be a discrete sample from a representative location and depth and collected in a large plastic bag. Samples will be retrieved from the first 6 to 12 inches of the sidewall or excavation base. In the instance where the treated slag is very hard, like cement, the sample interval may be from first 4 inches of the exposed surface. A sub-sample will then be placed in laboratory-supplied four-ounce sample jars, labeled with the sample location, depth of sample, date, and time of collection. The soil samples will be hand delivered to Oxidor Laboratories for TCLP analysis of lead and cadmium on a rush turnaround basis. Duplicate samples for quality assurance (QA) purposes will be collected as further discussed later on in this SAP.

3.1.2 Other Media Sampling

Dust and lead in air will be collected from samplers established at the work area perimeter as described in the *Perimeter Air Monitoring Plan* prepared by RSI. Lead and cadmium in worker breathing zones will be sampled using personal air monitoring equipment as described below.

Particulate Sampling

Dust samples will be analyzed using a real-time analyzer that will be calibrated in accordance with manufacturer instructions. Real-time particulate air monitors (e.g., E-Bam Particulate Monitor or equivalent) equipped with an omni-directional air intake device and a "PM10" impactor head will be used to monitor ambient air dust levels at the perimeter of the work area during the remedial activities that are likely to generate dust. The PM10 impactor head will enable the instrument to measure particulate matter (PM) in the size range of 0.1 to 10 micrometers (um) at concentrations between 0.005 and 65 milligrams per cubic meter (mg/m3). The instruments will be set to automatically store data for subsequent retrieval. [Note: The real-time particulate monitors measure PM and not actual lead concentrations in the air. Air samples will also be collected with low volume air samples as described below. The particulates collected with the filters on the low volume air samplers are then analyzed for total lead by an off-Site laboratory to determine the lead concentration in a measured volume of air. The lead concentrations from this process are then correlated to the PM measurements from the real time dust monitors.]

The particulate monitors are calibrated by the equipment manufacturer before arrival at the Site. When the monitors are turned on each day, the instrument self-calibrates and begins measuring and recording dust concentrations on a 30-minute time-weighted average (TWA).

Lead in Air Sampling

Lead in air samples will be obtained using low-volume air sampling equipment at the perimeter locations and at the frequency identified in the *Perimeter Air Monitoring Plan*. Analysis of the air cartridges will be by a NELAC accredited laboratory using approved NIOSH protocols. No duplicate samples will be analyzed, but field and trip blanks will be submitted as described in the Perimeter Air Monitoring Plan in the event that background values or contamination from other sources may affect the data or its interpretation.

Personal Air Monitoring

Air monitoring for Site workers will be conducted by collecting samples with low volume samplers on air sampling cassettes for total lead and total cadmium. Air samples will be collected in the breathing zone for each task being conducted. The sampling will be biased towards individuals with the expected greatest exposure potential.

Initial Exposure Assessments for lead and cadmium as required by 1926.62 and 1926.1127 will be collected on selected workers for each task during the first 3 days of intrusive activities. Air monitoring for lead and cadmium will be conducted on a weekly basis throughout the project.

The baseline level of protection for worker Personal Protective Equipment (PPE) is Level C. Level C respiratory protection will be required on all individuals in the regulated area until negative assessments have been completed or if action levels developed for the project are exceeded in any of the successive sampling events.

If the either of the actions levels for lead or cadmium are exceeded, two successive sampling events 7 days apart below the action level will be required prior to downgrading the respiratory protection.

3.2 Sampling Frequency

Sample frequency for treated slag will be as described in Section 3.1.

3.3 Sample Designation and Locations

The sample designation procedures (i.e., labeling) for the treated slag samples collected from the Site are presented in this section of the SAP. The samples will be labeled as follows:

- Project Number to denote the project designation;
- "SP" denotes slag samples collected from the re-treated stockpiles;
- "CS" denotes confirmation slag sample in excavated areas;
- "AA" denotes ambient air sample;
- "BZ" denotes breathing zone air sample;
- "BK" denotes background air sample;
- "FB" denotes field blank sample;
- "SC" or "Dup" denotes a duplicate sample;
- "TB" denotes trip blank;
- "-01" or "A-1" suffix identifies the unique sample locator designation;
- "YYMMDD" suffix may be used to identify a particular sampling period (e.g.,11/01/2012 = 121101);
- (x-x") identifies sample depth intervals, if required;
- "UW-xxxx" denotes upwind air sample and equipment serial number;
- "DW-xxxx" denotes downwind air sample and equipment serial number; and
- (Grab) or (composite) identifies the sample type.

As an example, a sampling code of "*112.059.004 CS-02 (0-12") Grab*" represents a confirmation slag sample collected from the Exide landfill at location CS-02 from 0-12 inches into the exposed subgrade or sidewall.

Blind duplicate samples will be labeled as Dup-1, Dup-2, and so on. The trip blanks will be labeled as *112.059.004 TB-01, -02,* etc. Sampling locations with duplicate samples will be noted in the log book with the corresponding sample, but not on the CoC.

Soil boring locations will be placed on a map in the field folder and noted on the log book. The location of the samples will also be recorded using Global Positioning Satellite (GPS) coordinates.

4.0 SAMPLE EQUIPMENT AND PROCEDURES

Slag, particulate matter, and air samples will be collected during the response actions as described below.

4.1 Slag Sampling

Slag samples will be collected from the landfill and stockpiles of excavated material using a clean metal hand trowel or disposable plastic trowel. All slag samples will be grab samples and will typically be recovered from intervals of 0-12 inches into the medium. In the instance where the treated slag is very hard, like cement, the sample interval may be from first 4 inches of the exposed surface. Either dedicated sampling equipment will be used between sampling locations or sampling equipment will be decontaminated between sampling locations. Samples will be placed directly into new 1-gallon plastic baggies, thoroughly homogenized and then placed into laboratory-supplied 4-ounce glass jars.

4.2 Particulate Sampling

Particulate samples as measured by the real-time monitors will be read directly by the particulate monitoring equipment and no physical samples are collected for off-Site analysis. Refer to the *Perimeter Air Monitoring Plan* for details regarding particulate monitoring equipment and datalogging.

Lead concentrations in the air will be determined from particulates collected by the perimeter low volume samplers. The filters from the low volume samplers will be labeled and sent to or hand delivered to an off-Site laboratory for analysis.

4.3 Equipment Decontamination

All equipment utilized during sampling activities will be either disposable equipment (one time use) or decontaminated prior to use in order to minimize the possibility of cross-contamination. Hand trowels or other sampling equipment used to collect slag samples will be decontaminated prior to use and between samples.

The decontamination process will be conducted as follows:

1. Alconox spray wash;
2. Rinse with tap water or distilled water; and
3. Air-drying.

Decontaminated equipment will be periodically inspected. All decontamination water will be containerized in steel, 55-gallon drums, labeled, analyzed for lead and cadmium, and properly disposed. Decontamination wash water will be periodically inspected and replaced as needed.

4.4 Project Documentation

All field information will be documented in field log books or pre-made forms. Typical information that will be included in the log book include:

- Date
- Weather conditions

- Names of field personnel
- Calibration record of field equipment
- Name and location of area of investigation
- Location of sample (may include a sketch)
- Type of sample (soil, groundwater, air, etc.)
- Time (military) of sample collection
- Sample identification number
- Interval and depth of sample
- Sample collection procedure/equipment
- Sample description (color, odor, etc.)
- Field observations of sampling event
- Parameters requested for analyses
- Field measurements
- Duplicate sample information
- Equipment decontamination procedures
- Sample shipment information
- Number assigned to the chain-of-custody (CoC)
- Field measurements
- Management of investigation-derived waste (IDW)
- Air monitoring results
- Level of PPE

5.0 SAMPLING HANDLING AND ANALYSIS

The sample handling and analytical procedures for the proposed Response Action activities at the Site are presented in this section of the SAP.

5.1 Sample Collection, Handling and Preservation

Samples of the treated slag material will be collected with a hand trowel or similar sampling equipment. Samples will be placed into gallon baggies, carefully mixed, and then placed into glass jars supplied by the analytical laboratory. All samples will be discrete grab samples.

Since the samples will be analyzed for TCLP lead and cadmium only, no preservation is required (i.e., no ice required in the coolers). The holding time for the selected metals is 6 months.

5.2 Sampling Documentation

All field activities will be detailed in field log books. The log books will be kept at all times by the lead field technician for the specified task (e.g., slag sampling may be managed by different staff than air sampling). The log book will detail all Site activities, sampling personnel, sample descriptions, and sample dates and times. Each page of the field log book will be dated and signed by the lead field technician. The log book will be kept in the possession of W&M at all times.

All of the soil samples collected during this investigation will be logged onto chain-of-custody (CoC) forms supplied by the selected laboratory. The CoC form shall include the sample identification code, date, time, and requested analysis. The CoC shall be signed and dated. Transferred possession of samples will be recorded on the CoC by both the person relinquishing and the person receiving the samples by signing, dating, and noting the time the transfer of possession takes place. Samples are considered to be a person's custody if they are within that person's line of sight, kept in a locked room or vehicle, or adequately sealed with custody seals. A CoC will be prepared for each cooler shipped or transported to the laboratory. All samples packed in the cooler will be recorded on the CoC accompanying that cooler. The following information is to be included on the CoC:

- Sample numbers
- Signature(s) of field personnel
- Date of collection
- Time (military) of collection
- Sample type (solid, etc.)
- Identification of sampling point (including depth)
- Number of containers
- Preservative used
- Parameters requested for analysis
- Signature of person(s) involved in the chain of possession
- Inclusive dates and times of possession
- Notations regarding the possible compromise of sample integrity
- Notation regarding sample temperature
- Laboratory Information Management System (LIMS) number for QA Lab

After completing the CoC, the original will be enclosed in a plastic bag and secured to the inside of the cooler lid. When responsibility for a group of samples changes several times, each custodian is not required to retain a copy of the CoC record, as long as the original custody record indicates that each person accepting the samples has subsequently relinquished custody appropriately. CoC records will be completed according to the following protocol:

- The originator will complete all the requested information from the sample labels.
- The originator will sign the "Relinquished by" box and keeps a copy.
- The original record sheet will be shipped with the samples (plastic shipping envelope will be taped to the inside of the cooler top and the original sheet of the CoC Record will be placed in the envelope).
- The person receiving custody will check the sample label information against the custody record, check sample condition, and will note anything unusual under "Remarks" on the CoC Record. The person receiving custody will sign in the adjacent "Received by" box and keep the original.
- The date/time will be the same for both signatures, since custody must be transferred between two individuals (however, when samples are shipped via common carrier [e.g., Federal Express], the date/time will not be the same for both signatures).
- When samples are shipped via common carrier, the original CoC Record will be shipped with the samples and the shipper (e.g., Field Sampling Team Leader) will keep a copy (the shipper also will keep all shipping papers, bills of lading, etc.).
- In all cases, it must be readily seen that the person receiving custody has relinquished it to the next custodian.

If samples are left unattended or a person refuses to sign, this must be documented and explained on the CoC Record.

5.3 Sample Analysis

The slag samples collected from the project area will be analyzed for TCLP lead and cadmium. Dust samples collected by the low volume air samplers and personal air samplers will be analyzed for total lead only.

The analytical methods for these parameters are as follows:

- Lead and cadmium in solids – EPA Method 6010 or 6020 (inductively coupled plasma); and
- Lead from the air samplers – NIOSH 7082 or 7303

The solid slag samples will be sent to an approved laboratory for analysis, with duplicates (e. g., split samples) sent to a third party laboratory as described in the QA section. All samples will be analyzed on an expedited turn-around-time, unless alternate turn-around times are specifically requested.

6.0 QUALITY ASSURANCE PROJECT PLAN (QAPP) DESCRIPTION

W&M developed this QAPP for the proposed response actions associated with the Class 2 Landfill. The QAPP details the organization, functional activities, and QA/QC procedures to be implemented during the response activities for both slag re-treatment and air monitoring of workers and in perimeter air.

7.0 PROJECT ORGANIZATION AND MANAGMENT

The proposed response actions in the landfill will be managed by staff from RSI (project execution and re-treatment sampling and perimeter air sampling) and W&M (project oversight and confirmation sampling). The project organization work chart is presented in the **Table** presented below.

Fred Ganster is the Corporate Director of Environment, Health & Safety for Exide. The Exide Facility Manager is David McKercher, and the facility Environmental Manager is Ms. Vanessa Coleman. Laurel Johnson is the plant Health & Safety Manager, and Wendell Carlile is the Environmental Superintendent familiar with routine facility environmental activities.

Grant Sherwood, President of RSI, is responsible for overall implementation of the response action. John Gillman, V.P. Operations and Dan Roth, Safety Manager, will be involved in Project Management and oversight.

The response action conceptual design has been managed by Mr. Frank W. Clark, P.E., P.G., a senior Consultant in W&M's Plano office. Ms. Lori Siegelman, CIH and Certified Safety Professional (CSP), will assist with air quality and worker safety issues. The quality assurance manager for this project will be Mr. Michael Whitehead, Senior Consultant the W&M Plano office. The field work will be performed by Steven Furlough and Brent Vollmar out of the W&M Plano office.

Project Management
Exide North Landfill Response Action

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Brent Vollmar	Field Scientist	972-509-9600 office 210-262-0607 cell	bvollmar@wh-m.com

8.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT

The objectives of the proposed Site Investigation by W&M are as follows: 1) ensure that re-treated slag material meets UTS requirements for land disposal; 2) ensure that all affected soil that does not satisfy the disposal criteria has been identified and removed; and 3) ensure the safety of workers and any other on-Site or off-Site receptors from impacted dust that may be generated by the Site activities.

A detailed program of slag testing and verification sampling has been developed, involving the collection and analysis of hundreds of samples and the completion of a robust program of quality sampling. The objective of the QA/QC performed during this response action is to ensure that the data generated from the proposed work is accurate, defensible, and reproducible.

8.1 QA/QC

The QA/QC samples recommended for this project are limited to duplicate samples, split samples (secondary laboratory), and trip blanks for particulate matter collected by the air samplers. Our QA/QC review will also include a summary of the laboratory QA/QC data packages.

In view of the high relative percent differences (RPDs) observed during the investigation phase for TCLP results on slag samples, blind duplicate samples will be collected at a frequency of 10% and analyzed by Oxidor Laboratories. Third party duplicates (split samples) will also be submitted to an independent laboratory at a frequency of 10%. Therefore, the overall project will involve duplicate/split samples at a rate of 20%. The key to lower RPD values for the proposed response actions will be complete mixing of the slag samples, which may be difficult if the samples are hard. W&M will make the best effort possible to homogenize the samples in a plastic bag prior to placement in the laboratory supplied sampling jar. Samples may be lightly crushed to improve the mixing process.

Trip blanks will be included with the sample containers for lead in air samples, but will be analyzed only if unusual results are detected in the air samples. Trip blanks will consist of unused but opened air cartridges taken from the laboratory to the sampling Site and transported back to the laboratory without having been exposed to any active air sampling. One trip blank per month of air sampling for lead is recommended. One field blank will be analyzed per week, as described in the *Perimeter Air Monitoring Plan.*

Due to the nature of the medium to be sampled, no equipment blanks will be collected.

W&M will review and summarize the laboratory QA/QC data package, which includes the laboratory control spikes, matrix spikes, method blanks, and associated duplicates.

8.2 Sample Custody

Sample custody procedures for this project will be limited to holding samples in the cooler in the possession of the field supervisor. The samples will remain with the field supervisor until shipped to the selected analytical laboratory. Custody seals will not be placed on the jars or coolers.

8.3 Sampling Documentation

All field activities will be documented in a field log book and CoC as described in Section 5.2.

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

The methods used by W&M to determine the precision and accuracy of the data generated during the proposed Site Investigation is presented in this section of the QAPP.

9.1 Data Reduction

The data produced by the analytical laboratory will be reviewed and summarized into tables. W&M will develop one table for the slag data and one each for the particulate and lead in air sample results. A QA check will be performed on the tables to ensure that the data has been accurately transmitted from the analytical laboratory reports.

9.2 Data Validation

Data validation is the process of filtering data and accepting/rejecting data on the basis of specific criteria. The validation procedures implemented for this project will be limited to the following procedures: 1) close adherence to specific sampling protocol, sample preparation, and analytical procedures; 2) examine the precision and accuracy of QC data generated; and 3) ensure that sampling and analytical equipment is properly calibrated and maintained.

All data will be subject to the TCEQ TRRP document *Review and Reporting of COC Concentration Data under TRRP* (RG-366/TRRP-13 revised May 2010). The objectives of this document are to ensure the documentation of the quality of COC concentration data used to demonstrate compliance with the TCEQ rule, data to include in rule-required results, technical review of the data performed by the laboratory, usability review of data performed by a person, and content of the data usability summary. Additional data reporting will include the requirement to spike the laboratory control sample with all of the COCs with some exceptions, a laboratory review checklist (LRC) with every data package, reporting detected and non-detected results based on the laboratory's documented analytical limits, and preparing a data usability summary (DUS) for TRRP-required reports.

Analytical data will be considered useful if the QA data for a spiked sample achieves the precision and accuracy goals stated in the QA plan and the sample was analyzed within the holding time for the specific analytes (e.g., 6 months for lead and cadmium). Matrix spikes will be utilized in the assessment of data. If the precision and accuracy of these data do not achieve the QA objectives, it will be flagged.

9.3 Data Assessment

The quality control procedures for this project will consist of the following: (1) review of matrix spikes; (2) analysis of duplicate samples; (3) analysis of trip blanks; (4) review of laboratory blanks; and (5) review of equipment blanks. Evaluation of the quality control data may include calculation of arithmetic means, standard deviations, RPD, and spike sample values expressed as percent recovery. The RPDs between duplicate pairs will be calculated as follows:

$$RPD = (Sample\ A - Sample\ B)/(Average\ of\ Sample\ A + Sample\ B)\ X\ 100$$

The data is generally considered accurate and reproducible as long as the RPDs are 40% or less.

- Names of field personnel
- Calibration record of field equipment
- Name and location of area of investigation
- Location of sample (may include a sketch)
- Type of sample (soil, groundwater, air, etc.)
- Time (military) of sample collection
- Sample identification number
- Interval and depth of sample
- Sample collection procedure/equipment
- Sample description (color, odor, etc.)
- Field observations of sampling event
- Parameters requested for analyses
- Field measurements
- Duplicate sample information
- Equipment decontamination procedures
- Sample shipment information
- Number assigned to the chain-of-custody (CoC)
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- Management of investigation-derived waste (IDW)
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Since the samples will be analyzed for TCLP lead and cadmium only, no preservation is required (i.e., no ice required in the coolers). The holding time for the selected metals is 6 months.

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All field activities will be detailed in field log books. The log books will be kept at all times by the lead field technician for the specified task (e.g., slag sampling may be managed by different staff than air sampling). The log book will detail all Site activities, sampling personnel, sample descriptions, and sample dates and times. Each page of the field log book will be dated and signed by the lead field technician. The log book will be kept in the possession of W&M at all times.

All of the soil samples collected during this investigation will be logged onto chain-of-custody (CoC) forms supplied by the selected laboratory. The CoC form shall include the sample identification code, date, time, and requested analysis. The CoC shall be signed and dated. Transferred possession of samples will be recorded on the CoC by both the person relinquishing and the person receiving the samples by signing, dating, and noting the time the transfer of possession takes place. Samples are considered to be a person's custody if they are within that person's line of sight, kept in a locked room or vehicle, or adequately sealed with custody seals. A CoC will be prepared for each cooler shipped or transported to the laboratory. All samples packed in the cooler will be recorded on the CoC accompanying that cooler. The following information is to be included on the CoC:

- Sample numbers
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- Date of collection
- Time (military) of collection
- Sample type (solid, etc.)
- Identification of sampling point (including depth)
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Project Management
Exide North Landfill Response Action

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Wendell Carlile	Environmental Superintendent	972-335-2121 ext. 32 9720786-5446 cell	wendell.carlile@exide.com

RSI Staff	Role on Project	Contact #	e-mail
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Dan Roth	Safety Manager	620-331-1200	droth@rsi-ks.com

W&M Staff	Role on Project	Contact #	e-mail
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Michael Whitehead	QA/QC	972-509-9608 office 214-335-3246 cell	mwhitehead@wh-m.com
Steven Furlough	Field Supervisor	972-509-9613 office 214-991-4992 cell	sfurlough@wh-m.com
Brent Vollmar	Field Scientist	972-509-9600 office 210-262-0607 cell	bvollmar@wh-m.com

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A detailed program of slag testing and verification sampling has been developed, involving the collection and analysis of hundreds of samples and the completion of a robust program of quality sampling. The objective of the QA/QC performed during this response action is to ensure that the data generated from the proposed work is accurate, defensible, and reproducible.

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The QA/QC samples recommended for this project are limited to duplicate samples, split samples (secondary laboratory), and trip blanks for particulate matter collected by the air samplers. Our QA/QC review will also include a summary of the laboratory QA/QC data packages.

In view of the high relative percent differences (RPDs) observed during the investigation phase for TCLP results on slag samples, blind duplicate samples will be collected at a frequency of 10% and analyzed by Oxidor Laboratories. Third party duplicates (split samples) will also be submitted to an independent laboratory at a frequency of 10%. Therefore, the overall project will involve duplicate/split samples at a rate of 20%. The key to lower RPD values for the proposed response actions will be complete mixing of the slag samples, which may be difficult if the samples are hard. W&M will make the best effort possible to homogenize the samples in a plastic bag prior to placement in the laboratory supplied sampling jar. Samples may be lightly crushed to improve the mixing process.

Trip blanks will be included with the sample containers for lead in air samples, but will be analyzed only if unusual results are detected in the air samples. Trip blanks will consist of unused but opened air cartridges taken from the laboratory to the sampling Site and transported back to the laboratory without having been exposed to any active air sampling. One trip blank per month of air sampling for lead is recommended. One field blank will be analyzed per week, as described in the *Perimeter Air Monitoring Plan.*

Due to the nature of the medium to be sampled, no equipment blanks will be collected.

W&M will review and summarize the laboratory QA/QC data package, which includes the laboratory control spikes, matrix spikes, method blanks, and associated duplicates.

8.2 Sample Custody

Sample custody procedures for this project will be limited to holding samples in the cooler in the possession of the field supervisor. The samples will remain with the field supervisor until shipped to the selected analytical laboratory. Custody seals will not be placed on the jars or coolers.

8.3 Sampling Documentation

All field activities will be documented in a field log book and CoC as described in Section 5.2.

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

The methods used by W&M to determine the precision and accuracy of the data generated during the proposed Site Investigation is presented in this section of the QAPP.

9.1 Data Reduction

The data produced by the analytical laboratory will be reviewed and summarized into tables. W&M will develop one table for the slag data and one each for the particulate and lead in air sample results. A QA check will be performed on the tables to ensure that the data has been accurately transmitted from the analytical laboratory reports.

9.2 Data Validation

Data validation is the process of filtering data and accepting/rejecting data on the basis of specific criteria. The validation procedures implemented for this project will be limited to the following procedures: 1) close adherence to specific sampling protocol, sample preparation, and analytical procedures; 2) examine the precision and accuracy of QC data generated; and 3) ensure that sampling and analytical equipment is properly calibrated and maintained.

All data will be subject to the TCEQ TRRP document *Review and Reporting of COC Concentration Data under TRRP* (RG-366/TRRP-13 revised May 2010). The objectives of this document are to ensure the documentation of the quality of COC concentration data used to demonstrate compliance with the TCEQ rule, data to include in rule-required results, technical review of the data performed by the laboratory, usability review of data performed by a person, and content of the data usability summary. Additional data reporting will include the requirement to spike the laboratory control sample with all of the COCs with some exceptions, a laboratory review checklist (LRC) with every data package, reporting detected and non-detected results based on the laboratory's documented analytical limits, and preparing a data usability summary (DUS) for TRRP-required reports.

Analytical data will be considered useful if the QA data for a spiked sample achieves the precision and accuracy goals stated in the QA plan and the sample was analyzed within the holding time for the specific analytes (e.g., 6 months for lead and cadmium). Matrix spikes will be utilized in the assessment of data. If the precision and accuracy of these data do not achieve the QA objectives, it will be flagged.

9.3 Data Assessment

The quality control procedures for this project will consist of the following: (1) review of matrix spikes; (2) analysis of duplicate samples; (3) analysis of trip blanks; (4) review of laboratory blanks; and (5) review of equipment blanks. Evaluation of the quality control data may include calculation of arithmetic means, standard deviations, RPD, and spike sample values expressed as percent recovery. The RPDs between duplicate pairs will be calculated as follows:

$$RPD = (Sample\ A - Sample\ B)/(Average\ of\ Sample\ A + Sample\ B)\ X\ 100$$

The data is generally considered accurate and reproducible as long as the RPDs are 40% or less.

9.4 Data Reporting

Data that is deemed accurate from the QA review will be presented in the Response Action Completion Report.