FINAL CLOSURE PLAN

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Exide Technologies Frisco Recycling Center
7471 Old Fifth Street, Frisco, Texas

JB Fassett

STATE OF TEXAS
5/3/19
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Table of Contents

STATE OF TEXAS
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1.0 INTRODUCTION AND BACKGROUND 1
1.1 Site Description..1
1.1.1 North Corrective Action Management Unit 2
1.1.2 Remediation Consolidation Area 3
1.2 Closure Plan Requirements 4
1.2.1 CAMU Requirements (40 CFR 264.552) 4
1.2.1.1 Capping 5
1.2.1.2 Post Closure Care 5
1.2.2 40 CFR 264.111 and 264.112 Requirements (Closure Plan Requirements for Hazardous Waste Facilities)..5
1.2.3 Agreed Order Requirements 7
1.2.4 Texas Risk Reduction Remedy Standard B Requirements (30 TAC 350.33)............8
1.3 Purpose 8
2.0 North CAMU CLOSURE 9
2.1 NORTH CAMU CLOSURE REQUIREMENTS 9
2.1.1 The Closure Complies with the Closure Requirements of 40 CFR 264.552(e)(6) [CAMU Requirements] and 40 CFR 264.601 through 603 [Miscellaneous Units]......9
2.1.1.1 Cover Design..9
2.1.1.2 Final Cover Stability Analysis..9
2.1.1.3 Minimization of Liquid Migration..9
2.1.1.4 Maintenance Needs..10
2.1.1.5 Drainage and Erosion 10
2.1.1.6 Settlement and Subsidence 10
2.1.1.7 Cover Permeability..11
2.1.2 Minimize the Need for Further Maintenance..11
2.1.3 Controls, Minimizes, or Eliminates, to the Extent Necessary to Protect Human Health and the Environment, Post-Closure Escape of Hazardous Waste, Hazardous Constituents, Leachate, Contaminated Run-off, or Hazardous Decomposition Products to the Ground or Surface Water or to the Atmosphere.............................11
2.1.3.1 Base Liner System..12
2.1.3.2 Leachate Collection System..12
2.1.3.3 Final Cover System..13
2.2 NORTH CAMU CLOSURE ACTIVITIES 14

2.2.1 Closure Schedule 14
2.2.2 Closure Preparation and Procedures 15
2.2.2.1 Final Lift of Soil Waste 15
2.2.2.2 Placement of Final Cover 16
2.2.3 Construction Quality Assurance and Certification 16
3.0 RCA CLOSURE 17
3.1 RCA CLOSURE REQUIREMENTS 17
3.1.1 The Closure Complies with the Closure Requirements of 40 CFR 264.552(e)(6) [CAMU Requirements] and 40 CFR 264.601 through 603 [Miscellaneous Units] 17
3.1.1.1 Cover Design 17
3.1.1.2 Final Cover Stability Analysis 17
3.1.1.3 Minimization of Liquid Migration 17
3.1.1.4 Maintenance Needs 18
3.1.1.5 Drainage and Erosion 18
3.1.1.6 Settlement and Subsidence 18
3.1.1.7 Cover Permeability 18
3.1.2 Minimize the Need for Further Maintenance 19
3.1.3 Controls, Minimizes, or Eliminates, to the Extent Necessary to Protect Human Health and the Environment, Post-Closure Escape of Hazardous Waste, Hazardous Constituents, Leachate, Contaminated Run-off, or Hazardous Decomposition Products to the Ground or Surface Water or to the Atmosphere 19
3.1.3.1 Design 20
3.1.3.2 Construction Quality Assurance 20
3.2 RCA CLOSURE ACTIVITIES 20
3.2.1 Closure Schedule 20
3.2.2 Closure Preparation and Procedures 21
3.2.2.1 Final Lift of Soil Waste 21
3.2.2.2 Placement of Final Cover 22
3.2.3 Construction Quality Assurance and Certification 22

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5/3/19
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GOLDER ASSOCIATES INC.
TEXAS REGISTRATION F-2578

4.0 POST-CLOSURE 23
4.1 Contact Information and Site Responsibility 23
4.2 Post-Closure Inspections and Maintenance 24
4.2.1 General Conditions 25
4.2.2 North CAMU Leachate Collection and Conveyance System 26

4.2.3 Final Covers 26
4.2.4 Groundwater Monitoring System 27
4.2.5 Surface Water Management 27
4.2.6 Flood Wall 28
4.2.7 Permeable Reactive Barrier 28
4.3 Monitoring 28
4.3.1 North CAMU Leachate Monitoring 28
4.3.2 Groundwater Monitoring 29
4.3.2.1 North CAMU Groundwater Monitoring 29
4.3.2.2 FOP Groundwater Monitoring 30
5.0 RECORDKEEPING AND REPORTING 31
6.0 CLOSING 32
7.0 REFERENCES 33

List of Tables

Table 1 Summary of Observations, Inspections, and Maintenance Actions
Table 2 Post-Closure Inspection Schedule

List of Figures

Figure 1 Former Operating Plant Location Map
Figure 2 Former Operating Plant Layout Map

STATE OF TEXAS
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PROFESSIONAL ENGINEER

GOLDER ASSOCIATES INC.
TEXAS REGISTRATION F-2578

List of Appendices

Appendix A Agreed Order
Appendix B Risk Evaluation
Appendix C Final North CAMU Cover System Drawings
Appendix D North CAMU Operations and Maintenance Plan
Appendix E North CAMU Quality Assurance/Quality Control Plan
Appendix F North CAMU Stability Calculations
Appendix G North CAMU Drainage Calculations
Appendix H North CAMU Air Monitoring Plan
Appendix I North CAMU Dust Control Plan
Appendix J Contingency Plan
Appendix K Final FOP Cover System Drawings

Appendix L FOP Operations and Maintenance Plan
Appendix M FOP Quality Assurance/Quality Control Plan
Appendix N FOP Stability Calculations
Appendix O FOP Drainage Calculations
Appendix P FOP Air Monitoring Plan
Appendix Q FOP Dust Control Plan
Appendix R Inspection and Maintenance Forms
Appendix S Signed Emergency Coordination Agreements

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TEXAS REGISTRATION F-2578

1.0 INTRODUCTION AND BACKGROUND

Golder Associates Inc., (Golder) is pleased to submit this Final Closure Plan for the Exide Technologies Former Operating Plant (FOP) located in Frisco, Collin County, Texas. The location of the FOP is shown on Figure 1.

1.1 Site Description

The FOP is located at 7471 Old Fifth Street in Frisco, Collin County, Texas. Based on historical information presented in the 2014 Affected Property Assessment Report (Golder 2014a) and other historical documents, it was developed for industrial purposes in approximately 1964, when Burrs Metals began producing lead oxide at the facility. Oxide manufacturing, battery recycling, and secondary lead smelting operations began at the facility in approximately 1969. The FOP recycled spent automobile batteries, industrial batteries, and other lead-bearing scrap materials to produce lead, lead alloys, and lead oxide. Exide Technologies (Exide) acquired GNB Technologies, Inc., the then owner of the FOP, in 2000 and ran the plant until operations ended in November 2012.

The approximately 94-acre facility includes the former plant area, two closed pre-Resource Conservation and Recovery Act (RCRA) landfills (the North Disposal Area [NDA] and the South Disposal Area [SDA]), one closed class 2 landfill (the Slag Landfill), and the Class 2 Landfill Corrective Action Management Unit (referred to herein as the North CAMU). It also includes the portions of Stewart Creek and the North Tributary to Stewart Creek traversing the FOP. These areas, which are within the original permitted boundary or are proposed to be added by the pending application, are collectively referred to as the FOP. The FOP does not include the former Exide-owned Undeveloped Buffer Property (UBP) surrounding the Site or areas otherwise outside the proposed permitted boundary (which includes the North CAMU). The layout of the FOP property boundary and permitted boundary are shown on Figure 2.

Hazardous waste permit HW-50206 was originally issued for the FOP on May 24, 1988, and was renewed and reissued on March 30, 2001. One renewal and several amendments, class 1, and class 1[1] modifications have been approved since the permit was issued. The permit authorized the FOP to store and process lead-acid batteries and other lead-bearing materials in two permitted units: the Battery Receiving/Storage Building (Unit No. 001) and the Raw Material Storage Building (Unit No. 002). Both of these buildings were demolished in 2013. Although demolished, the Battery Receiving/Storage Building and Raw Material Storage Building are currently classified as inactive RCRA permitted waste units as closure of these units has not been certified by the TCEQ (Inactive RCRA Units). The Inactive RCRA Units are located within the proposed Remediation Consolidation Area (RCA), discussed further below. These Inactive RCRA Units are intended to achieve final closure concurrently with the closure of the RCA and certification of such final closure will be requested concurrently with certification of closure and remediation of the FOP. Previous

Engineering and Closure Plans associated with the Inactive RCRA Units are provided as Attachment R of Part B Permit Renewal Application.

Per the requirements of the Agreed Order described below, Exide supplemented its pending application to renew its RCRA hazardous waste permit in October 2016 with a proposed major amendment incorporating the existing North CAMU into the footprint of the FOP. The October 2016 supplement to the original application was submitted with the understanding that an additional supplement to the permit renewal application reflecting the closure of the entire FOP would be submitted in 2017. The additional supplement to the permit renewal application was submitted in August 2017 and a further revised supplement is being submitted in May 2019 to address comments received from the TCEQ in December 2017. In accordance with the requirements of the Agreed Order, Exide had previously submitted the North CAMU Final Closure Plan (Golder 2016a) in January 2016. The Texas Commission on Environmental Quality (TCEQ) conditionally approved the North CAMU Final Closure Plan in a letter dated April 28, 2016.

This Final Closure Plan has been submitted with the May 2019 supplement to the pending hazardous waste permit renewal application described above. It includes the closure and post-closure specifications described in the North CAMU Final Closure Plan. Additionally, this plan includes the closure and post-closure specifications for the new proposed CAMU to be constructed on the south side of the FOP over the former plant area and inclusive of the two Inactive RCRA Units. The new CAMU, referred to herein as the RCA, will be added to the permit as a miscellaneous unit for purposes of the permit application template but will be regulated under 40 CFR 264, Subpart S and 30 Tex. Admin. Code § 335.152(14). The two CAMUs, which are the active waste management units, are described in more detail below. This closure plan also includes closure activities that will be performed for the SDA, NDA and the Slag Landfill located at the FOP.

1.1.1 North Corrective Action Management Unit

Initial notification for construction of an on-site class 2 industrial landfill, including engineering plans and a landfill operations plan, was provided to the Texas Natural Resource Conservation Commission (TNRCC) by GNB Technologies, Inc., in August 1995 (1995 Notification). The 1995 notification also included a closure and post-closure plan. TNRCC acknowledgement of receipt and review of the notification was provided in a September 14, 1995, letter. Landfill construction commenced thereafter and FOP records indicate that landfill operations began in 1996. The North CAMU currently consists of fifteen cells, nine of which (cells 1-9) have been closed and capped. The closed cells of the Landfill consist of treated slag monofills (PBW 2013). The active cells (cells 10-12) of the North CAMU currently contain treated slag and class 2 wastes, including metals-impacted soils from the UBP. The new cells (cells 13-15), completed in 2016, also contain class 2 wastes, including metals-impacted UBP soils. Additional class 2 wastes, such as FOP soils and demolition debris, may be added during closure of the FOP. The layout of the North CAMU is shown on Figure 3 of Appendix C.

The current total volume of North CAMU material (in cells 1 through 15) is estimated to be 190,000 cubic yards. Confirmation samples of the treated slag from cells 1-9 were analyzed by Exide and/or a third-party analytical laboratory (ERMI or OXIDOR) for pH and toxicity characteristic leaching potential (TCLP) lead, and periodically for TCLP cadmium and other metals to compare against the universal treatment standard (UTS).

In 2013, Exide conducted a comprehensive review of historical confirmation sampling data. Of the laboratory analytical results for sampling conducted by Exide, EMRI, and Oxidor of the capped cells (cells 1-9), which were in use from 1997 to 2009, approximately 2.4% were above the UTS for lead and/or cadmium and of those same results 0.7% were above the concentrations for characterization as hazardous waste. Cells 10-12 came into service in 2009. On May 19, 2011, TCEQ collected two treated slag samples from cells 10-12 and analyzed them for TCLP lead and cadmium. Both samples exceeded UTS criteria for lead and cadmium. Exide then completed an investigation of cells 10-12, which is documented in the Results of Class 2 Non-Hazardous Waste Landfill Investigation Exide Technologies, Inc., North Landfill, Frisco, Texas (Exide 2012). The results of the investigation indicated that some of the treated slag in cells 10-12 is above the lead and/or cadmium UTS, with the majority of the exceedances located near the surface of the material in the landfill at the time of the investigation (i.e., in the 0-0.5 foot depth interval) and discrete areas of exceedances located at greater depths. Analysis for other metals was performed on a subset of the samples for cells 10-12 and there were no exceedances of their respective UTS.

The North CAMU is subject to TCEQ Agreed Order No. 2013-2207-IHW-E effective April 27, 2015, which is included as Appendix A and referred to in this document as the Agreed Order. Consistent with the Agreed Order, additional treated slag with analytical results within class 2 standards was deposited in cells 10-12 and an interim cover was installed. Subsequently, class 2 remediation waste from the adjacent UBP remediation was disposed in cells 10-15. Once the placement of UBP remediation waste was complete, an interim cover was installed on cells 10-15. This cover will remain in place until FOP remediation begins and the remaining capacity can be used for class 2 remediation waste from the FOP.

1.1.2 Remediation Consolidation Area, NDA, and Slag Landfill

As shown on Figure 2, the proposed Remediation Consolidation Area (RCA) is a proposed CAMU and will be constructed over the former plant area of the FOP, inclusive of the footprint of the RCRA Inactive Units. Per the FOP Response Action Plan (RAP), which is submitted as Attachment M to the May 2019 Part B permit renewal application, in addition to materials currently in place, which include contaminated soils underlying the current surface of the RCA location, the RCA will contain a) surface soils exceeding applicable protective concentration levels (PCLs) excavated from affected property at the FOP where no cap is planned, b) sediments and other waste materials exceeding applicable PCLs removed from portions of Stewart Creek downstream from and on the FOP, c) other waste generated during remediation activities at the FOP, and d) non-hazardous soil stockpiled at the Railroad Museum (off-Site). Any of the materials placed in the RCA during the FOP remediation activities that are characterized as hazardous waste will meet applicable CAMU treatment standards; provided if any hazardous wastes are generated in connection with the remediation of portions of Stewart Creek downstream from the FOP, such wastes will be disposed of at a permitted off-site disposal facility.

Following removal of topsoil and vegetation, excavated soil, battery case fragments, concrete or other remediation waste from affected properties on-Site may be placed on the top of the footprint of the Slag Landfill or NDA to facilitate achieving final waste grades before capping. This is permitted through the use of the AOC policy as further described in Attachment M of the May 2019 supplement to the hazardous waste permit renewal application. Soil placed on top of the Slag Landfill or NDA would also meet criteria for waste which is approved for placement in the RCA in accordance with Attachment Q of the of May 2019 supplement to the hazardous waste permit renewal application.

As described in the RAP approximately 82,000 in-place cubic yards of soils and/or sediments will be placed in the RCA. An engineered multi-layer cover meeting RCRA requirements for a hazardous landfill cap will be placed over the consolidated soil and sediment after the excavation and consolidation activities are complete. The engineered multi-layer cover will also cover the Slag Landfill and NDA. Response actions for the FOP will also include a funnel and gate permeable reactive barrier (PRB) consisting of two slurry walls and a PRB as described in the RAP.

1.2 Closure Plan Requirements

1.2.1 CAMU Requirements (40 CFR 264.552)

CAMUs are special units created under RCRA to facilitate treatment, storage, and disposal of hazardous wastes managed for implementing cleanup (EPA 2002). One of the requirements of a CAMU is to develop a closure plan. Requirements for closure of a CAMU are included in 40 CFR 264.552(e)(6) and include capping and post-closure care as described below. The CAMU requirements are applicable to both the North CAMU and the RCA. In addition to the specific requirements (detailed below), CAMUs must be closed in a manner that:

- Minimizes the need for further maintenance;
- Controls, minimizes, or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous decomposition products to the ground or surface water or to the atmosphere.

1.2.1.1 Capping

Per 40 CFR 264.552(e)(6)(iv), at final closure of a CAMU, for areas in which wastes will remain after closure of the CAMU, with constituent concentrations at or above remedial levels or goals applicable to the site, the owner or operator must cover the CAMU with a final cover designed and constructed to meet the following performance criteria:

- Provide long-term minimization of migration of liquids through the closed unit;
- Function with minimum maintenance;
- Promote drainage and minimize erosion or abrasion of the cover;
- Accommodate settling and subsidence so that the cover's integrity is maintained; and
- Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.

1.2.1.2 Post Closure Care

Per 40 CFR 264.552(e)(6)(v), post-closure requirements must be implemented as necessary to protect human health and the environment, to include, for areas where wastes will remain in place, monitoring and maintenance activities, and the frequency with which such activities shall be performed to ensure the integrity of any cap, final cover, or other containment system.

1.2.2 40 CFR 264.111 and 264.112 Requirements (Closure Plan Requirements for Hazardous Waste Facilities)

40 CFR 264.112 specifies the requirements for a closure plan and references regulatory sections that include closure performance standards – particularly 40 CFR 264.111. The requirements of 40 CFR 264.112 are applicable to the closure of the North CAMU and the RCA (inclusive of the Inactive RCRA Units). 40 CFR 264.111 specifies closure must be performed in a manner that:

- Minimizes the need for further maintenance;
- Controls, minimizes, or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous decomposition products to the ground or surface waters or to the atmosphere; and
- Complies with the closure requirements of Part 264, including, but not limited to, the requirements of 40 CFR 264.178, 264.197, 264.228, 264.258, 264.280, 264.310, 264.351, 264.601 through 264.603, and 264.1102.

While the CAMUs are being added to the permit as Miscellaneous Units for purposes of the permit application template, TCEQ has confirmed the applicable requirements are those in 40 CFR Part 264 Subpart S. Although Sections 264.601 through 603 apply to miscellaneous units and do not apply to CAMUs, the factors are nevertheless useful to describing closure and are discussed below. 40 CFR 264.601 states that a miscellaneous unit must be closed in a manner that will:

- Prevent any releases that may have adverse effects on human health or the environment due to migration of waste constituents in the groundwater or subsurface environment, considering:
  - The volume and physical and chemical characteristics of the waste in the unit, including its potential for migration through soil, liners, or other containing structures;
  - The hydrologic and geologic characteristics of the unit and the surrounding area;
  - The existing quality of ground water, including other sources of contamination and their cumulative impact on the ground water;
  - The quantity and direction of ground-water flow;
  - The proximity to and withdrawal rates of current and potential ground-water users;
  - The patterns of land use in the region;
  - The potential for deposition or migration of waste constituents into subsurface physical structures, and into the root zone of food-chain crops and other vegetation;
  - The potential for health risks caused by human exposure to waste constituents; and
  - The potential for damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents.
- Prevent any releases that may have adverse effects on human health or the environment due to migration of waste constituents in surface water, or wetlands or on the soil surface considering
  - The volume and physical and chemical characteristics of the waste in the unit;
  - The effectiveness and reliability of containing, confining, and collecting systems and structures in preventing migration;
  - The hydrologic characteristics of the unit and the surrounding area, including the topography of the land around the unit;
  - The patterns of precipitation in the region;
  - The quantity, quality, and direction of ground-water flow;
  - The proximity of the unit to surface waters;
  - The current and potential uses of nearby surface waters and any water quality standards established for those surface waters;
  - The existing quality of surface waters and surface soils, including other sources of contamination and their cumulative impact on surface waters and surface soils;
  - The patterns of land use in the region;
  - The potential for health risks caused by human exposure to waste constituents; and
  - The potential for damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents.
- Prevent any release that may have adverse effects on human health or the environment due to migration of waste constituents in the air, considering:
  - The volume and physical and chemical characteristics of the waste in the unit, including its potential for the emission and dispersal of gases, aerosols and particulates;
  - The effectiveness and reliability of systems and structures to reduce or prevent emissions of hazardous constituents to the air;

- The operating characteristics of the unit;
- The atmospheric, meteorologic, and topographic characteristics of the unit and the surrounding area;
- The existing quality of the air, including other sources of contamination and their cumulative impact on the air;
- The potential for health risks caused by human exposure to waste constituents; and
- The potential for damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents.

1.2.3 Agreed Order Requirements

This Closure Plan also complies with the requirements of the Agreed Order, which specified that the North CAMU Closure Plan include the following:

1. The design criteria and basis of the final closure method(s) with detailed descriptions of both how the North CAMU will be closed and how such closure will be conducted to meet the requirements of 40 CFR 264.112 and 264.552 and Ordering Provision No. 2.h.(3);
2. Detailed descriptions of groundwater monitoring, leachate collection, and stormwater run-on and run-off control, and any other activity necessary to ensure that such closure meets the elements of 40 CFR 264.112 and 264.552;
3. Detailed final engineering design plans for the cap to be installed on cells 10-15. The cap shall comply with the requirements of 40 CFR 264.552 and shall be fully integrated with the existing cap over cells 1-9 so as to provide a unified cap over the entire landfill. For cells 10-15, the cap shall, at a minimum, consist of a multi-layer final cover system (MLFCS) as follows:
    i. A 3-foot thick layer of compacted clay or an equivalent geosynthetic clay liner (GCL) system;
    ii. A geomembrane as approved by the Executive Director installed over the compacted clay (or GCL) surface;
    iii. A geotextile will be placed on top of the geomembrane;
    iv. A 1.5-foot thick layer of general clean fill material will be placed on top of the geotextile; and
    v. A 1.5-foot thick layer of topsoil will then be placed above the general clean fill layer and hydroseeded;
4. A quality assurance/quality control plan to be followed during implementation of the final closure method(s);

5. A description of waste management practices to be followed during implementation of the final closure method(s), including removal and decontamination of equipment and devices used in the North CAMU waste management and closure activities;
6. Contingency plans and procedures to be followed during implementation of the final closure method(s);
7. Detailed operation and maintenance plans;
8. Detailed monitoring plans, including air monitoring and dust suppression plans, for the final closure method(s);
9. An implementation and activity schedule for the final closure method(s); and
10. A copy of the Risk Evaluation referenced in Finding of Fact No. 7.

1.2.4 Texas Risk Reduction Remedy Standard B Requirements (30 TAC 350.33)

The RAP describes in detail the remedial actions to be conducted to achieve Remedy Standard B (as set forth in Title 30 of the Texas Administrative Code [TAC] 350.33) at portions of the affected properties and Remedy Standard A (as set forth in 30 TAC 350.32) at the affected areas in Stewart Creek downstream of the FOP and portions of portions of the affected properties on the FOP (as portions of the affected properties on the FOP will be closed in accordance with Remedy Standard A and the remaining will be closed in accordance with Remedy Standard B). In general, the waste management units at the FOP protect ecological and human receptors by consolidating affected soils, sediments, and other waste material beneath multi-layer, low permeability caps. These caps reduce infiltration through the waste and migration of contaminants to groundwater and surface water. Collectively, these measures provide physical controls against exposure to concentrations of contaminants of concern above commercial/industrial PCLs. The FOP will be deed restricted to commercial/industrial use or, with the concurrence of the TCEQ, recreational use. In addition, a funnel and gate PRB will be installed downgradient from the RCA as described in the RAP.

1.3 Purpose

The purpose of this Final Closure Plan is to specify steps that will be taken at the time of final closure of the FOP, including the North CAMU, the RCA, NDA, Slag Landfill and SDA and to outline the post-closure inspections, maintenance, and monitoring that will be performed in accordance with the requirements listed above. This Final Closure Plan provides updates to the North CAMU Final Closure Plan. Components of the previous closure plan are referenced in this Final Closure Plan, as appropriate.

2.0 NORTH CAMU CLOSURE

2.1 NORTH CAMU CLOSURE REQUIREMENTS

The following sections describe how the proposed closure activities for the North CAMU will be performed in conformity with the regulatory standards listed above. A copy of the Risk Evaluation performed for the North CAMU is attached (Appendix B). The proposed layout of the closed North CAMU is shown on Figure 3 of Appendix C.

2.1.1 The Closure Complies with the Closure Requirements of 40 CFR 264.552(e)(6) [CAMU Requirements] and 40 CFR 264.601 through 603 [Miscellaneous Units]

The design of the North CAMU will ensure the protection of human health and the environment in conformance with these regulations. The following sections describe the closure activities at the North CAMU that will achieve these performance standards.

2.1.1.1 Cover Design

The final cover design includes soil layers to support vegetative growth along with geosynthetic layers that minimize the potential for vertical migration of liquids into the waste mass. The final cover design is described below in Section 2.1.3.3.

2.1.1.2 Final Cover Stability Analysis

Stability analyses of the final cover system were completed to demonstrate that the final cover will remain stable in the long term after closure. A detailed evaluation was included in the 1995 Notification and an updated evaluation was performed as a part of this Final Closure Plan. The updated results of the Final Cover Stability Analysis are included as Appendix F. The analysis and resulting factors of safety demonstrate that the final cover will remain stable during post-closure.

2.1.1.3 Minimization of Liquid Migration

As presented in Section 2.1.3, the components of the liner and cap will provide long-term minimization of migration of liquids through the closed North CAMU. The vegetative surface is designed to function with minimum maintenance after vegetation becomes established. The North CAMU cover is graded to direct surface water from the closed surface and convey it safely to drainage features off the cover system, reducing the potential for migration into the waste mass.

Run-on control is not an issue for the majority of the North CAMU due to the height of the perimeter berm above existing grade. Run-on from along the northern portion of the unit will be diverted to the west. Run-off will be controlled using mulch and erosion-control netting on exposed slopes, placement of lining materials on concentrated flow paths, and installation of culverts for road crossings over channels. Particular attention will be paid to the handling, control, and management of stormwater during the active filling operation and after cover installation to minimize leachate generation and avoid erosion and sediment deposition in drainage ways. Additional details regarding stormwater management is included below and in the North CAMU O&M Plan included as Appendix D.

2.1.1.4 Maintenance Needs

The waste mass is primarily composed of non-biodegradable materials that create a stable waste mass with minimal anticipated settlement. The North CAMU has been designed to minimize the need for maintenance as described in Section 1.2.

2.1.1.5 Drainage and Erosion

Only uncontaminated stormwater will be generated after the MLFCS is installed.

The planned final contour map for the North CAMU is included in Appendix C. The final cover of the North CAMU will have a top slope varying from 3 percent to 6 percent, with 5:1 (20 percent) slopes on the perimeter berm slope. The perimeter berms are constructed of clay soils and will be vegetated with native grasses.

Drainage calculations for the North CAMU were included in the 1995 Notification. Updated drainage calculations were prepared for this Closure Plan and are included as Appendix G.

As described in Section 2.1.1.3, the surface water control systems are designed to collect drainage from the closed North CAMU surface and convey it safely by means of channels at the perimeter of the North CAMU. The erosion control measures are designed to minimize erosion and abrasion of the cover. Uncontaminated stormwater will, to the greatest extent possible, be diverted by gravity flow to the perimeter drainage features, where it will be directed to the south and eventually flow into a tributary of Stewart Creek south of the North CAMU.

Once the final cover is installed and vegetation is established, sedimentation will be controlled using best management practices.

2.1.1.6 Settlement and Subsidence

The waste disposed at the North CAMU, consisting of high-density slag and compacted soils, has been and will be compacted during placement and is not expected to experience settling or subsidence after closure due to the stable physical nature of the materials. Therefore, the integrity of the final cover materials will be easily maintained.

2.1.1.7 Cover Permeability

The proposed final cover will consist of a composite system described in Section 2.1.3.3. The final cover will have a permeability less than or equal to the permeability of the bottom liner system in the North CAMU.

2.1.2 Minimize the Need for Further Maintenance

The North CAMU has been designed, and the final cover will be constructed, to minimize long-term maintenance. A detail of the final cover cross-section is included in Appendix C. Important elements of the North CAMU that will minimize the need for maintenance include the following:

- The North CAMU will almost entirely contain crushed slag and compacted soil excavated from the UBP and FOP. Therefore, the material is expected to remain stable with minimal settlement. Soil will be compacted to minimize settling. Additional grading of the final surface as a result of placing the excavated material in the North CAMU will be performed in accordance with the procedures identified in the North CAMU Operations and Maintenance Plan (O&M) included as Appendix D.
- The final cover will include an 18-inch thick layer of general clean fill overlain with 18 inches of topsoil. The seed mixture selected for topsoil cover will be amenable to the soil quality, thickness, and slope of the North CAMU and to moisture and climatological conditions that exist at the FOP. The seed mixture will require minimal continued maintenance and will include plants with minimal potential for root penetration into the less permeable sections of the final cover.
- The finished slopes will be protected using suitable short-term erosion control measures to hold the vegetation and soil in place and to conserve moisture during the initial growth phase. The maximum slope angle on the final cover is approximately 6 percent (6% grade on the limits of the final cover), which will limit stormwater runoff velocity and minimize scour and erosion potential.
- Stormwater and erosion control design elements are included on the final layout plan, Figure 3 in Appendix C, to collect and control runoff without scour or erosion of the surface materials.

Based on Golder's extensive experience with similar types of caps at other sites, further maintenance is anticipated to be minimal. This minimal maintenance is contemplated in the North CAMU O&M Plan and discussed below in Section 4.2.2. The leachate collection system (LCS) will be automated to minimize ongoing leachate removal maintenance.

2.1.3 Controls, Minimizes, or Eliminates, to the Extent Necessary to Protect Human Health and the Environment, Post-Closure Escape of Hazardous Waste, Hazardous Constituents, Leachate, Contaminated Run-off, or Hazardous Decomposition Products to the Ground or Surface Water or to the Atmosphere

Human health and the environment are protected from hazardous waste, hazardous constituents, leachate, contaminated run-off, and hazardous decomposition products by the North CAMU's robust bottom liner, cap, and LCS as described below.

2.1.3.1 Base Liner System

The North CAMU's base liner system provides control layers and containment barriers that are designed and constructed to contain leachate and protect groundwater from potential impacts associated with the North CAMU's contents. Infiltration to groundwater is limited by naturally occurring clay beneath the North CAMU and 2.5 to 3.0 feet of compacted clay with a permeability of less than 1 x 10-7 centimeters per second (cm/s). This clay is overlain by a 60-mil high density polyethylene (HDPE) flexible membrane liner (FML), a drainage geocomposite LCS, and 2 feet of protective soil.

2.1.3.2 Leachate Collection System

A leachate collection system is present at the North CAMU. In conformity with 40 CFR 264.552(e)(3)(i), leachate is removed from the LCS as necessary to ensure the leachate depth over the North CAMU liner does not exceed one foot (30 cm).

The design of the North CAMU's original LCS is presented in the 1995 Notification. Golder submitted a revised final design for the LCS in cells 13-15 in a technical memorandum (Golder 2016b), which is included with the May 2019 supplement to the hazardous waste permit renewal application. The two enclosed sumps in the LCS are backfilled with stone or gravel and overlain with a geotextile filter. The LCS for the southern portion of the North CAMU (cells 1-12) was designed to convey leachate to an enclosed sump in the southwestern corner of the North CAMU, from which leachate is pumped to an aboveground tank. In the northern part of the North CAMU (cells 13-15), the LCS drains to an enclosed sump located near the toe of the western sideslope, where it is also pumped to the aboveground tank.

Leachate which has collected in the enclosed sumps is removed using a submersible pump placed in a sideslope riser pipe. Currently, the leachate level is checked at least twice a week and leachate is manually pumped out as needed.

At the time of final closure, the leachate level in each enclosed sump will be monitored using a pressure transducer installed with the submersible pump. The pumps will be set to maintain a leachate head of less than 12 inches above the top of the liner system outside of the enclosed sump. High-level alarms signal when the enclosed collection sump is approaching the 1-foot maximum operating level. A local alarm and auto-dialer callout will occur in the event the leachate level approaches this 1-foot maximum in either of the enclosed sumps. The callout list will consist of at least two Exide Technologies employees who will contact a technician to inspect the FOP. If a call-out alarm is initiated, a technician will check the LCS and initiate any necessary corrective actions within 48 hours. A visual indicator is activated when the submersible pump is running.

The leachate will be transported from each enclosed sump in a dual-contained HDPE forcemain to the 5,000-gallon leachate holding tank located west of the North CAMU. The leachate holding tank will be equipped with a high-level switch that automatically turns the submersible sump pumps off if the tank becomes full prior to emptying the enclosed sumps.

2.1.3.3 Final Cover System

An MLFCS will be used at the North CAMU and will provide a low maintenance cover, prevent direct contact with the North CAMU's contents by human or ecological receptors, reduce rainfall percolation through the cover system, and minimize leachate generation within the North CAMU. This surface barrier will provide assurance that the North CAMU contents will not come into contact with stormwater or the atmosphere and that human health and the environment will be protected.

As noted in Section 1.1.1, the final cover system is currently in place over cells 1-9. The existing final cover consists of the following (from bottom to top):

- 3-foot thick compacted clay layer with a hydraulic conductivity less than 10^{-7} cm/s
- 40-mil thick HDPE geomembrane
- Vegetative soil cover with a thickness of 1 to 1.5 feet

A new final cover will be placed on the remaining cells 10-15 once the elevation of deposited waste in each cell reaches the proposed final waste elevation. This final cover for cells 10-15 is described in the subsections below.

The existing final cover system is generally sloped at approximately 3 percent toward the southwest. The North CAMU perimeter berm, outside the limits of the final cover, has a maximum slope of approximately 25 percent. The remaining portion of the final cover will be sloped at a minimum 3.2-percent slope and a maximum approximate 6-percent slope.

The existing cover on the closed cells and proposed final cover closure construction on the remaining cells will provide protection from potential threats to human health and the environment posed by the waste in the North CAMU.

2.1.3.3.1 Design

The MLFCS will be constructed over cells 10-15 as described in the following sections. Detailed engineering drawings are included in Appendix C. The MLFCS will include the following (in order of placement):

- A GCL system will be placed over those portions of the North CAMU that have not yet been capped. The new final cover will tie in to the existing compacted clay liner and extend beyond the liner system as shown on Figure 2 in Appendix C.
- Similar to the closed cells of the North CAMU and as specified in the 1995 Notification, following the installation of the GCL, a 40-mil HDPE geomembrane will then be installed over the GCL. The geomembrane will be anchored in a trench outside the North CAMU

perimeter and welded to the existing geomembrane to the south, as shown on Figure 2 in Appendix C. The geomembrane is one of the final cover layers (along with the GCL) designed to limit the vertical migration of liquids into the waste mass. A nonwoven geotextile will be placed on top of the geomembrane. The geomembrane and geotextile will meet the minimum requirements as outlined in the attached North CAMU Quality Assurance/Quality Control (QA/QC) Plan, included as Appendix E.

- An 18-inch thick layer of general clean fill material will be placed on top of the geotextile.
- An 18-inch thick layer of topsoil will then be placed above the general clean fill layer. The top 6-inch layer of the vegetative cover soil will be placed in a loose condition and will be amended as necessary to establish a dense growth of vegetation. After placement, the topsoil layer will be hydroseeded.

2.1.3.3.2 Construction Quality Assurance

The North CAMU final cover system will be constructed in accordance with the QA/QC procedures outlined in the following sections of the North CAMU QA/QC Plan, included as Appendix E:

- Geosynthetic Clay Liner Evaluation
  - Pre-Installation Material Evaluation
  - Installation Procedures
- Geomembrane Evaluation
  - Pre-Installation Material Evaluation
  - Installation Procedures
  - Installation Monitoring and Testing
- Soil Cover Layer Evaluation

2.2 NORTH CAMU CLOSURE ACTIVITIES

2.2.1 Closure Schedule

A sequence of steps will be taken to provide for the orderly final closure of the North CAMU and the North CAMU cells. These steps and the estimated implementation and activity schedule are outlined below:

- UBP remediation and soil placement in the North CAMU was completed in June of 2018.
- Following completion of the UBP remediation, an interim cover was installed at the North CAMU. The cover will remain in place until remediation activities are underway at the FOP. Surface soils exceeding applicable protective concentration levels may be placed in any remaining airspace in the North CAMU (if the soils are characterized as class 2 waste).
- Following the final waste placement, it is estimated that closure activities (capping, grading, seeding, etc.) can be completed in approximately two months.

No later than 60 days after closure of the North CAMU, Exide will do the following:

- Submit to the Executive Director of TCEQ a certification that the North CAMU has been closed in accordance with the approved Final Closure Plan for the Site. The certification will be signed by an Exide representative and by a qualified Professional Engineer.

- Submit to Collin County Development Services and to the Executive Director of TCEQ a record of the type, location, and quantity of hazardous wastes disposed of in the North CAMU.
- Record a deed notice or restrictive covenant on the facility property that will in perpetuity notify any potential purchaser of the property that the land has been used to manage hazardous wastes; its use is restricted under 40 CFR Part 264, Subpart G regulations; and the survey plat and record of the type, location, and quantity of hazardous wastes disposed of within each cell have been filed with the Collin County Development Services and with the Executive Director of TCEQ.
- Submit a certification, signed by Exide, to the Executive Director of TCEQ indicating that the deed notice or restrictive covenant has been recorded. The certification will include a copy of the deed notice or restrictive covenant.

Post-closure monitoring will begin upon the completion of all closure activities for the North CAMU and will continue for a period of 30 years.

2.2.2 Closure Preparation and Procedures

The closure activities for the North CAMU will be performed under the supervision of a third-party Professional Engineer (Engineer) licensed to practice in the State of Texas. The Engineer, or his designated alternate, will observe and test the work performed during closure of the North CAMU. Following completion of closure, the Engineer will certify that the closure work was performed in accordance with this Final Closure Plan.

A description of the closure steps is provided herein. Details of North CAMU operations and maintenance, including decontamination procedures, are included in Appendix D. Air monitoring and dust suppression activities will be performed as described in the Air Monitoring Plan, included as Appendix H, and the North CAMU Dust Control Plan, included as Appendix I. A Contingency Plan to address potential emergencies at the FOP during the closure and post-closure period is included as Appendix J. Signed emergency Coordination Agreements are included in Appendix S. Quality assurance procedures, as outlined in the North CAMU QA/QC Plan (Appendix E) will be followed to assure conformity of the final cover system to meet project specifications. This Final Closure Plan shall be used in conjunction with the North CAMU QA/QC Plan.

2.2.2.1 Final Lift of Soil Waste

Waste will be placed in loose lifts compacted to a general thickness of 1 foot. This will provide favorable conditions for achieving waste compaction with the waste mass and minimizing the potential for unwanted differential settlement. The waste surface will be graded as shown in Appendix C.

During the placement of the final lift of waste soils, the material will be visually observed to remove debris, organic materials, root, angular or sharp rocks, or other material that may damage the final cover system. The final lift will be drum rolled or equivalent to provide a smooth surface for placement of the working surface soil layer. The placement and acceptance of the working surface soil layer will follow the procedures outlined in the North CAMU QA/QC Plan (Appendix E).

2.2.2.2 Placement of Final Cover

Final cover placement is described above in Section 2.1.3.3. Prior to placement of the final cover, the final surface of waste will be covered with a minimum 12 inch-thick working surface layer placed and graded according to the design plans. The surface will be drum rolled to a smooth condition and surveyed at 100-foot intervals to establish the elevations of the surface prior to placement of the GCL. The working surface soil material will be obtained from an on- or off-site source, delivered using haul trucks, and spread with a dozer to prepare a smooth surface for the GCL. The working surface soil layer may be composed of waste soil provided it meets the requirements listed in the North CAMU QA/QC Plan (Appendix E).

2.2.3 Construction Quality Assurance and Certification

The construction of the final closure components will be performed under guidance of the QA/QC procedures included in the North CAMU QA/QC Plan (Appendix E). The Engineer, or his designated alternate, will be responsible for day-to-day observation and testing to verify that each component is constructed according to the design specifications, the North CAMU QA/QC Plan, and the conditions of the Agreed Order.

3.0 RCA AREA CLOSURE (INCLUDING NDA AND SLAG LANDFILL)

3.1 CLOSURE REQUIREMENTS

The following sections describe how the proposed closure activities for the RCA, NDA and Slag Landfill will be performed in conformity with the regulatory standards listed above. The layout of the waste areas is shown on Figure 1 of Appendix K.

3.1.1 The Closure Complies with the Closure Requirements of 40 CFR 264.552(e)(6) [CAMU Requirements] and 40 CFR 264.601 through 603 [Miscellaneous Units]

The design will ensure the protection of human health and the environment in conformance with these regulations. The following sections describe the closure activities that will achieve these performance standards. While the RCA is a CAMU, the cover design also satisfies the design standard for a cover on a hazardous waste landfill.

3.1.1.1 Cover Design

The final cover design includes soil layers to support vegetative growth and geosynthetic layers that minimize the potential for vertical migration of liquids into the waste mass. The final cover design is described below in Section 3.1.3.1.

3.1.1.2 Final Cover Stability Analysis

Stability analyses of the final cover system were completed to demonstrate that the final cover will remain stable after closure (long term). The stability analyses are attached in Appendix N. The analyses and resulting factors of safety demonstrate that the final cover will remain stable during post-closure.

3.1.1.3 Minimization of Liquid Migration

As presented earlier, the cap will provide long-term minimization of migration of liquids through the closed unit, inclusive of the Inactive RCRA Units. The vegetative surface is designed to function with minimum maintenance after vegetation becomes established. The cover is graded to direct surface water from the closed surface and convey it safely to drainage features off the unit's cover system, reducing the potential for migration into the waste mass.

A 3-foot high containment berm around the waste placement areas and the flood wall will provide run-on control. The containment berm will also control run-off during waste placement. Attention will be paid to the handling, control and management of stormwater during the active filling operation and after cover installation to minimize leachate generation and avoid erosion and sediment deposition in drainage ways. Additional details regarding storm water management is included below and in the RCA O&M Plan included in Appendix L.

3.1.1.4 Maintenance Needs

The waste mass is primarily composed of non-biodegradable materials that create a stable waste mass with minimal anticipated settlement. The final cover has been designed to minimize the need for maintenance as described in Section 3.1.2.

3.1.1.5 Drainage and Erosion

The planned final contour map for the FOP waste areas (defined as the RCA, NDA and Slag Landfill) is shown in Appendix K. The final cover of the RCA will generally have slopes of 3 percent, with slopes near the perimeter of 25 percent, as shown on Figure 1 of Appendix K. The existing grades and drainage patterns will be maintained on the NDA and Slag Landfill cover. Drainage calculations for the RCA and NDA are included as Appendix O.

The surface water control systems are designed to collect drainage from the closed surface and convey it safely by means of channels, and the erosion control measures are designed to minimize erosion and abrasion of the cover. Only uncontaminated stormwater will be generated after the MLFCS is installed. Uncontaminated stormwater will, to the greatest extent possible, be diverted by gravity flow to the perimeter drainage features. Storm water run-off from the RCA will flow radially off the northern portion of the RCA final cover on to the NDA, where it will be directed to Stewart Creek or the North Tributary. Storm water on southern facing RCA slopes will flow to a perimeter channel formed adjacent to the flood wall and/or be directed to the existing drainage pipe and directed to the stormwater retention pond as shown on Figure 1 in Appendix K of the Final Closure Plan. Surface water runoff from a small area in the northwest corner of the RCA will be directed to drain around the northern end of the sheet pile wall and discharge onto a drainage feature armored with riprap or similar material.

Once the final cover is installed and vegetation is established, sedimentation will be controlled using best management practices.

3.1.1.6 Settlement and Subsidence

The waste – consisting of soil, sediment, slag, battery case fragments and demolition debris– will be compacted during placement and is not expected to experience settling or subsidence after closure due to the stable physical nature of the materials. Therefore, the integrity of the final cover materials will be easily maintained.

3.1.1.7 Cover Permeability

The proposed final cover will consist of a composite system described in Section 3.1.3.1 and is required have a permeability ≤ the permeability of any bottom liner system or natural subsoils present. The RCA does not contain a liner system but is underlain with a concrete slab (the concrete slab is not considered a bottom liner). Due to cracks and joints in the concrete slab and to natural fissures and variability in the natural subsoils, the leakage rate (i.e. permeability) of the proposed geomembrane-GCL composite final cover systems will be significantly less than either the concrete slab or natural subsoils. The NDA and Slag Landfill were not constructed with a liner system and are underlain with natural subsoils.

3.1.2 Minimize the Need for Further Maintenance

The FOP waste areas cover has been designed, and the will be constructed, to minimize long-term maintenance. A detail of the final cover cross-section is included in Appendix K. Important elements of the design that will minimize the need for maintenance include the following:

- The FOP waste areas will contain waste which is primarily composed of non-biodegradable materials that create a stable waste mass with minimal anticipated settlement.
- The final protective cover will include a surface layer consisting of 6 inches of soil suitable for sustaining vegetative growth. The seed mixture selected for vegetative cover will be amenable to the soil quality, thickness, and slope and to moisture and climatological conditions that exist at the FOP. The seed mixture will require minimal continued maintenance and will include plants with minimal potential for root penetration into the less permeable sections of the final cover.
- The finished slopes will be protected using suitable short-term erosion control measures to hold the vegetation and soil in place and to conserve moisture during the initial growth phase. The final cover is generally sloped at 3 percent, with short slopes along the perimeter at 25 percent.
- Stormwater and erosion control design elements are included on the final grading plan, Figure 1 in Appendix K, to collect and control runoff without scour or erosion of the surface materials.

Based on extensive experience with similar types of caps at other sites, further maintenance is anticipated to be minimal. This minimal maintenance is contemplated in the O&M Plan and discussed below in Section 4.2.2.

3.1.3 Controls, Minimizes, or Eliminates, to the Extent Necessary to Protect Human Health and the Environment, Post-Closure Escape of Hazardous Waste, Hazardous Constituents, Leachate, Contaminated Run-off, or Hazardous Decomposition Products to the Ground or Surface Water or to the Atmosphere

Human health and the environment are protected from hazardous waste, hazardous constituents, leachate, contaminated run-off, and hazardous decomposition products by the robust cap, as described below.

An MLFCS will be used at the FOP waste areas and will provide a low maintenance cover, prevent direct contact with the waste by human or ecological receptors, reduce rainfall percolation through the cover system, and minimize leachate generation. This surface barrier will ensure that the contents will not come into contact with stormwater or the atmosphere and that human health and the environment will be protected.

3.1.3.1 Design

The MLFCS will be constructed over completed FOP waste areas as described in the following sections. Detailed engineering drawings are included in Appendix K. The MLFCS will include the following (in order of placement):

- GCL barrier layer;
- 40-mil linear low-density polyethylene (LLDPE) Geomembrane will be placed on top of the GCL;
- Geotextile or double-sided geocomposite (on areas steeper than 5%) will be placed on top of the geomembrane;
- 30 inches of cover soil will be placed on top of the geotextile; and
- 6 inches of soil suitable for sustaining vegetative growth would then be placed above the general clean fill layer and vegetated.

3.1.3.2 Construction Quality Assurance

The FOP waste areas final cover system will be constructed in accordance with the QA/QC procedures outlined in the following sections of the FOP Final Cover QA/QC Plan, included as Appendix M:

- Geosynthetic Clay Liner Evaluation
  - Pre-Installation Material Evaluation
  - Installation Procedures
- Geomembrane Evaluation
  - Pre-Installation Material Evaluation
  - Installation Procedures
  - Installation Monitoring and Testing
- Geotextile and Geocomposite Layer Evaluation
- Soil Cover Layer Evaluation

3.2 RCA CLOSURE ACTIVITIES

3.2.1 Closure Schedule

A detailed schedule for response actions and closure activities is included in Worksheet 6.0 of the RAP, which is submitted as Attachment M to the May 2019 Part B permit renewal application.

No later than 60 days after closure of the FOP waste areas, Exide will do the following:

- Submit to the TCEQ Executive Director a certification that the FOP waste areas, inclusive of the Inactive RCRA Units, has been closed in accordance with the approved Final Closure Plan for the FOP. The certification will be signed by an Exide representative and by a qualified Professional Engineer.

- Submit to Collin County Development Services and to the TCEQ Executive Director a record of the type, location, and quantity of hazardous wastes disposed of in the FOP waste areas.
- Record a deed notice or restrictive covenant on the facility property that will in perpetuity notify any potential purchaser of the property that the land has been used to manage hazardous wastes; its use is restricted under 40 CFR Part 264, Subpart G regulations; and the survey plat and record of the type, location, and quantity of hazardous wastes disposed of within the FOP waste areas have been filed with the Collin County Development Services and with the TCEQ Executive Director.
- Submit a certification, signed by Exide, to the TCEQ Executive Director indicating that the deed notice or restrictive covenant has been recorded. The certification will include a copy of the deed notice or restrictive covenant.

Post-closure monitoring periods at the FOP waste areas will continue for 30 years after the unit is closed.

3.2.2 Closure Preparation and Procedures

The closure activities for the FOP waste areas, inclusive of the Inactive RCRA Units, will be performed under the supervision of a third-party Professional Engineer licensed to practice in the State of Texas. The Engineer, or his designated alternate, will observe and test the work performed during closure of the FOP waste areas. Following completion of closure, the Engineer will certify that the closure work was performed in accordance with this Final Closure Plan.

A description of the closure steps is provided herein. Details of O&M at the FOP waste areas are included in Appendix L, including decontamination procedures. Air monitoring and dust suppression activities will be performed as described in Appendix P (RCA Air Monitoring Plan) and Appendix Q (RCA Dust Control Plan). A Contingency Plan to address potential emergencies at the FOP during the closure and post-closure period is included as Appendix J.

Quality assurance procedures, as outlined in the FOP Final Cover QA/QC Plan (Appendix M) will be followed to ensure the final cover system meets project specifications. This Final Closure Plan shall be used in conjunction with the FOP Final Cover QA/QC Plan.

3.2.2.1 Final Lift of Soil Waste

Waste will be placed in loose lifts compacted to a general thickness of 1 foot. This will provide favorable conditions for achieving waste compaction and minimizing the potential for unwanted differential settlement. The waste surface will be graded as shown in Appendix K.

During the placement of the final lift of waste soils, the material will be visually observed to remove debris, organic materials, root, angular or sharp rocks, or other material that may damage the final cover system. The final lift will be drum rolled or equivalent to provide a smooth surface for placement of the working surface soil layer. The placement and acceptance of this layer will follow the procedures outlined in the FOP Final Cover QA/QC Plan (included as Appendix M).

3.2.2.2 Placement of Final Cover

Final cover design is described above in Section 3.1.3.1. Prior to placement of the final cover, the final surface of waste will be covered with a minimum 12-inch-thick working surface layer placed and graded according to the design plans. The surface will be drum rolled to a smooth condition and surveyed at 100-foot intervals to establish the elevations of the surface prior to placement of the GCL. The working surface soil material will be obtained from an on- or off-site source, delivered using haul trucks, and spread with a dozer to prepare a smooth surface for the GCL. The working surface soil layer can be composed of waste soil provided it meets the requirements listed in the FOP Final Cover QA/QC Plan (Appendix M).

3.2.3 Construction Quality Assurance and Certification

The construction of the final closure components will be performed under guidance of the QA/QC procedures included in the FOP Final Cover QA/QC Plan (Appendix M). The Engineer, or his designated alternate, will be responsible for day-to-day observation and testing to verify that each component is constructed according to the design specifications and the FOP Final Cover QA/QC Plan.

4.0 POST-CLOSURE

In accordance with CAMU requirements, post-closure requirements will be implemented as necessary to protect human health and the environment. For areas where wastes will remain in place, post-closure care will include inspections, monitoring, and maintenance activities to ensure the integrity of the final covers, leachate collection system, and other FOP features. The length of the post-closure care period is 30 years from the date the final closure requirements are completed at either the North CAMU or the FOP waste areas, as applicable. The specific objectives of post-closure are to:

- Maintain the integrity and effectiveness of the final covers of the North CAMU and the FOP waste areas, including making repairs to the caps as necessary to correct the effects of settling, subsidence, erosion, or other events;
- Maintain the vegetative covers through periodic mowing, fertilization, and reestablishment of vegetation until it becomes self-sustaining;
- Prevent run-on and run-off from eroding or otherwise damaging the final covers of the North CAMU and the FOP waste areas;
- Maintain the integrity and effectiveness of the final covers the SDA, including making repairs and maintaining the vegetative covers;
- Maintain and operate the leachate collection and removal system in the North CAMU;
- Maintain and operate the groundwater monitoring system across the FOP.

This post-closure section includes the following information:

- The name, address, and telephone number of the office responsible for overseeing and/or conducting the post-closure care maintenance activities at the closed FOP during the post-closure period; and
- Descriptions of the monitoring and maintenance activities and the frequency at which these activities will be performed.

The RCA, North CAMU, Slag Landfill, NDA, and the SDA are referred to as the consolidated units for ease of reference.

4.1 Contact Information and Site Responsibility

The FOP is currently owned and operated by Exide. Exide will maintain responsibility for overseeing the post-closure care maintenance activities at the FOP. Exide will perform activities required by this closure and post-closure plan using personnel employed by Exide or contracted to them.

The following office will serve as the contact for post-closure care maintenance:

Former Exide Technologies Operating Plant
P.O. Box 250
Frisco, TX 75034
Telephone: (972) 335-2121

If no Exide staff are located at the FOP on a full-time basis following completion of all closure activities at the FOP, the following office will serve as the contact for post-closure care maintenance:

Exide Technologies
Attn: Mr. Brad Weaver, Non-producing properties
13000 Deerfield Parkway, Suite B100W
Milton, GA 30004
Telephone: (678) 566--9000

Exide will maintain the integrity and effectiveness of the final covers, FOP vegetation, and the drainage features during the post-closure period. Exide will correct any effects of settlement, subsidence, ponded water, erosion, or other events detrimental to the integrity of the consolidated units at the FOP. Exide will also take any actions necessary to prevent surface water run-on and run-off from eroding or otherwise damaging the final covers. The North CAMU's leachate collection system will be operated and maintained. Groundwater at the FOP will be monitored during the post-closure period. The following sections describe the ongoing activities that will be performed during the post-closure period, including the frequency of inspections, monitoring, and maintenance.

4.2 Post-Closure Inspections and Maintenance

Inspections shall be conducted by Exide-authorized personnel after significant storms, monthly, quarterly, semiannually, or annually, as indicated below. Items that will be inspected during the post-closure care period include the final covers of the consolidated units, the North CAMU's leachate collection and conveyance system, groundwater monitoring wells, survey reference marks, the flood wall, and general FOP conditions. These areas are described in the following subsections and documented on the Inspection Form and Repair Report Form, which are included as Appendix R. The North CAMU, the RCA, the Slag Landfill, the NDA, and the SDA will be inspected to ensure the cover and liner systems, as applicable, are protective of human health and the environment throughout the post-closure care period.

A Summary of Observations, Inspections, and Maintenance Actions is included as Table 1. The post-closure inspection schedule is summarized in Table 2. The frequency of inspections may be reduced if it can be demonstrated that a reduced frequency is sufficient to protect human health and the environment; but no reduction in the frequency of inspections will be implemented without prior approval from TCEQ.

Exide will maintain the right of entry to the closed FOP and will maintain all right-of-ways to allow access for monitoring, maintenance, and any remediation activities, should they be necessary. A fence will be installed following final closure activities and the fence and gates will be secured to prevent unauthorized entry into the FOP. The proposed fence location is shown on Figure 2. Damage to the fence or gates will be repaired as quickly as possible.

If damage, deterioration, or malfunction of any of the systems, components, or facilities is observed during an inspection, steps shall be initiated to rectify the problem. FOP personnel, or their designated contractor, will perform minor maintenance activities as needed. If more significant effort is required, the inspector shall contact Exide personnel to obtain an appropriate subcontractor. Inspectors should follow the procedures below to ensure that Exide is aware of problems and any defects are corrected.

The Exide-authorized inspectors will adhere to the following procedures for the correction of defects and remedial action follow-up:

- Complete periodic inspections repairs and note other recommended remedial actions on the Inspection Form.
- Within one day of inspection, notify an appropriate Exide representative of any outstanding issues and recommended actions. Submit the Inspection Form to the Exide representative.
- Within one week of the inspection, establish a schedule for any necessary remedial actions. If work to correct the defects has not been scheduled within one week of inspection, write a letter or memorandum to the inspection file stating the reasons for the delay.
- Document completion of the remedial action on Repair Report Form in the inspection file.

4.2.1 General Conditions

The following features of the FOP, including all capped areas should be inspected and noted on the Inspection Form:

- Signs of erosion, obstructions, or ponding on the exterior berm slopes and surface water control systems, including ditches and culverts;
- Access road conditions (i.e., potholes, washouts, ponding, or other deterioration);
- Conditions of the perimeter security fence, locks, gates, and signs (i.e., note any missing items, damage, or signs of tampering);
- Condition of emergency equipment (note any missing or damaged equipment);
- Length of grass throughout the capped areas. Grass length should be well maintained;
- Condition of the surveyed benchmarks (i.e., note any damages); and
- Signs of movement of the surveyed benchmarks.

Security devices, including chain-link fencing, gates, locks, and signs, will be maintained around the perimeter of the FOP or around the capped areas throughout the post closure care period, unless otherwise approved by TCEQ. Surveyed benchmarks will receive maintenance if damage or signs of movement are noted. The on-site access road will be inspected semiannually and maintained so that routine inspections can be performed. Any potholes or washouts of the road will be repaired and the road will be graded, as needed.

4.2.2 North CAMU Leachate Collection and Conveyance System

The leachate collection and conveyance system at the North CAMU will be inspected monthly. If the liquid level in the sump stays below the pump operating level for two consecutive months, the inspection frequency will be changed to quarterly. If the liquid level stays below the pump operating level for two consecutive quarters, then the inspection frequency will be changed to semiannually. The following should be inspected and noted on the Inspection Form:

- Flow rate in gallons per minute (gpm) and total flow in gallons through the LCS pumps
- Leachate levels in the enclosed collection sumps
- All exposed piping, conduit, and other facilities for apparent wear, damage or leakage
- Alarm and auto-dialer system receiving power
- Alarm system in working order
- Auto-dialer system in working order

Several leachate collection system components will require ongoing maintenance during the post-closure care period. The pumps will be removed and cleaned annually and will be replaced as needed during the post-closure care period. Sediment will be cleaned from the collection pipes and the enclosed sump by a high pressure jet cleaning contractor as needed.

If the liquid level in the sump stays below the pump operating level for two consecutive months, the amount removed will be recorded at least quarterly. If the liquid level stays below the pump operating level for two consecutive quarters, then the amount removed will be recorded at least semiannually.

Leachate removed from the sump the will be sampled for antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, and silver and will be disposed of as appropriate at an off-site facility.

4.2.3 Final Covers

The final covers of the North CAMU, the RCA, the Slag Landfill, the NDA, and the SDA will be inspected quarterly during the first two years of the post-closure care period and then at least semiannually thereafter. (The precise inspection schedule will be determined after an assessment is conducted at each unit at the end of two years). Inspections will be performed by walking the units to confirm positive drainage from the covers to the perimeter drainage features and to assess the condition of the covers. Any subsidence that significantly alters drainage from the cover will be corrected. Any areas that allow water to pond on the cover will be backfilled and revegetated. The inspector will look for evidence of erosion, subsidence, ponded water, animal burrows, cracks along the cover, and loss of soil. Any excessive erosion will be identified and corrected. Erosion over large areas will be backfilled and revegetated. The following should be noted on the Inspection Form:

- Rills, gullies, and crevices 6 inches or deeper in the vegetative soil layer
- Cover settling or subsidence that affects surface water runoff
- Reworked surfaces and areas with sparse or eroded vegetation in excess of 100 square feet cumulatively
- Brush, trees, or similar invasive vegetation with tap roots growing in areas not designated for this type of vegetation
- Evidence of burrowing or other cover disturbance by burrowing animals
- Effectiveness of stormwater drainage features

Reports documenting the quarterly final cover inspections of the final covers will be submitted semiannually during the first two years of the post-closure care period. In consultation with TCEQ, the units will be assessed two years after FOP closure to determine whether to continue with quarterly inspections or whether semiannual inspections are appropriate.

The vegetative surface will be mowed after initial establishment of the planted species on the final covers. Mowing is assumed to occur twice a year. Any areas with rills and gullies greater than 6 inches in depth will be filled with soil and the vegetation re-established. Settlement, subsidence, or displacement of the two consolidated units will be corrected. Temporary erosion and sediment control measures will be employed on steep slopes to enhance restoration of the restored surfaces.

4.2.4 Groundwater Monitoring System

The groundwater monitoring system is described in Section 4.3.2 below. Post-closure inspections will include visual checks of the physical integrity of the groundwater monitoring wells. Inspections of each well will be performed at least semiannually during sampling activities and will include checks of the protective casing, padlock, and concrete pad. The following will be inspected and noted on the Inspection Form to document the conditions of the groundwater monitoring wells:

- Integrity of the protective casing
- Presence of locks, their functionality/condition, and any signs of tampering
- Ground surface seal integrity
- Accumulation of surface water and drainage around the well

Groundwater monitoring well maintenance activities include keeping the locks in operating condition or replacing them; maintaining the structural integrity of the concrete bollards that protect the wells; replacing the surface components of the wells that become compromised, such as the ground surface seal and protective casing; and redeveloping the well as needed to maintain the full monitoring depth.

If the protective casing appears to be damaged, a qualified geologist or engineer will inspect the damage to determine the appropriate actions to be taken. Any missing padlocks will be replaced and the losses will be recorded. The well will be inspected for evidence of tampering or vandalism. If cracks wider than 1/4-inch develop in a concrete pad, the cracks will be repaired or the concrete base replaced. Some of the monitoring wells may need to be replaced periodically.

4.2.5 Surface Water Management

Surface water management features at the FOP will receive maintenance in accordance with the proposed inspection schedule. Typical activities that will occur include repair of drainage ditches that have experienced erosion by re-grading the surface and restoring channel linings, repair of erosion and sediment control devices to their original condition, and removal of obstructions found in culverts and drainage conveyance pipes. The stormwater retention pond will also be inspected to ensure that it is functioning properly and in good condition.

4.2.6 Flood Wall

The flood wall will be inspected at the same time as periodic inspection of the RCA final cover. The condition of waterstops and joint filters will be assessed to ensure they are in good condition, and the flood wall will be inspected for signs of seepage through the wall, cracks, and other signs of damage. The area along the flood wall will be inspected for any signs of seepage, settlement, sand boils, saturated soil areas, or other damage. The area along the flood wall will also be inspected for high vegetation (trees or high brush), any accumulations of trash or debris, any bank erosion/caving that would endanger wall stability. Additional inspection protocols for the flood wall are addressed in the Exide Frisco Recycling Facility French Drain Monitoring Plan (Golder 2014b).

4.2.7 Permeable Reactive Barrier

Maintenance activities associated with the funnel and gate PRB (other than for monitoring wells discussed above) would include rejuvenation of the PRB if breakthrough is indicated. No other maintenance is required outside of groundwater monitoring (see the RAP included as Attachment M to the Part B RCRA Permit Renewal Application for additional information).

4.3 Monitoring

4.3.1 North CAMU Leachate Monitoring

The purposes of leachate monitoring are to provide long-term data on the quantity of leachate generated within the North CAMU and to maintain head levels below 12 inches on the liner under design conditions. Knowledge of leachate quantity and levels is necessary to evaluate the effectiveness of the North CAMU design and construction and to schedule timely removal of leachate from the enclosed sumps. Records of leachate quantities removed will be maintained in the FOP records. The leachate collection system will be operated until leachate is no longer detected in the sumps.

As described in Section 2.1.3.2, high-level alarms will be installed to signal when the enclosed collection sump is approaching the 1-foot maximum operating level. The high-level alarm consists of a level sensor installed 1 foot above the liner. A visual indicator will be activated when the submersible pump is running.

The manual procedure for measuring the leachate level in the enclosed sumps is to use a water level indicator attached to a weighted, wheeled device. This device is rolled down the side of the enclosed sump riser pipe until it contacts leachate. The distance to the leachate as shown on the indicator or tape is recorded on a field form. The distance to the leachate, the known elevation of the lower lip of the riser pipe at the cell crest, the top of liner elevation adjacent to the enclosed sump, and the angle of the riser pipe are then used to calculate the depth of the leachate on the liner. Leachate levels will be measured quarterly or more frequently on an as-needed basis. Other methods may be used to measure leachate levels as appropriate.

As described in Section 4.2.1.2, leachate removed from the sump will be sampled for antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, and silver and will be disposed of as appropriate at an off-site facility.

4.3.2 Groundwater Monitoring

The groundwater monitoring programs for the North CAMU and for the rest of the FOP are described separately below.

4.3.2.1 North CAMU Groundwater Monitoring

As required by 30 TAC 335.157, the Revised Class 2 Landfill Groundwater Monitoring Plan by Pastor, Behling & Wheeler (PBW) dated July 31, 2013, (PBW 2013) serves as the detection monitoring plan (North CAMU Detection Monitoring Plan) for the North CAMU (included as Attachment K of the May 2019 supplement to the hazardous waste permit renewal application). As described in the North CAMU Detection Monitoring Plan and subsequent correspondence, the North CAMU monitoring well network consists of nine monitoring wells. The wells will be sampled quarterly for two years (and semi-annually thereafter) for total and dissolved selenium, arsenic, cadmium, and lead. Additional groundwater samples will be collected on an annual basis to be analyzed for other constituents including total and dissolved barium, chromium, mercury, silver, antimony, copper, and zinc. Groundwater well sampling procedures, testing parameters, and reporting requirements are further described in the North CAMU Detection Monitoring Plan. In addition to the wells described in the North CAMU Detection Monitoring Plan, additional wells near the North CAMU will be monitored at the same frequency for arsenic and selenium as part of the FOP Response Actions (Plume Management Zone) monitoring described in Attachment M to the Part B Permit Renewal Application.

4.3.2.2 FOP Groundwater Monitoring

The proposed groundwater monitoring plan for the FOP, excluding the North CAMU, is included in Attachment L of the May 2019 supplement to the hazardous waste permit renewal application (FOP Groundwater Monitoring Plan). The FOP groundwater sampling is being performed as part of corrective action groundwater monitoring since constituents of concern have already been detected in the groundwater at the FOP, and corrective action for groundwater is being performed in accordance with the FOP RAP, which is submitted as Attachment M to the May 2019 Part B permit renewal application. Sampling will be conducted quarterly for the first two years following FOP closure and semiannually thereafter. Samples will be analyzed for total and dissolved lead, arsenic, cadmium, selenium, and antimony. The groundwater well sampling procedures, testing parameters, and reporting requirements are described in detail in the FOP Groundwater Monitoring Plan.

5.0 RECORDKEEPING AND REPORTING

A copy of the 1995 Notification, this Final Closure Plan (including all Appendices), and any other required plans or related documents shall be maintained at the Exide trailer at the FOP or an alternate location specified by Exide and approved by the TCEQ Executive Director.

In addition to the documents specified above, the following information will also be recorded and retained in the FOP records within seven working days of completion or receipt:

- Inspection records, training procedures, and notification procedures relating to excluding the disposal of prohibited waste
- Unit design, certification, findings, monitoring, testing, and analytical data relating to groundwater monitoring and corrective action
- Monitoring, testing, or analytical data related to post-closure requirements
- Copies of correspondence and responses relating to the operation of the facility, modifications to the permit, approvals, and other matters pertaining to technical assistance
- Other document(s) as specified by the approved permit or by the executive director

Exide Technologies shall place all information specified above in the FOP records and maintain the records in an organized format which allows the information to be easily located and retrieved.

A semiannual report documenting the post-closure care inspections will be consolidated with other semiannual reports, as appropriate, and submitted to TCEQ.

6.0 CLOSING

Golder appreciates the opportunity to assist Exide with this project. Please contact the undersigned if you have any questions or comments regarding this Closure Plan.

Sincerely,

GOLDER ASSOCIATES INC.

Anne M. Faeth-Boyd, P.G.
Associate and Senior Engineer

Jeffrey B. Fassett, P.E.
Associate

STATE OF TEXAS
5/31/19
JEFFREY B. FASSETT
85675
LICENSED
PROFESSIONAL ENGINEER

GOLDER ASSOCIATES INC.
TEXAS REGISTRATION F-2578

7.0 REFERENCES

Exide Technologies (Exide) 2012. Results of Class 2 Non-Hazardous Waste Landfill Investigation Exide Technologies, Inc., North Landfill, Frisco, Texas. March 2012.

Golder 2014a. Affected Property Assessment Report. May 2014.

Golder 2014b. Exide Frisco Recycling Facility French Drain Monitoring Plan. June 2014.

Golder 2016a. Class 2 Landfill CAMU Final Closure Plan. January 14, 2016.

Golder 2016b. Leachate Collection System, Cells 13-15, Class 2 Landfill Corrective Action Management Unit, Former Exide Frisco Recycling Facility. October 20, 2016.

Golder 2016c. Class 2 Landfill CAMU Compliance Monitoring Sampling and Analysis Plan. October 2016.

Golder 2017. LMW-22 Arsenic Exceedance Response – Class 2 Landfill Groundwater Monitoring; Exide Frisco Recycling Center – Frisco, Texas. February 10, 2017.

Pastor, Behling & Wheeler (PBW) 2013. Revised Class 2 Landfill Groundwater Monitoring Plan. July 31, 2013.

TCEQ 2014. Approval with Modifications, Class 2 Landfill Groundwater Monitoring Plan. April 4, 2014.

TCEQ 2017. Acknowledgment of Receipt and Notice to Proceed, LMW-22 Arsenic Exceedance Response dated February 10, 2017. March 1, 2017.

United States Environmental Protection Agency (EPA) 2002. Amendments to the Corrective Action Management Unit Rule; Final Rule. January 22, 2002.

TABLES

Table 1: Summary of Observations, Inspections, and Maintenance Actions
Exide Technologies Frisco Recycling Center

Observations and Inspections	Maintenance Action
General Facility Components	
Exterior berm slopes erosion	Scarify, fill, re-grade, compact, and re-vegetate
Access road ponding or washout	Scarify, fill, re-graded, compact, and re-pave
Surface water control system obstruction	Re-grade and re-vegetate, remove obstructions
Missing lock	Replace
Safety and Emergency Equipment	Repair or replace
Fence damage	Repair or replace
Gates damage	Repair or replace
Sign damage	Repair or replace
Surveyed benchmarks	Repair or replace
Final Cover Systems	
Erosion	Add topsoil, re-grade, and re-vegetate
Minor cover settlement (less than 6 inches over 20 feet)	Scarify, rill, re-grade, compact, and add topsoil
Major cover settlement (greater than 6 inches over 20 feet)	Contact a Professional Engineer
Ponded water	Scarify, rill, re-grade, compact, and add topsoil
Sparse or eroded vegetation	Re-grade, add topsoil, and re-seed
Invasive vegetation	Remove roots and vegetation, re-grade, add topsoil, and re-seed
Burrowing animals	Fill in burrows and limit animal access
Length of grass	Mow twice a year
Surface Water Drainage Systems	
Erosion of ditches	Fill with topsoil, re-grade, and re-seed
Erosion and sediment control devices	Repair to original condition
Culverts and conveyance pipes blockage	Clear blockage
Excessive vegetation height	Mow
Ponded water	Scarify, rill, re-grade, compact, and re-seed
Storm Water Pond	Repair
North CAMU Leachate Collection System	
Inoperative pump	Repair or replace
Pump house damage	Repair
Sump riser and leachate pipe connections	Repair or replace
Riser cap missing	Replace
Riser cracked	Contact a Professional Engineer for evaluation
Alarm system or auto-dialer not working	Repair or replace
Groundwater Monitoring Systems	
Protective casing damage	Contact a Professional Geologist or Professional Engineer
Locks	Repair or replace
Damaged ground surface seal	Repair or replace
Accumulation of surface water around well	Fill, compact, re-grade, and add soil
Damaged concrete pad and bollards	Repair or replace

Flood Wall	
Waterstops and joint fillers	Repair or replace
Seepage through flood wall	Repair
Sand boils or saturated soils	Repair
Settlement	Repair
Cracks or other damage to flood wall	Repair
Trash or debris	Remove
Vegetation	Remove
Erosion	Repair

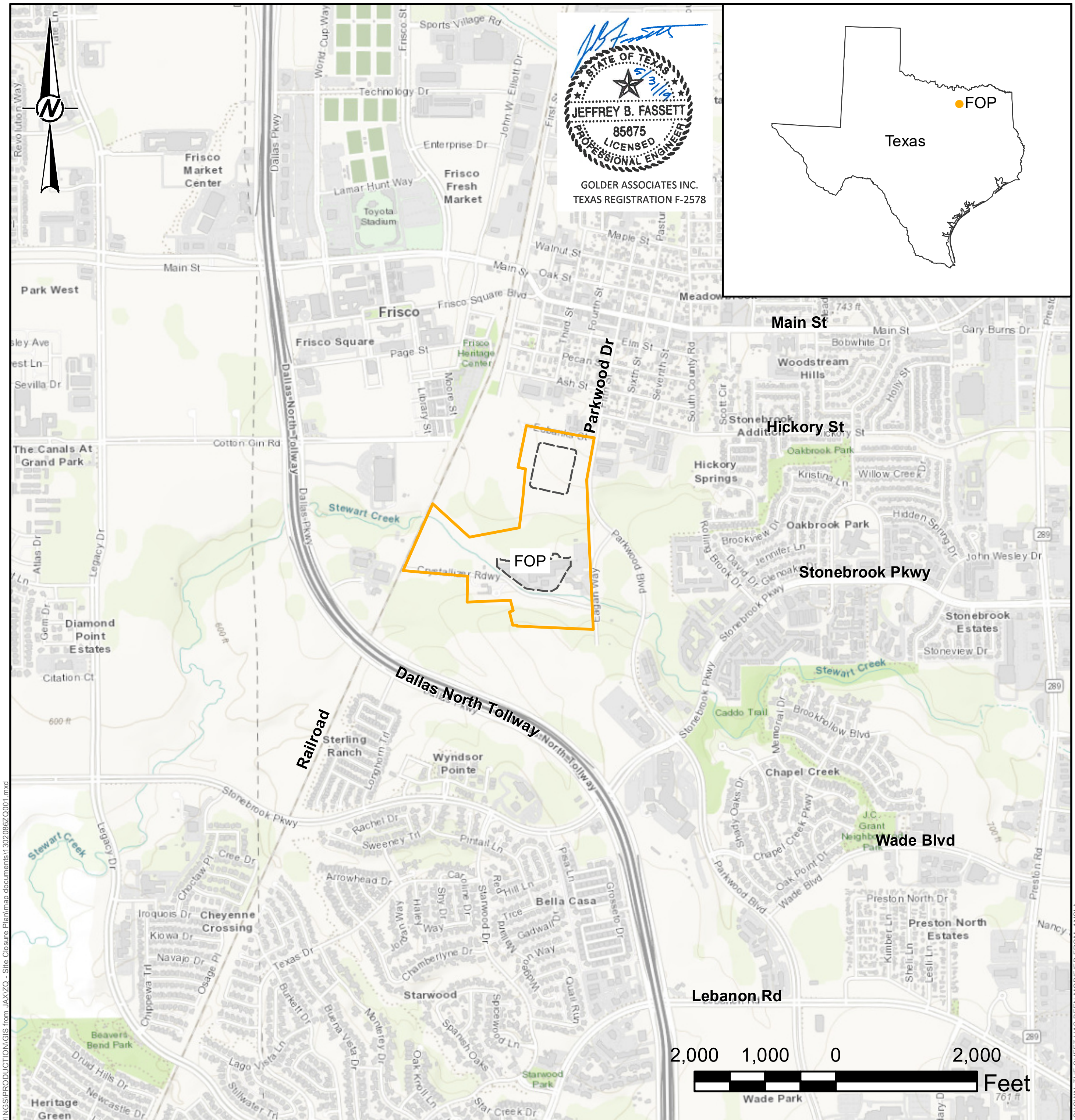
Table 2: Post-Closure Inspection Schedule
Exide Technologies Frisco Recycling Center

Facility Component	Inspection Item	Inspection Frequency			
		Monthly	Quarterly	Quarterly for 2 Years then Semi-annually	Semi-annually
General Conditions	Exterior berm slopes and surface water control systems including ditches and culverts			X	
	Access road on berm			X	
	Signs, security fence, and gates			X	
	Safety and Emergency Equipment			X	
	Surveyed benchmarks			X	
Final Cover Systems	Surface erosion, rills, gullies, and crevasses			X	
	Cover settlement or subsidence			X	
	Water on landfill surface			X	
	Sparse or eroded vegetation			X	
	Invasive vegetation			X	
	Cover disturbance by burrowing animals			X	
	Grass			X	
Surface Water Management	Ditches			X	
	Erosion and sediment control devices			X	
	Culverts and conveyance pipes			X	
	Grass			X	
	Surface water drainage			X	
	Storm Water Pond				
North CAMU Leachate Collection Conveyance System	Pumps and pump house	X			
	Collection sumps	X			
	Exposed piping, conduit, and appurtenances	X			
	Riser cracked	X			
	Alarm system and auto-dialer system	X			
Groundwater Monitoring Systems	Protective casing		X		X
	Locks		X		X
	Ground surface seal		X		X
	Accumulation of surface water		X		X
	Concrete pad and bollards		X		X
Flood Wall	Waterstops and joint fillers			X	
	Seepage through flood wall			X	
	Sand boils or saturated soils			X	
	Settlement			X	
	Cracks or other damage to flood wall			X	
	Trash or debris				X
	Vegetation				X

Notes

- Final cover systems, drainage systems, and general facility components will be inspected quarterly for the first two years following final closure and then at least semiannually. The exact inspection schedule will be determined after an assessment is conducted at the end of two years. If a problem is identified, the required maintenance action may be followed by one or more additional inspections to ensure the correct action has been taken to alleviate the problem.
- The North CAMU leachate collection system will be inspected after a storm, monthly, quarterly or semiannually as described in the Closure Plan. Pumps will be cleaned annually.
- The groundwater monitoring system will be inspected at least semiannually during sampling activities and will include checks of the protective casings, padlocks, and concrete pads. The North CAMU and RCA groundwater monitoring network wells may be inspected more frequently during the compliance period.

FIGURES



LEGEND

Approximate RCRA Permitted Boundary

REFERENCE

1.BASE MAP - SOURCES: ESRI, HERE, DELORME, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER

CLIENT
EXIDE TECHNOLOGIES

PROJECT
FRISCO RECYCLING CENTER FINAL CLOSURE PLAN

TITLE
FORMER OPERATING PLANT LOCATION MAP

CONSULTANT

GOLDER

YYYY-MM-DD	2019-05-30
PREPARED	EFT
DESIGN	CDS
REVIEW	EPW
APPROVED	AMF

PROJECT No.	CONTROL	Rev.	FIGURE
13-02086-06	1302086ZQ001.mxd	0	1

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LEGEND

- Surface Water Centerline
- Remediation Consolidation Area
- Disposal Area
- Approximate North CAMU Extent
- Former Operating Plant Property Boundary
- Former Undeveloped Buffer Property
- Proposed Fenced Area
- Proposed Flood Wall

STATE OF TEXAS
JEFFREY B. FASSETT
85675
LICENSED
PROFESSIONAL ENGINEER

GOLDER ASSOCIATES INC.
TEXAS REGISTRATION F-2578

300 150 0 300
Feet

REFERENCE

1. SITE FEATURES - GOLDER, 2014
2. AERIAL IMAGERY - SOURCE: ESRI, DIGITALGLOBE, GEOEYE, I-CUBED, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEX, GETMAPPING, AEROGRID, IGN, IGP, SWISSTOPO, AND THE GIS USER COMMUNITY

CLIENT
EXIDE TECHNOLOGIES

PROJECT
FRISCO RECYCLING CENTER FINAL CLOSURE PLAN

TITLE
FORMER OPERATING PLANT LAYOUT MAP

CONSULTANT
GOLDER

YYYY-MM-DD	2019-05-30
PREPARED	EFT
DESIGN	DGC
REVIEW	EPW
APPROVED	AMF

PROJECT No.	CONTROL	Rev.	FIGURE
13-02086-06	1302086ZQ002.mxd	0	2

LEGEND

- North CAMU Detection Monitoring Well
- North CAMU Detection/Corrective Action Monitoring Well
- North CAMU Corrective Action Monitoring Well
- SDA Detection Monitoring Well
- FOP Corrective Action Monitoring Well
- Existing Wells to be Decommissioned
- Piezometer Location
- Sump Reactor Monitoring Point
- Surface Water Centerline
- Disposal Area
- Proposed PRB (Gate) Location
- Proposed Slurry Wall Locations
- Proposed Sheet Pile (Funnel) Location
- Remediation Consolidation Area
- Approximate North CAMU Extent
- Approximate RCRA Permitted Boundary

STATE OF TEXAS
JEFFREY B. FASSETT
85675
LICENSED PROFESSIONAL ENGINEER

GOLDER ASSOCIATES INC.
TEXAS REGISTRATION F-2578

300 150 0 300
Feet

REFERENCE

1. SITE FEATURES - GOLDER, 2014
2. AERIAL IMAGERY - SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY AND SITE AERIAL IMAGERY PROVIDED BY DALLAS AERIAL SURVEY DATED APRIL, 2017
3. * - PROPOSED NEW MONITORING WELL/PIEZOMETER LOCATION, NOT YET INSTALLED

CLIENT
EXIDE TECHNOLOGIES

PROJECT
RCRA PERMIT RENEWAL

TITLE
PROPOSED GROUNDWATER MONITORING WELL NETWORK

CONSULTANT
GOLDER

YYYY-MM-DD	2019-05-30
PREPARED	EFT
DESIGN	BEF
REVIEW	EPW
APPROVED	AMF

PROJECT No.	CONTROL	Rev.	FIGURE
13-0208606	1302086ZQ003.mxd	0	3

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APPENDIX A

AGREED ORDER

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

April 24, 2015

FIRST CLASS MAIL

Matthew A. Love, Director
Exide Technologies
P.O. Box 14294
Reading, Pennsylvania 19612-4294

Aileen Hooks, Attorney
Baker Botts L.L.P.
98 San Jacinto Boulevard, Suite 1500
Austin, Texas 78701-4297

RE: Exide Technologies
TCEQ Docket No. 2013-2207-IHW-E; Registration No. 30516
Agreed Order Assessing Administrative Penalties and Requiring Certain Action

Enclosed is a copy of an order issued by the Commission.

Questions regarding the order should be directed to the Texas Commission on Environmental Quality's Enforcement Division at (512) 239-2545 or the Litigation Division at (512) 239-3400. If there are questions pertaining to the mailing of the order, then please contact Leslie Gann of the Office of the Chief Clerk at (512) 239-3319.

Sincerely,

Bridget C. Bohac

Bridget C. Bohac
Chief Clerk

BCB/lg

Enclosure

cc: Lena Roberts, Staff Attorney, TCEQ Litigation Division
Sam Barrett, Regional Contact, TCEQ Regional Office
Thomas Greimel, Enforcement Coordinator, TCEQ Enforcement Division

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

THE STATE OF TEXAS
COUNTY OF TRAVIS
I HEREBY CERTIFY THAT THIS IS A TRUE AND CORRECT COPY OF A TEXAS COMMISSION ON ENVIRONMENTAL QUALITY DOCUMENT, WHICH IS FILED IN THE PERMANENT RECORDS
APR 24 2015
OF THE COMMISSION. GIVEN UNDER MY HAND AND THE SEAL OF OFFICE ON
Bridget C. Bohac
BRIDGET C. BOHAC, CHIEF CLERK
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

IN THE MATTER OF AN ENFORCEMENT ACTION CONCERNING EXIDE TECHNOLOGIES RN100218643	§ § § § §	**BEFORE THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY**

AGREED ORDER
DOCKET NO. 2013-2207-IHW-E

At its APR 15 2015 agenda, the Texas Commission on Environmental Quality ("the Commission" or "TCEQ") considered this agreement of the parties (as defined below), resolving an enforcement action regarding Exide Technologies ("Respondent") under the authority of TEX. HEALTH & SAFETY CODE ch. 361 and TEX. WATER CODE ch. 7. The Executive Director of the TCEQ, through the Enforcement Division, and Respondent, represented by Ms. Aileen Hooks of the law firm of Baker Botts L.L.P. (collectively, the "parties"), presented this agreement to the Commission.

Respondent understands that it has certain procedural rights at certain points in the enforcement process, including, but not limited to, the right to formal notice of violations, notice of an evidentiary hearing, the right to an evidentiary hearing, and a right to appeal. By entering into this Order, Respondent agrees to waive all notice and procedural rights associated with the entry of this Order.

It is further understood and agreed that this Order represents the complete and fully-integrated settlement of the parties. The duties and responsibilities imposed by this Order are binding upon Respondent.

The Commission makes the following Findings of Fact and Conclusions of Law:

I. FINDINGS OF FACT

1. Respondent owns a property located at 7471 South 5th Street in Frisco, Collin County, Texas, on which it formerly operated a lead and lead bearing waste reclamation facility (the "Facility"). The Facility consists of several waste management units, one of which is a Class 2 landfill (Notice of Registration ("NOR") waste management unit 012) and

formerly included recycling units. The enforcement actions related to this Order do not include the property enrolled in the TCEQ Voluntary Cleanup Program, VCP No. 2541.

2. The Facility involves or involved the management of industrial solid waste and industrial hazardous waste ("IHW") as defined in TEX. HEALTH & SAFETY CODE ch. 361 and 30 Tex. Admin. Code ch. 335, and is subject to IHW Permit No. 50206, for the storage and processing of hazardous waste (the "Permit") and ISWR No. 30516 for the management of industrial solid waste.

3. An investigation was conducted beginning with a site visit on February 13, 2013, while Respondent was in the process of shutting down its operations, and included a review of documents provided by Respondent on April 11, 2013, regarding the Class 2 landfill. Based on the site visit and document review, TCEQ staff documented that Respondent:

   a. Failed to obtain a permit or other authorization and meet the requirements for storage of hazardous waste in waste piles. Specifically, in two waste piles, consisting of treated slag ("Treated Slag Piles") located within the east and west sides of the Class 2 landfill, Respondent stored waste, a portion of which did not meet land disposal restriction ("LDR") universal treatment standards ("UTS") and/or was characteristically hazardous for lead, without a permit and without meeting the requirements for storage of hazardous waste in a waste pile;

   b. Failed to obtain a permit to store hazardous waste. Specifically, Respondent stored super sacks containing waste characteristically hazardous for lead and cadmium in the former Battery Breaker Area, which is not a permitted container storage area ("CSA");

   c. Failed to limit waste storage and management in a permitted unit to authorized wastes. Specifically, Respondent stored and managed super sacks containing waste characteristically hazardous for lead and/or cadmium in the former Battery Receiving and Storage Area, which is a permitted CSA but not authorized to store this particular waste;

   d. Failed to label hazardous waste containers with the beginning date of accumulation and with the words "Hazardous Waste." Specifically, Respondent failed to timely label super sacks containing waste characteristically hazardous for lead and/or cadmium in the Battery Breaker Area and the Battery Receiving and Storage Area;

   e. Failed to obtain a permit or other authorization for disposal and failed to meet the LDR UTS for hazardous waste. Specifically, on April 11, 2013, Respondent provided analytical results of samples of treated blast furnace slag disposed of in cells 1 through 9 of the Class 2 landfill at the Facility, which included some results that exceeded the Toxicity Characteristic Leaching Procedure ("TCLP") concentration of 5.0 mg/l for lead and the UTS of 0.75 mg/l for lead; and

f. Failed to conduct a proper hazardous waste determination or waste classification and failed to completely characterize waste for the purpose of meeting LDRs. Specifically, Respondent provided analytical results of treated blast furnace slag that was disposed of in cells 1 through 9 of the Class 2 landfill and placed in the Treated Slag Piles on the east and west sides of the Class 2 landfill that did not consistently include analyses for cadmium.

4. Respondent received notice of the violations on September 27, 2013.

5. The Facility is located in the portion of Collin County that is an air quality non-attainment area for lead.

6. Site investigations have identified lead as a chemical of concern in Facility soils.

7. The Executive Director recognizes that:

a. On or about December 1, 2012, Respondent began the process of decommissioning the Facility. Respondent completed demolition of the lead and lead bearing waste reclamation facility, including the Battery Receiving and Storage Area and the Battery Breaker Area, by August 20, 2013;

b. Respondent shipped all super sacks identified as containing treated blast furnace slag characteristically hazardous for lead and/or cadmium offsite for treatment and disposal by March 1, 2013;

c. Respondent appropriately labeled the super sacks by February 14, 2013;

d. On June 10, 2013, Respondent filed a petition for bankruptcy relief pursuant to Chapter 11 of the United States Code ("U.S.C.");

e. Respondent submitted a sampling plan for the Treated Slag Piles on July 3, 2014 (such sampling plan, upon approval by the Executive Director, the "Sampling and Analysis Plan");

f. Based on Respondent's analysis of certain sample results, some of the waste in the Treated Slag Piles was removed and disposed of at an authorized facility on or about March 1, 2012; and

g. Respondent engaged a consultant to conduct an evaluation to assess the feasibility of and identify potential risks associated with Class 2 landfill closure scenarios and submitted the report by Golder Associates titled *Exide Class 2 Landfill Risk Evaluation of Remedial Alternatives, August 2014* to the TCEQ on August 25, 2014 ("Risk Evaluation").

8. The Class 2 landfill in its entirety is addressed by this Order. Accordingly, Ordering Provision No. 3.a. of TCEQ Agreed Order Docket No. 2011-1712-IHW-E should be terminated.

9. The Risk Evaluation states that the open and capped cells of the Class 2 landfill have a composite liner consisting of a 60-mil high density polyethylene ("HDPE") flexible membrane liner and 2.5-3.0 feet of compacted clay with a hydraulic conductivity of no more than $1x10^{-7}$ cm/sec.

10. The information provided by the Risk Evaluation satisfies the liner criteria for designation of the Class 2 landfill as a corrective action management unit ("CAMU").

11. The Risk Evaluation states that the Class 2 landfill has a leachate collection system that is designed to convey leachate to a sump, where it is then pumped to an above ground storage tank.

12. The information provided by the Risk Evaluation satisfies the leachate collection system criteria for designation of the Class 2 landfill as a CAMU.

13. The Risk Evaluation states that cells 1 through 9 have a cap that consists of one foot of soil, covered by three feet of compacted clay, covered by a 40-mil HDPE geomembrane, covered by 18 inches of vegetated topsoil.

14. The information regarding the cap on cells 1 through 9 of the Class 2 landfill, as provided by the Risk Evaluation, satisfies the cap criteria for designation of the Class 2 landfill as a CAMU.

15. The Risk Evaluation demonstrates that the concentrations of lead and cadmium in the waste currently located in cells 1 through 12 of the Class 2 landfill are protective of human health and the environment when properly contained in the Class 2 landfill. The Risk Evaluation further demonstrates the technical impracticability and the elevated short-term risk to human health and the environment associated with excavation and re-treatment of the waste currently located in cells 1 through 12 to the standards in 40 Code of Federal Regulations ("C.F.R.") § 264.522(e)(4)(iv).

16. The information provided by the Risk Evaluation satisfies the adjusted treatment standards for approval of the Class 2 landfill as a CAMU.

17. The Risk Evaluation considered available remedial alternatives and their impacts to human health and the environment and recommends the alternative that poses the least risk to human health and the environment, which is that the waste in the Class 2 landfill remain in place.

18. The Executive Director agrees with the conclusions of, and has approved, the Risk Evaluation.

19. Pursuant to its NOR and Permit, Respondent identified itself as a generator of industrial solid and hazardous waste and an owner/operator of a treatment, storage, or disposal facility with respect to the Facility.

20. According to reports submitted and the results of samples collected at the Facility there have been releases of industrial solid and hazardous wastes and/or hazardous constituents into the environment at the Facility.

21. Respondent generated industrial solid and hazardous waste with respect to the Facility.

22. Respondent generated, stored, processed, and/or disposed of industrial solid and hazardous waste at the Facility.

23. Industrial solid and hazardous waste and/or hazardous constituents identified in the reports and sample results associated with the Facility, if not properly managed, may pose an unacceptable risk to human health and/or the environment.

24. The Risk Evaluation supports the designation of the Class 2 landfill at the Facility as a CAMU, and such designation is a protective, effective, reliable and cost-effective method of managing the CAMU-eligible waste that remains at the Facility.

25. The following wastes are CAMU-eligible wastes that are authorized to be contained in the Class 2 landfill: the treated slag that currently exists in cells 1 through 12, waste in the Treated Slag Piles that meets Class 2 specifications, the re-treated slag that is currently contained in nine roll-off boxes located within the footprint of the Class 2 landfill at the Facility, and the Class 2 non-hazardous remediation waste associated with clean-up activities for VCP No. 2541 (J Parcel) and other Class 2 remediation waste approved in the Final Closure Plan.

26. The information in the Risk Evaluation provides support for the conclusion that the Class 2 landfill satisfies all applicable regulatory criteria for its designation as a CAMU under 30 TEX. ADMIN. CODE ch. 335 and 40 C.F.R. § 264.552(c).

II. CONCLUSIONS OF LAW

1. Respondent is subject to the jurisdiction of the TCEQ pursuant to TEX. HEALTH & SAFETY CODE ch. 361 and the rules of the Commission.

2. As evidenced by Finding of Fact No. 3.a., Respondent failed to obtain a permit or other authorization and meet the requirements for storage of hazardous waste in waste piles, in violation of 30 TEX. ADMIN. CODE §§ 335.2, 335.43, 335.152(a)(10) and 335.431; 40 C.F.R. §§ 264.13, 264.250, 264.251, 264.252, 264.253, 264.254, 264.258, 268.50(a) and 268.50(c); and IHW Permit No. 50206, General Facility Standards, C.1.d.

3. As evidenced by Finding of Fact No. 3.b., Respondent failed to obtain a permit or other authorization to store hazardous waste, in violation of 30 TEX. ADMIN. CODE §§ 335.2 and 335.43; and IHW Permit No. 50206, General Facility Standards, C.1.d.

4. As evidenced by Finding of Fact No. 3.c., Respondent failed to store and manage authorized waste in a permitted unit, in violation of 30 TEX. ADMIN. CODE § 335.152; and IHW Permit No. 50206, Wastes and Waste Analysis, B.1, B.4 and C.1.f.

5. As evidenced by Finding of Fact No. 3.d., Respondent failed to label hazardous waste containers with the beginning date of accumulation and with the words "Hazardous Waste," in violation of 30 TEX. ADMIN. CODE § 335.69(a)(2) and (a)(3) and 40 C.F.R. § 262.34(a)(2) and (a)(3).

6. As evidenced by Findings of Fact No. 3.e., Respondent failed to obtain a permit for disposal of hazardous waste and meet the LDR UTS for that waste, in violation of 30 TEX. ADMIN. CODE §§ 335.2 and 335.431 and 40 C.F.R. §§ 268.34(b) and 268.40.

7. As evidenced by Findings of Fact No. 3.f., Respondent failed to conduct a proper hazardous waste determination and waste classification and completely characterize

waste for the purpose of meeting LDRs, in violation of 30 TEX. ADMIN. CODE §§ 335.62, 335.503(a), and 335.504 and 40 C.F.R. §§ 262.11.

8. Certain materials found at the Facility are industrial solid and/or hazardous waste, and/or hazardous constituents as defined by § 1004(5) of the Resource Conservation and Recovery Act ("RCRA"), § 3001 of RCRA, 40 C.F.R. Part 261, TEX. HEALTH & SAFETY CODE ch. 361, and 30 TEX. ADMIN. CODE ch. 335.

9. Industrial solid and/or hazardous waste, hazardous substances, and/or hazardous constituents were disposed of at the Facility.

10. There is and/or has been a release of industrial solid and/or hazardous wastes, and/or hazardous constituents into the environment from the Facility.

11. The Class 2 Landfill CAMU designated by this Order is consistent with RCRA and TEX. HEALTH & SAFETY CODE ch. 361 and is necessary to protect human health and/or the environment.

12. As evidenced by Findings of Fact Nos. 9 and 10, the Class 2 landfill's composite liner meets the CAMU requirements for liners, in accordance with 40 C.F.R. § 264.552(e)(3)(i).

13. As evidenced by Findings of Fact Nos. 11 and 12, the Class 2 landfill's leachate collection system meets the CAMU requirements for leachate collection systems, in accordance with 40 C.F.R. § 264.552(e)(3)(i).

14. As evidenced by Findings of Fact Nos. 13 and 14, the cap on cells 1 through 9 of the Class 2 landfill meets the CAMU requirements for a cap, in accordance with 40 C.F.R. § 264.552(e)(6)(iv).

15. Pursuant to 40 C.F.R. § 264.552(e)(4)(v) and as evidenced by Findings of Fact Nos. 15 and 16, the waste currently in cells 1 through 12 of the Class 2 landfill meets adjusted treatment standards when properly contained in the Class 2 landfill.

16. As evidenced by Finding of Fact No. 25, the materials to be consolidated or placed into the Class 2 landfill CAMU are "CAMU-eligible wastes," as defined by 40 C.F.R. § 264.552.

17. As required by 40 C.F.R. § 264.552(d), and as evidenced by Findings of Fact Nos. 9 through 18 and 24 through 26, the Risk Evaluation provides sufficient information to enable the TCEQ to designate the Class 2 landfill at the Facility a CAMU (Attachment A, "Planned Cap Extent") and to ensure that the criteria for this CAMU designation under 40 C.F.R. § 264.552 and 30 TEX. ADMIN. CODE ch. 335 have been satisfied.

18. Pursuant to TEX. WATER CODE § 7.051, the Commission has the authority to assess an administrative penalty against Respondent for violations of statutes within the Commission's jurisdiction; for violations of rules adopted under such statutes; or for violations of orders or permits issued under such statutes.

19. Pursuant to TEX. WATER CODE § 7.073, the Commission has the authority to assess an administrative penalty against Respondent and order Respondent to take corrective action.

20. As evidenced by Finding of Fact No. 7.d., Exide Technologies filed a petition for bankruptcy relief pursuant to Chapter 11 of the United States Code. The Automatic Stay imposed by the Bankruptcy Code [specifically, 11 U.S.C. Section 362(a)] does not apply to the commencement or continuation of an action or proceeding by a governmental unit to enforce such governmental unit's police or regulatory power, by virtue of the exception set out at 11 U.S.C. Section 362(b)(4). Accordingly, TCEQ [a governmental unit as defined under 11 U.S.C. Section 101(27)] is expressly excepted from the automatic stay in pursuing enforcement of the State's environmental protection laws, and in seeking to liquidate its damages for such violations. A Bankruptcy Rule 9019 Motion ("9019 Motion") has or will be filed with the U.S. Bankruptcy Court for the District of Delaware, in which the Debtor's bankruptcy case is pending (case number: 13-11482), requesting authorization for Exide's entry into this Order and approval of the compromise and settlement of this enforcement action, expressly conditioned on approval by the TCEQ Commissioners.

An administrative penalty in the amount of two million four hundred fifty-one thousand nine hundred eighty-four dollars ($2,451,984.00), is justified by the facts recited in this Order, and considered in light of the factors set forth in Tex. Water Code § 7.053.

III. ORDERING PROVISIONS

NOW, THEREFORE, THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY ORDERS that:

1. Respondent is assessed an administrative penalty in the amount of two million four hundred fifty-one thousand nine hundred eighty-four dollars ($2,451,984.00), as set forth in Section II, Paragraph 20 above, for violations of TCEQ rules and state statutes, such penalty to be treated and allocated as set forth in an order of the Bankruptcy Court approving such treatment and allocation. The assessment of this administrative penalty and Respondent's compliance with all the terms and conditions set forth in this Order completely resolve only the violations set forth by this Order in this action. However, the Commission shall not be constrained in any manner from requiring corrective actions or penalties for other violations that are not raised here. Payments for the portion of the administrative penalty determined by the Bankruptcy Court order approving the compromise to be entitled to administrative expense priority shall be made payable in accordance with the terms of that order.

2. Respondent shall undertake the following technical requirements:

    a. Immediately upon the effective date of this Order, implement procedures to ensure the use of waste handling practices that comport with 30 TEX. ADMIN. CODE chs. 330 and 335 during Facility closure and remediation;

    b. Conduct proper hazardous waste determinations and waste classifications and characterize waste generated during Facility closure and remediation for the purpose of meeting applicable LDRs, in accordance with 30 TEX. ADMIN. CODE

§§ 335.2, 335.62, 335.431, 335.503, and 335.504 and 40 C.F.R. § 262.11, 264.13, 268.7, 268.34, and 268.40;

c. Conduct all work associated with this Order in a manner that will employ good housekeeping practices and dust suppression measures that will minimize to the greatest extent practicable air emissions of particulate matter and lead. Respondent shall evaluate air monitoring data from the monitoring system and shall also use E-BAM monitors to monitor air quality while potentially dust generating work is being conducted. Respondent shall dedicate one person with the authority to stop work to monitor the E-BAM alarms, take 30-minute block readings from the E-BAM monitors, and monitor the wind direction and wind speed with a localized meteorological station. If sustained wind speed (the wind speed obtained by averaging the measured values over a ten-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. Multiple (three or more) E-BAM monitors shall be located in the vicinity of the Class 2 landfill according to wind direction, so as to adequately monitor air quality downwind of the work. Additionally, air samples shall be collected every other day, beginning with the first day of work, with high volume pumps that draw approximately 10 liters of air, and analyzed for metals concentrations, including lead and cadmium. Respondent will adhere to the following portions of the previously TCEQ approved (dated January 31, 2013, as revised) Perimeter Air Monitoring Plan for Response Actions at the Class 2 Non-Hazardous Waste Landfill ("Perimeter Air Monitoring Plan"): the procedures relating to stop-work levels for wind (p. 5), and the procedures and stop-work levels relating to "Initial Action Levels and Response," Table 1 (p. 9). Respondent shall also comply with the provisions of 30 Tex. Admin. Code § 106.533 (Air Quality Permit by Rule for Remediation);

d. Within 40 calendar days of the later of the (i) effective date of this Order, or (ii) the date Respondent receives approval of the Sampling and Analysis Plan from the Executive Director, initiate installation and maintain an interim cover consisting of either one foot of clean fill material or an HDPE membrane at least 8-mil thick and secured in place for cells 10 through 12 of the Class 2 landfill in order to minimize emissions of particulate matter and lead from the open areas of these cells; and

e. Within 15 days after completion of the installation of the interim cover required by Ordering Provision No. 2.d., submit the construction details of the interim cover and an operation and maintenance plan for the interim cover to the Executive Director for approval. Respondent shall respond to any comments or changes requested by the Executive Director concerning the interim cover and the operation and maintenance plan within 15 days of receiving such requests. The construction details and operation and maintenance plan shall be submitted to:

Industrial and Hazardous Waste Permits Section
Waste Permits Division, MC 126
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

with copies to:

Remediation Division, MC 225
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

Order Compliance Team
Enforcement Division, MC 149A
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

Waste Section Manager
Dallas/Fort Worth Regional Office
Texas Commission on Environmental Quality
2309 Gravel Drive
Fort Worth, Texas 76118-6951

f. With respect to the Treated Slag Piles:

i. Within 50 days of the later of (A) the effective date of this Order, or (B) the date Respondent receives approval of the Sampling and Analysis Plan from the Executive Director, implement the Sampling and Analysis Plan; and

ii. Within 80 days of the later of (A) the effective date of this Order, or (B) the date Respondent receives approval of the Sampling and Analysis Plan from the Executive Director, dispose of the Treated Slag Piles located within the east and west sides of the Class 2 landfill, utilizing dust suppression procedures that will minimize air emissions of particulate matter and lead. Such disposal may occur: (1) in the Class 2 landfill if the waste meets the definition of Class 2 waste in 30 TEX. ADMIN. CODE ch. 335, and/or (2) at a facility authorized to accept the waste, in accordance with the results of the Sampling and Analysis Plan. If any portion of the waste is placed in the Class 2 landfill, Respondent shall cover such waste daily with an interim cover consistent with that specified in Ordering Provision No. 2.d.

g. Within 75 days after the later of the (A) effective date of this Order, or (B) the date Respondent receives approval of the Sampling and Analysis Plan from the Executive Director, submit written certification in accordance with Ordering Provision No. 2.w. below, to demonstrate compliance with Ordering Provisions Nos. 2.a. through 2.f.

h. Within 120 days after the effective date of this Order, submit for Executive Director review and approval a Final Closure Plan for the Class 2 Landfill CAMU ("Final Closure Plan"), demonstrating how the Class 2 Landfill CAMU will be closed in accordance with 40 C.F.R. §§ 264.112 and 264.552. The Final Closure Plan shall include:

(1) The design criteria and basis of the final closure method(s) with detailed descriptions of both how the Class 2 Landfill CAMU will be closed and how such closure will be conducted to meet the requirements of 40 C.F.R. §§ 264.112 and 264.552 and Ordering Provision No. 2.h.(3);

(2) Detailed descriptions of groundwater monitoring, leachate collection, and storm water run-on and run-off control, and any other activity necessary to ensure that such closure meets the elements of 40 C.F.R. §§ 264.112 and 264.552;

(3) Detailed final engineering design plans for the cap to be installed on cells 10-15. The cap shall comply with the requirements of 40 C.F.R. § 264.552 and shall be fully integrated with the existing cap over cells 1-9 so as to provide a unified cap over the entire landfill. For cells 10-15, the cap shall, at a minimum, consist of a multi-layer final cover system ("MLFCS") as follows:

i. A 3-foot thick layer of compacted clay or an equivalent geosynthetic clay liner ("GCL") system;

ii. A geomembrane as approved by the Executive Director installed over the compacted clay (or GCL) surface;

iii. A geotextile will be placed on top of the geomembrane;

iv. A 1.5-foot thick layer of general clean fill material will be placed on top of the geotextile; and

v. A 1.5-foot thick layer of topsoil would then be placed above the general clean fill layer and hydroseeded;

(4) A quality assurance/quality control plan to be followed during implementation of the final closure method(s);

(5) A description of waste management practices to be followed during implementation of the final closure method(s), including removal and decontamination of equipment and devices used in the CAMU waste management and closure activities;

(6) Contingency plans and procedures to be followed during implementation of the final closure method(s);

(7) Detailed operation and maintenance plans;

(8) Detailed monitoring plans, including air monitoring and dust suppression plans, for the final closure method(s);

(9) An implementation and activity schedule for the final closure method(s); and

(10) A copy of the Risk Evaluation referenced in Finding of Fact No. 7.

i. Within 120 days after the effective date of this Order, publish the Final Closure Plan on the Exide Technologies Frisco Recycling Center Closure community notice website, currently located at http://www.exidefriscoclosure.com, and provide the opportunity to submit written comments on the Final Closure Plan for a period of 30 days after the plan is published.

j. Within 120 days after the effective date of this Order, publish notice of the Final Closure Plan in a newspaper that serves the community in which the Facility is located and provide the opportunity to submit written comments on the Final Closure Plan for a period of 30 days after the notice is published.

k. Within 30 days after the end of the comment period in Ordering Provisions Nos. 2.i. and 2.j., prepare and submit to the Executive Director a response to the public comments received regarding the Final Closure Plan. Such response shall be simultaneously published on the Exide Technologies Frisco Recycling Center Closure community notice website, referenced in Ordering Provision No. 2.i.

l. Any samples of waste and environmental media collected pursuant to this Order shall be collected and analyzed in accordance with the latest edition of EPA Guidance SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, or other agency-approved methods.

m. Any engineered designs and/or plans submitted to the TCEQ pursuant to this Order shall be sealed by a Professional Engineer licensed by the State of Texas.

n. Any geological designs, reports, and/or plans submitted to the TCEQ pursuant to this Order shall be sealed by a Professional Geologist licensed by the State of Texas.

o. Financial assurance for closure and post closure for the Class 2 landfill is required to be posted by September 7, 2015, in the amount of nine hundred thousand dollars ($900,000.00) for closure and nine hundred thousand dollars ($900,000.00) for post-closure care. To the extent one or more approved financial assurance mechanisms are not already in place for the closure and post-closure care for the Class 2 landfill, provide financial assurance for the remaining amount for closure and/or post-closure care, as applicable, by September 7, 2015. The financial assurance mechanisms shall be in an amount sufficient to cover the cost of implementation of the proposed final closure method(s) by a third party and any requisite post-closure care, and shall be a financial assurance mechanism approved by the TCEQ that complies with applicable provisions of 30 Tex. Admin. Code chs. 37 and 335. The financial assurance mechanism shall be submitted to:

Financial Assurance Team
Revenue Operations Section, Financial Administration Division, MC 184
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

with copies to:

Industrial and Hazardous Waste Permits Section
Waste Permits Division, MC 126
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

Remediation Division, MC 225
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

Order Compliance Team
Enforcement Division, MC 149A
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

Waste Section Manager
Dallas/Fort Worth Regional Office
Texas Commission on Environmental Quality
2309 Gravel Drive
Fort Worth, Texas 76118-6951

p. The Executive Director will review the Final Closure Plan. During this review, Respondent shall respond completely and adequately, in good faith, to any comments or changes requested by the Executive Director concerning the submitted Final Closure Plan within ten business days after the date of such requests, or by another deadline specified by the Executive Director in writing.

q. Within 65 days after the submission of the Final Closure Plan, submit written certification in accordance with Ordering Provision No. 2.w., to demonstrate the timely submission of the Final Closure Plan under Ordering Provision No. 2.h. and compliance with Ordering Provisions Nos. 2.i., 2.j., 2.k., and 2.o.

r. Initiate implementation of the final closure method(s) for the Class 2 Landfill CAMU in accordance with the schedule in the Final Closure Plan as approved by the Executive Director.

s. Within 10 days after initiating implementation of the Final Closure Plan for the Class 2 Landfill CAMU, submit written certification in accordance with Ordering Provision No. 2.w., below, to demonstrate compliance with Ordering Provision No. 2.r.

t. Within 30 days after approval of the Final Closure Plan for the Class 2 Landfill CAMU by the Executive Director, amend the financial assurance mechanism required by Ordering Provision No. 2.o. to comport with the approved final closure method(s) in the Final Closure Plan, and any other changes required by the Executive Director. Such amendment shall be submitted as set forth in Ordering Provision No. 2.o.

u. Within 45 days after approval of the Final Closure Plan for the Class 2 Landfill CAMU by the Executive Director, submit written certification in accordance with Ordering Provision No. 2.w., to demonstrate compliance with Ordering Provision No. 2.t.

v. Within 15 days after completion of closure as specified in the Final Closure Plan, submit written certification in accordance with Ordering Provision No. 2.w., to demonstrate compliance with the closure requirements set forth in the approved Final Closure Plan.

w. The certifications required by these Ordering Provisions shall be accompanied by detailed supporting documentation, including photographs, receipts, and/or other records, shall be signed by Respondent, and shall include the following certification language:

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

are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations."

The certifications and supporting documentation shall be submitted to:

Order Compliance Team
Enforcement Division, MC 149A
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

with a copy to:

Waste Section Manager
Dallas/Fort Worth Regional Office
Texas Commission on Environmental Quality
2309 Gravel Drive
Fort Worth, Texas 76118-6951

3. Ordering Provision No. 3.a. of TCEQ Agreed Order Docket No. 2011-1712-IHW-E is terminated by this Order.

4. Respondent shall plan, implement, perform, and complete all actions required by this Order in accordance with the standards, criteria, specifications, requirements, and schedules set forth herein.

5. All relief not expressly granted in this Order is denied.

6. The provisions of this Order shall apply to and are binding upon Respondent. Respondent is ordered to give notice of the Order to personnel who maintain day-to-day control over the Facility operations referenced in this Order.

7. The provisions of this Order (other than Ordering Provision No. 1 which will be governed by the 9019 Motion and the Bankruptcy Court's order of approval of such motion), including but not limited to, financial assurance requirements, shall be binding upon any successor and assign that holds title to the property on which the Class 2 landfill is located, including any Reorganized Debtor under the Debtor's confirmed Plan of Reorganization.

8. If Respondent fails to comply with any of the Ordering Provisions in this Order within the prescribed schedules, and that failure is caused solely by an act of God, war, strike, riot, or other catastrophe, Respondent's failure to comply is not a violation of this Order. Respondent shall have the burden of establishing to the Executive Director's satisfaction that such an event has occurred. Respondent shall notify the Executive Director within seven days after Respondent becomes aware of a delaying event and shall take all reasonable measures to mitigate and minimize any delay.

9. The Executive Director may grant an extension of any deadline in this Order or in any plan, report, or other document submitted pursuant to this Order, upon a written and substantiated showing of good cause. The parties understand that the speed of work may be impacted by dust suppression efforts and by uncontrollable delays in permitting processes, but this understanding does not negate the requirement to submit a written extension request. All requests for extensions by Respondent shall be made in writing to the Executive Director. Extensions are not effective until Respondent receives written approval from the Executive Director. The determination of what constitutes good cause rests solely with the Executive Director. Extension requests shall be sent to the Order Compliance Team at the address listed above. When a deadline under this Order falls on a weekend or state holiday, such deadline shall be deemed to be the next business day.

10. The Executive Director may refer this matter to the Office of the Attorney General of the State of Texas ("OAG") for further enforcement proceedings without notice to the Respondent if the Executive Director determines that the Respondent has not complied with one or more of the terms or conditions in this Order.

11. The provisions of this Order are deemed severable, and, if a court of competent jurisdiction or other appropriate authority deems any provision of this Order unenforceable, the remaining provisions shall be valid and enforceable.

12. This Order shall terminate five years from its effective date or upon compliance with all the terms and conditions set forth in this Order, whichever is later.

13. In accordance with TEX. WATER CODE §7.071, this Order, issued by the Commission, shall not be admissible against Respondent in a civil proceeding, unless the proceeding is brought by the OAG to: (1) enforce the terms of this Order; or (2) pursue violations of a statute within the Commission's jurisdiction, or of a rule adopted or an order or permit issued by the Commission under such a statute. This Order may be admissible if offered by Respondent in a proceeding to confirm, establish or prove: the entry of this Order; the scope of this settlement including the actions required of Respondent under this Order; the final administrative resolution of violations covered by this Order; and the payment by Respondent of a penalty under this Order.

14. This Order may be executed in separate and multiple counterparts, which together shall constitute a single instrument. Any page of this Order may be copied, scanned, digitized, converted to electronic portable document format ("pdf"), or otherwise reproduced and may be transmitted by digital or electronic transmission, including but not limited to facsimile transmission and electronic mail. Any signature affixed to this Order shall constitute an original signature for all purposes and may be used, filed, substituted, or issued for any purpose for which an original signature could be used. The term "signature" shall include manual signatures and true and accurate reproductions of manual signatures created, executed, endorsed, adopted, or authorized by the person or persons to whom the signatures are attributable. Signatures may be copied or reproduced digitally, electronically, by photocopying, engraving, imprinting, lithographing, electronic mail, facsimile transmission, stamping, or any other means or process which the Executive Director deems acceptable. In this paragraph exclusively,

the terms "electronic transmission," "owner," "person," "writing," and "written" shall have the meanings assigned to them under TEX. BUS. ORG. CODE § 1.002.

15. Pursuant to 30 Tex. Admin. Code § 70.10(b) and Tex. Gov't Code § 2001.142, the effective date of this Order is the date of hand delivery of the fully executed Order to Respondent, or three days after the date on which the Commission mails a copy of the fully executed Order to Respondent, whichever is earlier. The Chief Clerk shall provide a copy of the fully executed Order to each of the parties. Notwithstanding anything to the contrary herein, the effectiveness of this Order is subject to Bankruptcy Court approval.

IV. DESIGNATION OF THE CLASS 2 LANDFILL CAMU

Now, therefore, the TCEQ further orders that:

In making this CAMU designation, the Executive Director has considered all relevant factors specified under 40 C.F.R. Part 264, Subpart S, and 30 TEX. ADMIN. CODE ch. 335. The Risk Evaluation demonstrates how the Class 2 Landfill CAMU will be consistent with applicable and relevant regulatory standards and serves as the basis for the Executive Director's CAMU designation ordered herein. Based on these considerations, the Executive Director hereby concludes that the construction, operation, and closure of the Class 2 Landfill CAMU at the Facility, as described in the Risk Evaluation and this Order, and as will be incorporated in the permit amendment and associated permit process, is a reliable and cost-effective method of managing Class 2 CAMU-eligible wastes from the ongoing decommissioning and remediation projects listed in Finding of Fact No. 25 or any other Facility CAMU-eligible wastes which may be approved or conditionally approved for disposal in the CAMU by the Executive Director. The actions contemplated under this Order are consistent with RCRA and TEX. HEALTH & SAFETY CODE ch. 361, are protective of human health and the environment, and are hereby approved by the Commission.

1. The unit included and incorporated into the designated CAMU is the Class 2 landfill (Attachment A, "Planned Cap Extent").

2. Within 180 days after approval by the Executive Director of the Final Closure Plan for the Class 2 Landfill CAMU, Respondent shall submit all applicable parts of a Part B application as an amendment to the previously submitted Renewal Application for the Facility to incorporate this new CAMU unit and address the post-closure care and re-noticing related to the Class 2 Landfill CAMU in accordance with or following the requirements of 30 TEX. ADMIN. CODE chs. 281, 305, and 335, as applicable. If required, a Post Closure Authorization Application shall be submitted as a modification to TCEQ IHW Permit No. 50206. Respondent shall also file any other permit modifications that become necessary during the course of the currently ongoing plant decommission for corrective action, closure and post-closure care with or in advance of the modification application for the Class 2 landfill post-closure care. The Post Closure Authorization Application shall be submitted to the addresses set forth in Ordering Provision 2.e.

3. Until the Post Closure Authorization, which will apply reporting provisions, is effective, Respondent shall provide information on the status of CAMU activities, including post-closure activities, in annual reports that shall be filed on January 25 of each year, beginning January 25, 2016.

4. Respondent shall require that all of its contractors, subcontractors, laboratories, and consultants retained to conduct or monitor any portion of the work performed under this Order will comply with the terms of this Order.

5. Respondent shall be responsible for and liable for completing all of the obligations under this Order, regardless of whether the activities specified herein are to be performed by employees, agents, contractors, or consultants of the Respondent, or by employees, agents, contractors, or consultants of any party to whom the property is transferred before or after execution of this Order.

6. Any documents transferring ownership and/or operations of the Facility from Respondent to a successor-in-interest shall include written notice and a copy of this Order. Respondent shall provide written confirmation of the notice and a copy of this Order being provided to the new owner and/or operator and, except for transfer to the Reorganized Debtor, written notice of the transfer of ownership and/or operations of the Facility to TCEQ no less than ninety (90) days prior to the transfer consistent with requirements set out in 30 TEX. ADMIN. CODE §305.64(g). Transfer of any of the obligations of Respondent under this Order to any third party is subject to approval by the Executive Director, except for transfer to the Reorganized Debtor.

SIGNATURE PAGE

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

For the Commission

For the Executive Director

Date March 12, 2015

I understand that by entering into this Order, Exide Technologies waives certain procedural rights, including, but not limited to, the right to formal notice of violations addressed by this Order, notice of an evidentiary hearing, the right to an evidentiary hearing, and the right to appeal. I agree to the terms of the Order in lieu of an evidentiary hearing. This Order constitutes full and final adjudication by the Commission of the violations set forth in this Order.

I also understand that failure to comply with the Ordering Provisions, if any, in this order may result in:

- A negative impact on compliance history;
- Greater scrutiny of any permit applications submitted;
- Referral of this case to the Attorney General's Office for contempt, injunctive relief, additional penalties, and/or attorney fees;
- Increased penalties in any future enforcement actions;
- Automatic referral to the Attorney General's Office of any future enforcement actions; and
- TCEQ seeking other relief as authorized by law.

In addition, any falsification of any compliance documents may result in criminal prosecution.

Signature

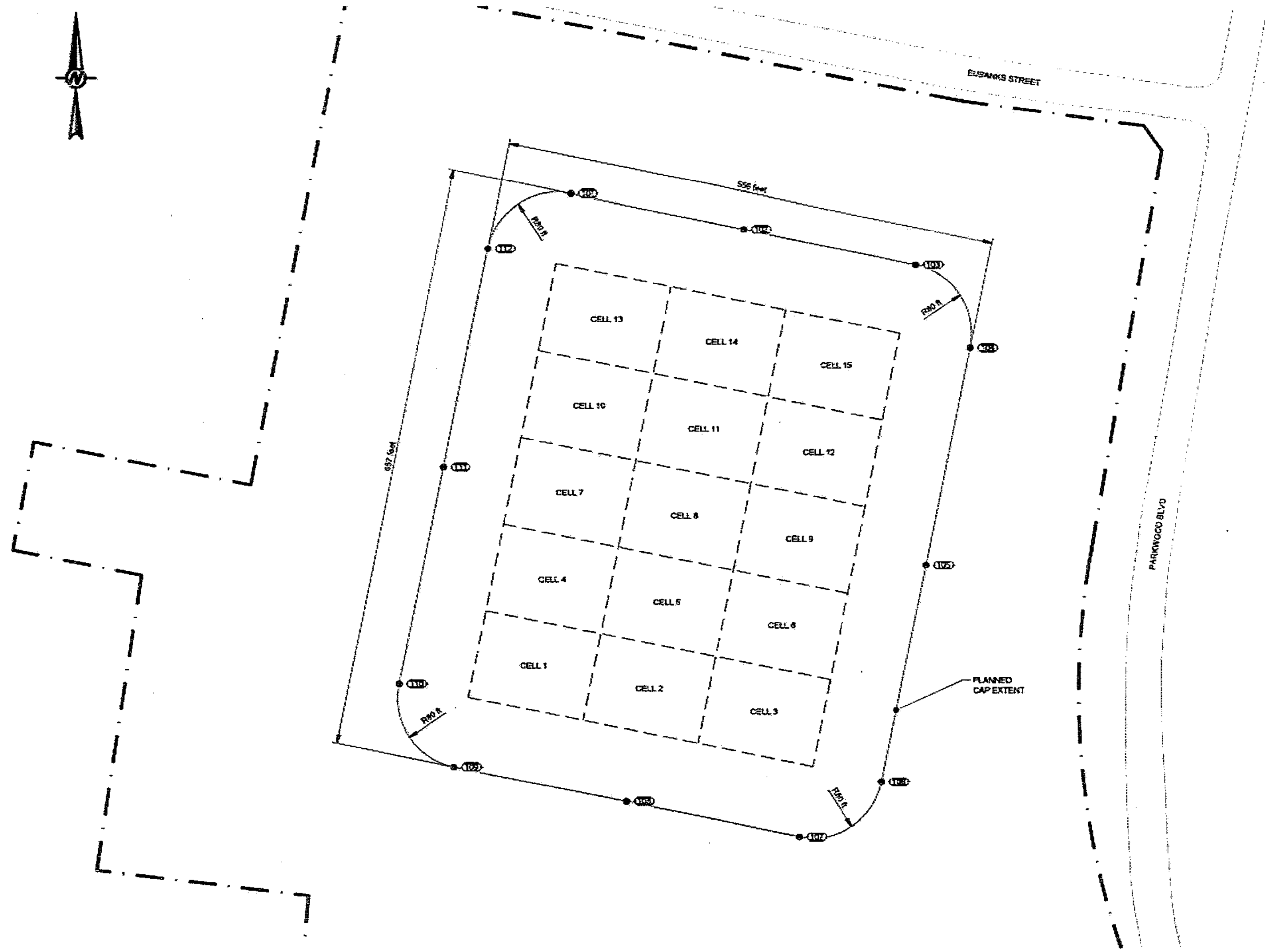
12 March 2015
Date

PHILLIP A DAMASKA
Name (Printed or typed)
Authorized Representative of
Exide Technologies (subject to Bankruptcy Court approval)

EVP & CFO
Title

☐ ***If mailing address has changed, please check this box and provide the new address below:***

ATTACHMENT A



LEGEND

- PLANNED LANDFILL CAP EXTENT (THE AERIAL CONFIGURATION OF THE CAMU)
- WASTE CELL BASE FOOTPRINT BOUNDARY
- PROPERTY BOUNDARY
- LANDFILL CAP EXTENT CONTROL POINT

NOTES

1. THE PROPERTY BOUNDARY USED IN THIS DRAWING IS CONSISTENT WITH THE 2014 REVISED AFFECTED PROPERTY ASSESSMENT REPORT (APAR) AND TITAN ENGINEERING, INC. CONSTRUCTION DRAWINGS FOR THE CLASS II LANDFILL.
2. THE LANDFILL CAP EXTENT IS FROM CONSTRUCTION DRAWINGS AND DEPICTS PROPOSED EXTENTS.
3. THE COORDINATE SYSTEM USED IN THIS DRAWING IS NAD83, TEXAS STATE PLANE, NORTH CENTRAL ZONE, US FOOT.
4. THE FACILITY ADDRESS IS: 7471 SOUTH 5TH STREET, FRISCO, TX 75034

REFERENCE

LANDFILL BASEMAP FROM "FINAL GRADING PLAN – CLASS II INDUSTRIAL WASTE LANDFILL EXPANSION – WASTE CELLS 7, 8, 9", BY TITAN ENGINEERING, INC., DATED 08/26/2003, IN HARD COPY FORMAT.

LANDFILL WASTE AND CAP EXTENTS ARE FROM "CONSTRUCTION PLANS – CLASS II INDUSTRIAL WASTE LANDFILL EXPANSION WASTE CELLS 7, 8, 9", BY TITAN ENGINEERING, INC., DATED 08/26/2003, IN HARD COPY FORMAT.

PLANNED LANDFILL CAP EXTENT POINT TABLE

POINT NO.	POINT NAME	DESCRIPTION	NORTHING (FT)	EASTING (FT)
1	101	CAP EXTENT	7103764,43	2480352,53
2	102	CAP EXTENT	7103724,26	2480547,73
3	103	CAP EXTENT	7103684,12	2480741,93
4	104	CAP EXTENT	7103590,93	2480803,38
5	105	CAP EXTENT	7103346,90	2480753,50
6	106	CAP EXTENT	7103102,87	2480703,63
7	107	CAP EXTENT	7103041,27	2480610,52
8	108	CAP EXTENT	7103080,75	2480415,95
9	109	CAP EXTENT	7103120,22	2480221,39
10	110	CAP EXTENT	7103213,38	2480159,58
11	111	CAP EXTENT	7103458,09	2480209,42
12	112	CAP EXTENT	7103702,79	2480259,15

0 60 120 180
FEET

NOT FOR CONSTRUCTION

A	2015-03-04	ORIGINAL	JCW	JCW	AMF	FMB
			PREPARED	DESIGN	REVIEW	APPROVED

CLIENT
EXIDE TECHNOLOGIES

CONSULTANT
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PROJECT
CORRECTIVE ACTION MANAGEMENT UNIT
FRISCO, TEXAS

TITLE
PLANNED CAP EXTENT

PROJECT No.	CONTROL	Rev.	of	FIGURE
130-2086-01	1	—		1

APPENDIX B

RISK EVALUATION

REPORT

EXIDE CLASS 2 LANDFILL RISK EVALUATION OF REMEDIAL ALTERNATIVES

Exide Technologies
7471 South 5th Street
Frisco, Texas 75034-5047

Submitted To: Exide Technologies
3000 Montrose Avenue
Reading, PA 19605

Submitted By: Golder Associates Inc.
18300 NE Union Hill Road, Suite 200
Redmond, WA 98052 USA

August 2014 **Project No. 13-02086.1012**

EXECUTIVE SUMMARY

A Class 2 landfill is located on the northern portion of Exide Technologies' (Exide's) Frisco Recycling Center (FRC) in Frisco, Texas. This landfill accepted treated slag from on-site lead battery recycling operations. The recycling operations used two furnaces to melt the lead-bearing components of batteries to produce lead bullion and a slag by-product. When cooled, slag is a fused (rock-like) material that contains concentrations of lead and other metals that are relatively immobile due to the fused nature of the material (after cooling). The slag was treated with reagents to immobilize metals in the slag prior to placement in the landfill. The treatment of the slag typically used cement in addition to reagent, which resulted in the slag curing to a concrete-like consistency. Operations at the FRC ceased as of November 30, 2012 and no slag has been generated since then. Most of the FRC has been demolished with the only remaining buildings being an administrative office building, a wastewater treatment building, and a crystallizer (which is part of the wastewater treatment operation).

The landfill was designed with a multi-layer bottom liner and multi-layer capping system to prevent release of landfill contents to the environment. The landfill consists of a series of 15 cells: cells 1 through 9 are full and capped, cells 10 through 12 received treated slag waste but are not full and remain open, and cells 13 through 15 are part of a partially constructed expansion. Cells 13 through 15 will have to be completed to finish out the original landfill design and create necessary slopes for final closure of the landfill. No wastes have been placed in cells 13 through 15 to date. Treated slag was routinely analyzed to confirm applicable treatment standards (Universal Treatment Standards [UTS]) were met. A small fraction of analytical results during the period when the capped cells 1 through 9 were in operation were above the UTS for lead and/or cadmium, and a small subset of those were also above the concentrations for characterization as hazardous waste. Exide conducted an in-place sampling investigation of cells 10 through 12, the results of which indicated that portions of the treated slag in cells 10 through 12 were above the UTS for lead and/or cadmium, primarily in the 0 to 0.5 foot depth and at greater depths in a few discrete areas. A smaller subset of these materials above the UTS was also above the concentrations for characterization as hazardous waste.

Exide conducted a pilot test, following approval of a work plan by the Texas Commission on Environmental Quality (TCEQ). Exide excavated and retreated a portion of the material in cells 10 through 12 that was above the UTS to determine whether it would be feasible to excavate, retreat, test, and re-deposit this material in cells 10 through 12. For the pilot test, large equipment crushed limited areas of the material to break it loose and then further crushed it to a size suitable for retreatment. Because of conflicting analytical results from different laboratories received during the pilot test program, the retreatment project was suspended at the direction of TCEQ.

RISK EVALUATION

This risk evaluation is being conducted to evaluate potential remedial alternatives for insufficiently treated material in the Class 2 landfill in a systematic and comprehensive manner to determine which alternative provides the best balance of the criteria evaluated, with the primary criteria being minimization of short-term and long-term risks to human health and the environment, and implementability.

Three remedial alternatives for the Class 2 landfill were identified for detailed risk evaluation. The three alternatives are:

- **Alternative 1: Closure in Place** – This alternative assumes the landfill would be closed in place and there would be no excavation or crushing of the material currently in the landfill. Remaining capacity in the cells that have not yet been capped and those currently being constructed will be used for disposal of Class 2 wastes including treated slag that has been accumulated at the FRC pending a decision regarding the remediation requirements for the Class 2 landfill and wastes generated at the FRC during site closure and remediation activities. When the remaining capacity is filled, the open cells will be covered with a multi-layer cap, including compacted clay, a liner, general clean fill, and a hydroseeded topsoil layer like that used for the capped cells. The implementation of this remedy is assumed to occur over a 3 to 4 month period once the remaining capacity is filled. Long-term cover maintenance and inspections would be conducted.
- **Alternative 2: On-Site Ex Situ Retreatment** – This alternative assumes that the material in the landfill (an estimated volume of 130,000 cubic yards [yd^3] of concrete-like material) would be excavated, crushed on-site to a specified size fraction, retreated on-site, tested to confirm adequate treatment, and placed back in the landfill. An additional estimated 25,000 yd^3 of cover and liner material would be removed from the Class 2 landfill, and also treated on-site as necessary before placement back in the landfill. The remaining capacity of the landfill would then be used for Class 2 wastes including treated slag that has been accumulated at the FRC pending decision on the remediation requirements for the Class 2 landfill and wastes generated during site closure and remediation activities and then capped as described in Alternative 1. It is assumed that this excavation and retreatment would occur over a 2-year period, plus 3 to 4 months to replace the cap on the landfill. Long-term cover maintenance and inspections would be conducted.
- **Alternative 3: Excavation and Off-Site Retreatment and Disposal** – This alternative assumes that all of the treated slag material in the landfill (an estimated volume of 130,000 yd^3 of concrete-like material) would be broken to allow excavation, excavated and loaded into haul trucks, and that this material and impacted portions of the cover/liner material (an aggregate volume of 155,000 yd^3) would be transported to a permitted hazardous waste facility for crushing, retreatment, and disposal. An estimated 15,500 truckloads would be required to transport the material to the permitted off-site disposal facility at a rate of about 21 to 42 trucks per day. The nearest permitted off-site disposal facility identified to date that currently would accept this material is 250 miles from the Exide facility. It is assumed that this alternative would occur over a 1.5- to 3-year period.

Conceptual site models (CSMs) were developed for each alternative to enable analysis of each aspect of the activities, including identification of potential routes of exposure to human and ecological receptors, potential hazards associated with the activities, and potential effects to the surrounding environment. The elements identified in the CSMs are categorized into the following primary criteria:

- Long-Term Risks – This criterion addresses the potential risks remaining after implementation of the remedy has been completed, including risks to the community, ecological receptors, and future site workers. This includes the consideration of the long-term reliability of the alternatives at reducing risks.
- Short-Term Risks – This criterion addresses potential risks while the alternative is being implemented, including risks to site workers, the community, and ecological receptors. For example, evaluations include potential health effects to the community from emissions of construction dust, including potentially lead/metal-bearing dust, truck emissions, traffic, transportation risks, potential health effects to site workers from exposure to materials in the landfill, safety risks from construction activities, etc.
- Implementability – This criterion addresses the feasibility of and the degree of difficulty in implementing the remedial alternatives, technically and administratively.

Costs of implementation are relevant and presented for consideration.

For each exposure route/hazard and receptor combination, the likelihood of occurrence is evaluated on a scale of one (almost certain likelihood) to five (rare likelihood). Then the consequence of the exposure, if it were to occur, is evaluated on a scale of one (critical consequence) to five (minimal consequence). These two semi-quantitative values, assigned based on best professional judgment, are then multiplied to calculate CSM risk values (on a scale of 1 to 25) for each long- and short-term exposure/receptor combination. The risk value scores are categorized as follows:

Table ES-1: Risk Analysis Matrix

		Consequence				
		Minimal	Minor	Medium	Major	Critical
Likelihood	**Score**	**5**	**4**	**3**	**2**	**1**
Rare	**5**	25	20	15	10	5
Unlikely	**4**	20	16	12	8	4
Possible	**3**	15	12	9	6	3
Likely	**2**	10	8	6	4	2
Almost Certain	**1**	5	4	3	2	1

Risk Rating	**Risk Score**
Minimal Risk	19.6 - 25
Minor Risk	14.6 - 19.5
Medium Risk	7.6 - 14.5
Major Risk	3.6 - 7.5
Critical Risk	0.0 - 3.5

Table ES-2: Implementability Matrix

Implementability Rating	Implementability Score
Very High	19.6 - 25
High	14.6 - 19.5
Medium	7.6 - 14.5
Low	3.6 - 7.5
Very Low or Negligible	0.0 - 3.5

The CSM risk values are used to develop the Indicator Scores in the risk assessment of the remedial alternatives. The higher the indicator score, the less likelihood/consequence of the risk for that exposure route and receptor combination (i.e. the higher the score the more favorable).

In addition to the CSM risk values, which are used to set the Indicator Scores for exposure-related criteria, several additional non-exposure related criteria (e.g., regulatory compliance, impacts on property values) were evaluated and assigned Indicator Scores on a scale of 1 (least optimal) to 25 (most optimal). Examples of how to follow the steps presented in this report for determining the Indicator Scores are included in Attachment A, Readers' Guide to Risk Evaluation Scoring.

RESULTS

Alternative 1: Closure in Place

There are minimal to minor risks of long-term effects from human or ecological exposure to lead or other metals present in the treated slag or associated dust for this alternative because the treated slag would remain undisturbed in place. This alternative does not involve excavation, crushing or transport activities that would generate potentially lead/metal-bearing dust. Based on best professional judgment, lead and other metals in slag material typically demonstrate low mobility. Further, given the analytical data for the material in the landfill and the landfill design, which includes a multi-layer bottom liner and a multi-layer cap, it is unlikely that there would be a release to the surrounding environment.

Short-term risks associated with the implementation of this alternative are estimated to be minimal to minor, and include increases in traffic and on-site machinery. Although some dust may be generated during implementation (which would be controlled by water trucks and other dust control measures), the potential for migration of dust to off-site soil would be expected to be dust from clean materials, in contrast to Alternatives 2 and 3.

Alternative 2: On-Site Ex Situ Retreatment

Similar to Alternative 1, there are minimal to minor risks of long-term effects from human or ecological exposure to landfill material. The material would be retreated and confirmed to be below UTS standards, and the landfill is designed with both a multi-layer bottom liner and a multi-layer cap. Potential long-term effects include the risks associated with potential future release from the landfill, which, as with Alternative 1, are unlikely. There are medium risks associated with aerial dispersion and off-site deposition to soils of lead/metal-bearing construction dust generated from breaking and crushing 130,000 yd^3 of concrete-like treated slag. An additional estimated 25,000 yd^3 of cover and liner material would also be removed from the Class 2 landfill and also treated on-site as necessary before placement back in the landfill.

The material in the landfill would be excavated and crushed on-site, which would result in short-term generation of potentially lead/metal-bearing dust, truck emissions, increased traffic, and noise. It is estimated that the total volume of material could be processed in at least a 2-year period, followed by about 3 to 4 months of capping the landfill area. The crushing and retreatment operations involve an increase in on-site machinery and the potential for incidents during implementation. The short-term risks during implementation of this alternative are estimated to be medium for off-site residents and ecological receptors, to major for on-site remediation workers.

Implementation is expected to require additional development of and agency acceptance of protocols to demonstrate the effectiveness and reliability of the retreatment and the analytical confirmation that treatment criteria are met. The generation of potentially lead/metal-bearing dust could result in frequent reductions in, or temporary cessations of remediation work to properly control dust. In addition, air permitting authorizations for certain equipment may be required, which may be complicated by the lead nonattainment status of the area. The potential for generation of lead/metal-bearing dust during the implementation of this alternative is likely to receive increased scrutiny for regulatory acceptance in light of the requirement to attain and maintain the lead National Ambient Air Quality Standard (NAAQS).

Alternative 3: Excavation and Off-Site Retreatment and Disposal

There are minimal to minor risks of long-term effects from human or ecological exposure to landfill material. The potential long-term risks in the vicinity of the Class 2 landfill and along the transportation route include off-site soil effects from potentially lead/metal-bearing dust generation and deposition related to on-site breakage, excavation, loading, and hauling of 130,000 yd^3 of concrete-like treated slag. The long-term risks include risks associated with potential future releases at the off-site treatment, storage and disposal facility (off-site TSD) because the material in the Class 2 landfill would be removed and placed at that facility. Given that this would be a permitted landfill facility that has met siting and engineering regulatory requirements, the risk of releases to the surrounding environment is expected to be minimal.

The total volume of material to be excavated (which would require some crushing or breaking of the material to allow excavation and handling) is 155,000 yd^3 of landfill material and cover/liner material. This volume corresponds to 15,500 truckloads that would be hauled 250 miles to the off-site TSD at a rate of about 21 to 42 trucks per day for a total of 7,750,000 truck miles travelled to implement this alternative.

The potential short-term risks for this alternative at the Class 2 landfill include medium risks to off-site residents, on-site workers, and ecological receptors related to the generation of potentially lead/metal-bearing construction dust from breaking and excavation of the concrete-like treated slag material; medium to major risks to off-site residents and ecological receptors from increased traffic; major risks to on-site workers from on-site machinery; and medium to major risks from increased noise to off-site residents, on-site workers, and terrestrial organisms. The potential short-term risks along the transportation route include minimal to medium risks to off-site residents and ecological receptors from generation of potential lead/metal-bearing dust, increased traffic, and potential spills of landfill material during transport to the off-site TSD. The potential short-term risks at the off-site TSD include minor risks from increased traffic, potential contact with landfill material, and potential chemical incidents (treating the material). In addition, there are medium risks for on-site workers at the off-site TSD from on-site machinery, noise, and inhalation of potential lead/metal-bearing dust.

The potential for air and other off-site impacts could negatively affect regulatory approval and community acceptance of this alternative. The potential for generation of lead/metal-bearing dust during the implementation of this alternative is likely to receive increased scrutiny for regulatory acceptance in light of the requirement to attain and maintain the lead NAAQS.

CONCLUSIONS

The main conclusions of this evaluation are:

- For long-term risk minimization, all three alternatives scored as presenting minimal risks (Scores for Alternatives 1, 2, and 3 are 20.1, 19.7, and 20.7, respectively).
- For short-term risk minimization, Alternative 1 (Closure in Place, score = 23.0) scores 15% higher than Alternative 2 (On-Site Ex Situ Retreatment, score = 19.5) and 37% higher than Alternative 3 (Excavation and Off-Site Retreatment and Disposal, score = 14.5). Alternatives 2 and 3 score lower because they involve removing and processing the existing waste material, creating the potential for lead/metal-bearing dust generation, and traffic and noise issues, among other considerations.
- For implementability, Alternative 1 (score = 17.8) scores 30% higher than Alternative 2 (score = 12.5) and 6% higher than Alternative 3 (score = 16.6). The Alternative 2 implementability score is medium, which is lower than the other alternatives because it involves removing and processing the existing waste material, creating the potential for

lead/metal-bearing dust generation, developing analytical procedures, more complex regulatory approval, and community acceptance challenges. The Alternative 3 implementability score is high, but lower than Alternative 1 due to the challenges to be faced in gaining acceptance for landfill material excavation, lead/metal-bearing dust, long-distance hauling, retreatment, and disposal.

The long-term risk minimization criteria scores for all three alternatives indicate minimal long-term risk, with little variability between scores, indicating that all three alternatives have high potential to provide long-term protection to human and ecological receptors, and the environment.

In contrast, Alternative 1 scores higher than the other two alternatives in the remaining two primary criteria (short-term risk and implementability). While all three remedial alternatives achieve the long-term goals of risk minimization, there are some moderate to major concerns in short-term risk management and implementability for Alternatives 2 and 3.

Short-term risk minimization represents a more substantial concern for Alternatives 2 and 3 than Alternative 1 due to the intrusive nature of these alternatives, which entail excavation of a substantial volume of concrete-like landfill material, crushing or breaking the material, loading the material into containers or trucks, and (for Alternative 3) hauling the material for off-site retreatment and disposal. As a result, the potential short-term impacts to nearby communities, on-site workers related to emissions of lead/metal-bearing construction dust, noise, and truck traffic are substantially greater for Alternatives 2 and 3 than for Alternative 1. It should be noted that the scores for short-term risk minimization are averaged over 42 indicators (which tends to attenuate the individual scores). For Alternative 2 there were 11 indicators scored medium, and 3 indicators scored major; and for Alternative 3 there 11 indicators that scored medium and 5 indicators that scored major.

Implementability is also a greater concern with Alternatives 2 and 3 than for Alternative 1. An analytical testing protocol to confirm effectiveness of the retreatment process would likely be necessary and would need to gain agency concurrence, which poses a challenge for regulatory acceptance. Also, the generation of potentially lead/metal-bearing dust could result in frequent reductions in, or cessation of remediation work to properly control dust. In addition, Alternatives 2 and 3 may involve air quality program implications. Alternative 3 also includes a substantial volume of truck traffic in and out of the Class 2 landfill and through the local community over an extended period of years, along the expected 250-mile transportation route, which could negatively affect regulatory and community acceptance.

The estimated cost for Alternative 1 (estimated to be less than $2 million) is more than an order of magnitude less than the estimated cost for Alternative 2 (estimated to be over $30 million), and the cost for Alternative 3 estimated to be about $80 million) is over twice the cost for Alternative 2, and approximately 40 times the cost of Alternative 1. Thus Alternatives 2 and 3 entail significantly higher costs. Despite entailing significantly higher cost, implementation of these higher cost alternatives would not achieve a distinguishable difference in long-term risks or the ultimate goal of long-term effectiveness, and as noted above, would result in increased short-term risks.

Given that all three Alternatives score comparably for long-term risk minimization and Alternative 1 scores higher than Alternatives 2 and 3 with respect to short-term risk minimization and implementability, from a risk evaluation standpoint, Alternative 1 is the best option.

Table of Contents

EXECUTIVE SUMMARY ES-1
1.0 INTRODUCTION 1
1.1 Purpose and Scope 3
2.0 APPROACH 4
3.0 SITE BACKGROUND 7
3.1 History of Operations 7
3.2 Summary of Existing Data 9
3.2.1 Treated Slag Data 9
3.2.2 Surface Soil Data 10
3.2.3 Groundwater Data 11
3.2.4 Dust 11
4.0 DEVELOPMENT OF REMEDIAL ALTERNATIVES 13
4.1 Alternative 1: Closure In Place 13
4.2 Alternative 2: On Site Ex-Situ Treatment 14
4.3 Alternative 3: Excavation and Off-Site Retreatment and Disposal 16
4.4 Conceptual Site Model 18
4.4.1 Scoring Guide 18
4.4.2 Exposure Assumptions 19
4.4.2.1 Likelihood of Exposure 20
4.4.2.2 Consequences of Exposure 21
4.4.3 Conceptual Site Model Evaluation and Scoring 24
4.4.3.1 Conceptual Site Model for Alternative 1: Closure in Place 24
4.4.3.2 Conceptual Site Model for Alternative 2: On-Site Ex Situ Retreatment 26
4.4.3.3 Conceptual Site Model for Alternative 3: Excavation and Off-Site Retreatment and Disposal 27
5.0 RISK EVALUATION 31
5.1 Indicator Scoring 31
5.2 Evaluation Criteria and Indicators 32
5.2.1 Long-Term Risk Minimization 33
5.2.1.1 Community Hazard Minimization 33
5.2.1.2 Occupational Hazard Minimization 34
5.2.1.3 Ecological Hazard Minimization 34
5.2.1.4 Environmental Effects 35
5.2.2 Short-Term Risk Minimization 36
5.2.2.1 Community Hazard Minimization 36
5.2.2.2 Occupational Hazard Minimization 37
5.2.2.3 Ecological Hazard Minimization 39

5.2.2.4 Environmental Effects 41
5.2.3 Implementability 41
5.2.3.1 Technical Feasibility 41
5.2.3.2 Administrative Feasibility 42
5.2.4 Cost 43
5.3 Risk Evaluation of Remedial Alternatives 43
5.3.1 Effectiveness 44
5.3.1.1 Long-Term Risk Minimization 44
5.3.1.2 Short-Term Risk Minimization 46
5.3.2 Implementability 48
5.3.3 Cost 50
6.0 CONCLUSIONS 51
7.0 QUALIFICATIONS 53
8.0 REFERENCES 54

List of Tables

Table 1 Risk Evaluation of Remedial Alternatives

List of Figures

Figure 1 Site Location
Figure 2 Layout of Landfill Cells
Figure 3 Soil Sample Locations near the Class 2 Landfill
Figure 4 Final Cover Cross Section for Alternatives 1 and 2
Figure 5 Conceptual Site Model for the Class 2 Landfill: Alternative 1 - Close in Place
Figure 6 Conceptual Site Model for the Class 2 Landfill: Alternative 2 –On-Site Ex Situ Treatment
Figure 7 Conceptual Site Model for the Class 2 Landfill: Alternative 3 - Excavate and Haul
Figure 8 Diamond Chart of Average Scores for the Three Remedial Alternatives
Figure 9 Bar Charts for Comparing Remedial Alternatives for the Class 2 Landfill
Figure 10 Bar Chart Comparing Indicators for Remedial Alternatives for the Class 2 Landfill

List of Attachments

Attachment A Readers' Guide to Risk Evaluation Scoring

1.0 INTRODUCTION

A Class 2 landfill is located on the northern portion of Exide Technologies' (Exide's) Frisco Recycling Center (FRC) in Frisco, Texas (Figure 1). The Class 2 landfill received treated slag from on-site lead battery recycling operations.[1] The recycling operations used a furnace to melt the lead-bearing components of batteries to produce lead bullion and a slag by-product. When cooled, slag is a fused (rock-like) material that contains lead and other metals that are relatively immobile due to the fused nature of the material. The slag was crushed and treated with reagents to further immobilize metals in the slag prior to placement in the landfill. The treatment of the slag typically used Portland cement in addition to reagent, which resulted in the slag curing to a concrete-like consistency. The Class 2 landfill consists of 15 cells, which are not physically separated from each other (i.e., the Class 2 landfill is one continuous unit divided into 15 areas or cells of relatively equal size starting from the south and moving north). Cells 1 through 9 are capped. Cells 10 through 12 have additional capacity and remain uncapped, and cells 13 through 15 are part of a partially constructed expansion. Cells 13 through 15 will have to be completed to finish the original landfill design and create necessary final slopes for closure of the landfill.

Under the Resource Conservation and Recovery Act (RCRA), a waste stream must be characterized prior to disposal. Characterization includes determining whether a waste stream is listed as a hazardous waste or is a characteristically hazardous waste based on specific regulatory criteria for the characteristics of toxicity, ignitability, reactivity, or corrosivity. Hazardous wastes that will be land disposed are required to meet the applicable Universal Treatment Standards (UTS) as prescribed by United States Environmental Protection Agency (USEPA) in 40 CFR § 268.48. The UTS represent the maximum level of treatment determined to be technologically achievable by the USEPA. The UTS are treatment standards rather than risk-based standards.

Metal-bearing slag from the FRC is not a listed hazardous waste and is not otherwise a hazardous waste unless it exhibits the toxicity characteristic under RCRA (this type of slag does not exhibit the characteristics of ignitability, reactivity and/or corrosivity). The hazardous waste toxicity characteristic is evaluated using the toxicity characteristic leaching procedure (TCLP) analysis on waste materials. The toxicity characteristic criteria for cadmium and lead are TCLP results above 1.0 milligrams per liter (mg/L) and 5.0 mg/L, respectively. Waste that exceeds the toxicity characteristics for metals when generated (before treatment) must comply with the UTS after treatment. The UTS for cadmium and lead in metal-bearing slag are 0.11 mg/L and 0.75 mg/L, respectively. Texas standards for wastes to be placed into Class 2 landfills, as defined by 30 Texas Administrative Code §335.506, for cadmium and lead are TCLP

[1] In addition, furnace refractory bricks from occasional maintenance activities were also placed in the Class 2 landfill.

results less than 0.50 mg/L and 1.5 mg/L, respectively. However, as-generated material that was hazardous waste must meet the more stringent UTS for disposal in a Class 2 landfill.

Cells 10 through 12 were the focus of an investigation by Exide and enforcement by the Texas Commission on Environmental Quality (TCEQ) in 2011 to 2012 to determine whether the material in cells 10 through 12 met applicable treatment standards and to determine the extent of material not meeting applicable treatment standards. Exide completed an investigation of cells 10 to 12, which is documented in the *Results of Class 2 Non-Hazardous Waste Landfill Investigation Exide Technologies, Inc., North Landfill, Frisco, Texas* (Exide 2012). Some exceedances of applicable treatment standards were detected. The majority of the sampling results above UTS for lead or cadmium in cells 10 to 12 were documented in the 0 to 0.5 foot depth interval with discrete areas above the UTS for lead or cadmium identified at greater depths. A smaller subset of the material in cells 10 through 12 that was above the UTS was also above the concentrations for characterization as hazardous waste.

Exide submitted a work plan to TCEQ to retreat material in cells 10 through 12 that was above the UTS, subject to a pilot test to determine whether it would be feasible to excavate, retreat, test, and re-deposit this material in cells 10 through 12. TCEQ approved this work plan. For the pilot test, large equipment crushed limited areas of the material to break it loose and then further crushed it to a size suitable for retreatment. Because of conflicting analytical results received from different laboratories during the pilot test program, the retreatment project was suspended at the direction of TCEQ.

In 2013, Exide conducted a review of analytical data from the FRC during the period the capped cells (1 to 9) were in operation. While the FRC was operating, Exide followed a protocol for analyzing treated slag to confirm applicable treatment standards were being met. Such analyses occurred and were analyzed immediately after treatment. A small fraction of the analytical results during the period when the capped cells 1 through 9 were in operation were above the applicable UTS for lead and/or cadmium. A smaller subset of analytical results above the applicable UTS was also above the concentrations for characterization as hazardous waste. Information regarding cells 1 to 9 was submitted to TCEQ and USEPA.

Exide retained Golder Associates Inc. (Golder) to evaluate the risks associated with potential remedial alternatives to address material in the Class 2 landfill above the UTS. A range of potential remedial alternatives could be implemented. However, for the purposes of this risk evaluation, three remedial alternatives were selected that are representative of this range of potential alternatives:

- Closure of the landfill in place (closure in place)
- Excavate landfill contents, retreat, and replace in the footprint of the existing landfill (which would be on-site ex-situ retreatment)

- Excavate the landfill contents and transfer it to an off-site permitted treatment, storage and disposal facility (off-site TSD) for retreatment and disposal (excavation and off-site retreatment and disposal)

While it is possible to develop variations of these representative alternatives, risk evaluations of such variations are not expected to materially differ from those presented in this report. Therefore, this report provides a risk evaluation of these three alternatives to determine which alternative provides the best balance of the criteria evaluated. The risk-based evaluation was developed to allow evaluation of each alternative using a multi-criteria analysis. This approach is inclusive of the many aspects of the remedial alternatives related to the surrounding environment, community, and other related elements, as well as technical and economic factors. In addition, information concerning estimated costs is provided for comparison purposes.

1.1 Purpose and Scope

The purpose of this risk evaluation is to evaluate potential remedial alternatives for the Class 2 landfill in a systematic and comprehensive manner to determine which alternative provides the best balance of the criteria evaluated.

2.0 APPROACH

The approach for evaluating the three remedial alternatives is summarized in this section. This section describes the three steps in developing the problem formulation approach: 1) state the problem; 2) identify the decision parameters; and 3) explain the risk evaluation approach.

State the Problem: The Class 2 landfill contains several cells of treated slag. As described in more detail in Section 3.2, a small fraction of the analytical results for the treated slag during the period when the capped cells 1 through 9 were in operation were above the applicable UTS for lead and/or cadmium. In addition, analytical results of samples collected of in-place slag in cells 10 through 12 indicated that some treated slag in cells 10 through 12 is above the UTS for lead and/or cadmium with the majority of that material located near the surface of the material currently in the landfill (i.e., in the 0 to 0.5 foot depth interval) and discrete areas above the UTS for lead and/or cadmium located at greater depths. A subset of the analytical results above the UTS was also above the concentrations for characterization as hazardous waste. Detailed information concerning the specific areas of exceedance is not provided in this evaluation, as their exact locations do not affect the conclusions described below. Three remedial alternatives were evaluated to determine which alternative provides the best balance of the criteria evaluated.

It is possible that the three selected remedies could be implemented only in cells 10 through 12, or, alternatively, in other combinations of areas within the landfill. However, for the purposes of this risk evaluation, it is assumed that the entire landfill would be remediated under each alternative. This was assumed in order to simplify comparison among the three alternatives. The inclusion of the landfill in its entirety does not have a substantial effect on the likelihood or consequences of the risks associated with each remedy. For example, excavation of materials from the landfill (as specified in Alternatives 2 and 3) would require disturbance of cover materials, intrusive activities to delineate the areas to be excavated, and excavation of landfill materials; all of which would generate construction dust, regardless of the size of the operation.

Identify the Decision Parameters: Three remedial alternatives to address the material that exceeds the UTS have been selected for evaluation: closure in place, on-site ex-situ retreatment, and excavation and off-site retreatment and disposal.

Decision Factors: The criteria considered for the risk evaluation are:

- Protection of Human Health and the Environment; Reliability
  - Long-term risk to human health and the environment: This criterion addresses potential risks remaining after implementation of the remediation alternative has been completed, including any residual risks to the community, site workers, and ecological receptors as a result of implementation activities. This criterion also

encompasses the concept of long-term reliability: whether an alternative's remedy and controls will be adequate and effective into the future.

- Short-term risk to human health and the environment: This criterion addresses potential risks while the alternative is being implemented, including risk to community, site workers, and ecological receptors. For example, evaluations include potential health effects to the community from emissions of potentially lead/metal-bearing dust; truck emissions; increased traffic or transportation risks; potential health effects to site workers from exposure to materials in the landfill; and safety risks from construction activities.

- Implementability: This criterion addresses the degree of feasibility of and difficulty in implementing the remedial alternatives, and is subdivided into technical feasibility (e.g., ability to effectively implement the remediation) and administrative feasibility (e.g., permitting, regulatory approval, timing, and availability of services and materials).
- As an additional relevant consideration, the estimated costs of each of the remedial alternatives are discussed for comparison purposes.

Risk Evaluation Approach: Existing data and reports were reviewed to gain an understanding of the site history and of the issues related to sampling results above the lead or cadmium UTS and the hazardous waste criteria, and to gather information on the physical parameters and design of the Class 2 landfill to understand its design and calculate areas and volumes for remedial alternative planning and estimating purposes. After reviewing existing information available for the FRC, the risk evaluation was conducted in a three-tiered approach, as summarized below.

1. A detailed list of the activities that would be conducted for each alternative was developed.
2. Conceptual site models (CSMs) were developed for the three remedial alternatives. The CSMs are used to identify the potential pathways of exposure to contaminants and potential physical hazards associated with each of the remedial alternatives for human and ecological receptors in both long-term and short-term exposure scenarios. In addition to the traditional CSMs, an analysis of the likelihood of occurrence and consequences of occurrences for each pathway and each receptor was conducted. The pathways and receptors identified in the CSMs were used to identify the indicators used in the risk evaluation.
3. Additional (non-receptor based) factors were identified for evaluation of effectiveness and implementability of the three remedial alternatives. These factors include technical and economic factors, such as regulatory compliance, reduction of toxicity, effects on surrounding property values, etc.

A risk evaluation was conducted for the indicators identified in the CSM risk analysis and the non-receptor based factors using a multi-criteria analysis methodology. This methodology provides a means for comparing the three alternatives against each other for various indicators, and to conduct a balanced, impartial and comprehensive analysis of the many factors potentially contributing risk for each remedial alternative. This analysis method is intended to provide transparency in the decision process by presenting every piece of information entered into the analysis. The resulting scores provide an indication of the relative strengths and weaknesses of each remedial alternative to determine which alternative provides the best balance of the criteria evaluated.

The Indicator Scores used in this risk evaluation were developed such that a high score represents the minimization of risk from exposures or physical hazards, and a low score represents a higher probability of risk. This way, the higher scores reflect a more favorable outcome. The indicators, scoring mechanisms, and scores are described in more detail in Section 4.0.

In addition, the relative estimated costs are discussed. Cost estimates were developed for this risk evaluation to provide an idea of the magnitude of the approximate costs for each alternative and for relative comparison across the three alternatives.

3.0 SITE BACKGROUND

A brief history and review of existing data relevant to the risk evaluation are presented in this section.

3.1 History of Operations

The Exide FRC is a former lead battery recycling facility in the City of Frisco, Collin County, Texas. The former operational area of the FRC covers approximately 87 acres overall, consisting of the former production/operation area, two closed pre-RCRA landfills (North Disposal Area and South Disposal Area), one closed Class 2 landfill (the Slag Landfill), the active Class 2 landfill, and ancillary facilities (the site). Stewart Creek, which runs through the south side of the former production area, and a tributary of Stewart Creek (the North Tributary), which runs north of the North Disposal Area and the Slag Landfill, both cross the site from east to west. The site features have been described in detail in the Affected Property Assessment Report (APAR) (Golder 2014). The extent of the Class 2 landfill that is the subject of this risk evaluation is shown in Figure 1.

Lead oxide was produced at the site starting in approximately 1964, and battery recycling operations began in 1969. From 1969 to 2012, the FRC recycled spent automobile and industrial batteries and other lead-bearing scrap materials to produce lead, lead alloys and lead oxide. Exide acquired GNB Technologies in 2000 (including the site) and operated the FRC until ceasing operations in November 2012.

In 1991, the area of Collin County surrounding the FRC was designated a lead nonattainment area under the federal Clean Air Act. Following installation of new emission control equipment at the FRC and other measures in 1999, the area was designated as an attainment area with ambient air meeting the lead National Ambient Air Quality Standards (NAAQS) of 1.5 micrograms per cubic meter ($\mu g/m^3$) (quarterly average). In 2008, USEPA lowered the lead NAAQS to 0.15 $\mu g/m^3$ (three-month rolling average) and the area was again declared a nonattainment area for lead in 2010, with an attainment demonstration date of December 31, 2015. For the purpose of implementing measures to demonstrate attainment with the 2008 lead NAAQS by the attainment demonstration date, Exide entered into an Agreed Order with TCEQ under which it agreed to either undertake certain emission reduction strategies or cease recycling plant operations. Exide ceased recycling operations at the FRC in November 2012.

The recycling operations used two furnaces to melt the lead-bearing components of batteries to produce lead bullion and a slag waste. Slag is a fused (rock-like) material that contains concentrations of lead and other metals that are relatively immobile due to the fused nature of the material. The notice of intent to build a Class 2 landfill was filed with the TCEQ in September 1995 and construction of the first cell began in November 1995. Blast furnace slag and, occasionally, refractory bricks from furnace maintenance were disposed of in the Class 2 landfill. The expansions of the landfill occurred over time, as originally contemplated. Cells 1 to 9 were capped in 2009. Cells 10 to 12 were constructed in 2009 and have additional capacity and remain uncapped, and the final cells (13 to 15) are under construction and are planned to be used for disposal of Class 2 waste generated during the FRC closure process. Cells 13 through 15 have to be completed to finish out the original landfill design and create necessary slopes for final closure of the landfill. Cells 13 to 15 do not currently contain any wastes.

Although not all slag was hazardous waste when generated, Exide (and its predecessor) conservatively elected to assume that all blast furnace slag was hazardous as generated and therefore was subject to the UTS. The slag was crushed to a specified size, screened, then mixed with cement, water and a stabilization reagent to chemically fix any remaining lead content in a non-leachable form. The stabilization reagent and formula varied over time. When placed in the Class 2 landfill, the treated slag typically had the consistency of wet concrete and hardened in place in the landfill. Samples of the treated slag were collected in accordance with an established protocol and analyzed for lead using TCLP analysis. As mentioned previously and discussed further in Section 3.2, a small fraction of the analytical results during the period when the capped cells 1 through 9 were in operation were above the UTS for lead and/or cadmium. In addition, analytical results of samples collected of in-place slag in cells 10 through 12 indicated that some of the treated slag in cells 10 through 12 is above the UTS for lead and/or cadmium with the majority of that material located near the surface of the material currently in the landfill (i.e., in the 0 to 0.5 foot depth interval) and discrete areas above the UTS for lead and/or cadmium located at greater depths.

The treated slag was disposed into the Class 2 landfill, a monofill designed to receive treated slag from on-site operations in a manner that protects against releases of constituents to the environment. The landfill was designed as a below- and above-grade landfill, with the majority of the waste volume placed below grade. The landfill was designed to cover an area of 11 acres and have a capacity of 190,000 cubic yards (yd^3), which would support approximately 30 years of recycling operations. Fifteen cells were planned. Each cell within the landfill was designed to provide an active cell life of approximately two years or 12,000 yd^3 of waste.

The landfill was designed to contain treated waste and protect groundwater with a containment system at the bottom of the landfill. Infiltration to groundwater is limited by an existing clay base and 2.5 to 3.0 feet of compacted clay with a permeability of less than 1×10^{-7} centimeters per second (cm/sec). This clay is overlain by a 60-mil high density polyethylene (HDPE) flexible membrane liner (FML), a drainage geocomposite leachate collection system (LCS), and two feet of protective soil. The LCS was designed to convey leachate to a sump in the southwestern corner of the landfill, from which leachate is pumped to an aboveground tank. The sump is backfilled with stone or gravel and overlain with a geotextile filter fabric.

Once treated waste has been placed to final grade within the landfill, the landfill is designed to receive a final cover consisting of 12 inches of intermediate soil cover, 3 feet of compacted clay, overlain by a 40-mil HDPE geomembrane, overlain by 18 inches of vegetated topsoil (GNB Technologies 1995). This cap system is currently in place on cells 1 through 9.

A solar evaporation pond is located to the southwest of the landfill, with a volume of approximately 900,000 gallons. This pond was constructed in approximately 1997 of compacted clay and a HDPE liner and has one aerator. The solar evaporation pond is used to store rainwater that falls on the open cells of the Class 2 landfill. Contact water from the Class 2 landfill is pumped to the solar evaporation pond via a hard-piped system.

For purposes of this risk evaluation, the current total volume of landfill material (in cells 1 through 12) is estimated to be 130,000 yd^3, with approximately 12,350 yd^3 in each of cells 1 through 9, and approximately 6,170 yd^3 in each of cells 10 through 12.

An approximation of the current landfill cell configuration is presented in Figure 2. Currently, cells 1 through 9 have the final cover system in place, cells 10 to 12 were constructed in 2009 and received treated slag but are not full and have not been capped (estimated to be 50 percent full), and cells 13 to 15 currently do not contain waste. The landfill area for cells 1 through 12 as constructed is approximately 6.75 acres (Golder 2014), and the average thickness of landfill material is assumed to be 17 feet, based on design drawings.

3.2 Summary of Existing Data

Relevant existing data from the landfill included analytical results from TCLP samples from the treated slag, surface soil data, nearby groundwater samples, and air monitoring from the retreatment pilot test period.

3.2.1 Treated Slag Data

The confirmation samples of the treated slag were analyzed by Exide and/or a third-party analytical laboratory (ERMI or OXIDOR) for pH and TCLP lead, and periodically for TCLP cadmium and other metals to compare against the UTS.

Of the laboratory analytical results for sampling conducted by Exide, EMRI, and Oxidor of the capped cells (1 through 9), which were in use from 1997 to 2009, approximately 2.4% were above the UTS for lead and/or cadmium and of those same results 0.7% were above the concentrations for characterization as hazardous waste. Cells 10 to 12 came into service in 2009. On May 19, 2011 TCEQ collected two treated slag samples from cells 10 to 12 and analyzed them for TCLP lead and cadmium. Both samples exceeded UTS criteria for lead and cadmium. Exide then completed an investigation of cells 10 to 12, which is documented in the *Results of Class 2 Non-Hazardous Waste Landfill Investigation Exide Technologies, Inc., North Landfill, Frisco, Texas* (Exide 2012). The results of the investigation indicated that some of the treated slag in cells 10 through 12 is above the lead and/or cadmium UTS, with the majority of the exceedances located near the surface of the material currently in the landfill (i.e., in the 0 to 0.5 foot depth interval) and discrete areas of exceedances located at greater depths. Analysis for other metals was performed on a subset of the samples for cells 10 through 12 and there were no exceedances of their respective UTS.

3.2.2 Surface Soil Data

During the first phase of the APAR investigation (2013), four monitoring wells (PMW-19R, PMW-20R, LMW-21, and LMW-22) were installed around the Class 2 landfill (Figure 3). Samples from the 0.0 to 0.5-foot below ground surface (bgs) depth interval from these borings were analyzed for lead and cadmium to evaluate the potential for atmospheric deposition of these metals in this area in the prevailing downwind direction from the former production area. Soil samples from PMW-19R and LMW-22 were additionally analyzed for arsenic to evaluate potential aerial deposition of arsenic in this area. The concentrations at LMW-22 exceeded the site specific TCEQ residential assessment levels (RALs) for lead and arsenic. In the remaining samples, concentrations of lead, cadmium, and arsenic were below applicable RALs in all soil samples from these locations.

During the second phase of the APAR investigation (2014), samples were collected at ten locations around the Class 2 landfill to provide additional horizontal and vertical delineation. All samples were analyzed for lead, cadmium, arsenic, and selenium, and some samples were also analyzed for antimony. Based on results of sampling, step-out samples were collected to further delineate near locations where exceedances were detected. The boring for MW-45, installed to provide upgradient groundwater data per the work plan, was also sampled for lead, cadmium, arsenic, and selenium. Grid samples of surficial soils were collected at six locations on the Class 2 landfill cap. Samples were analyzed for lead, cadmium, arsenic, selenium, and in the shallow sample at 2013-CL2-C01, also for antimony. Subsequently, step-out samples collected near 2013-CL2-C01 were analyzed for all five COC metals (Golder 2014).

Results showed concentrations exceeding the lead RAL in the shallow sample interval (0 to 0.5 feet bgs) at sample location 2013-C2L-6, located west of the Class 2 landfill. Subsequent step-out samples exceeded the lead RAL at the 2014-CL2-06A and 2014-CL2-06C locations, north and southeast of the original sample, respectively. The RALs for antimony, arsenic, and selenium were also exceeded at the 2014-CL2-06 and 2014-CL2-06C locations and the RAL for selenium was also exceeded at 2014-CL2-06A. The arsenic concentration slightly exceeded the RAL in the shallow sample at 2013-C2L-01 (17.2 milligrams per kilogram [mg/kg]), located north of the Class 2 landfill, near the north site boundary, in a former agricultural area. This exceedance is believed to represent a background concentration (Golder

2014). The arsenic concentration slightly exceeded the RAL in the 15 to 17 feet bgs sample at 2013-C2L-08 (18.5 mg/kg), located north of the Class 2 landfill, near the north site boundary.

The cap sample at 2013-CL2-C01 exceeded the RAL for lead and arsenic, and arsenic also exceeded the RAL at 2014-CL2-C01B. None of the other samples exceeded the respective RALs for the five COC metals, as applicable (Golder 2014). This surficial soil data is provided to describe the conditions around the Class 2 landfill; the lead and arsenic are likely a result of aerial distribution due to former recycling operations.

3.2.3 Groundwater Data

Recent and historical groundwater data collected from wells near the landfill were reviewed. From recent measurements in 2013 and 2014, the only detection of lead was at Well MW-45, with a total lead concentration of 0.0046 mg/L. This well is upgradient of the landfill, as determined by the APAR investigations (Golder 2014), and the measured lead concentration is less than the groundwater RAL for lead of 0.015 mg/L (Golder 2014). There were no detectable concentrations of total arsenic, cadmium, or selenium in this well from the same groundwater sample. The other upgradient groundwater well, LMW-9, was sampled but did not contain detectable lead concentrations.

There were no detectable concentrations in the groundwater immediately downgradient of the landfill of lead (detection level of 0.0029 mg/L) or cadmium (detection level of 0.00035 mg/L). These results include wells LMW-5, LMW-8, LMW-17, LMW-21, MW-28, P-1, and PMW-20R (Golder 2014). As reported in the APAR (Golder 2014), none of these wells had detectable concentrations of arsenic (detection level of 0.0033 mg/L). Two of these wells (LMW-8 and PMW-20R) had detections of selenium greater than the detection level of 0.0042 mg/L, but all concentrations were below the RAL of 0.05 mg/L for total selenium and below the groundwater protective concentration level (0.02 mg/L) for dissolved selenium (Golder 2014).

Data are available from 1997 through 2005 for the following wells: LMW-5, LMW-17, and LMW-19. There were only a few total and there were no dissolved lead concentrations greater than the RAL of 0.015 mg/L. No other metals were tested for in these water samples during that time period.

3.2.4 Dust

Lead and cadmium in airborne dust samples were collected at seven downwind locations and one upwind location from the landfill during pilot testing for retreatment of landfill materials in 2013. Other decontamination and demolition activities were also being conducted on-site at the time. A total of 42 downwind perimeter samples were collected. Dust suppression measures were in effect during these activities. Over the seven-day monitoring period, daily lead air concentrations were generally non-detect (detection limit 0.15 micrograms per cubic meter [$\mu g/m^3$]). Two samples had concentrations of 0.20 $\mu g/m^3$

and 0.22 µg/m^3 at the downwind locations. Upwind location samples were non-detect (data submitted by W&M Environmental Group to the TCEQ). There were only three detections of cadmium in the air samples (with a maximum concentration of 0.012 µg/m^3), which were slightly above the detections limits of 0.010 µg/m^3.

4.0 DEVELOPMENT OF REMEDIAL ALTERNATIVES

The three potential remedial alternatives are described in this section, along with assumptions used in the development of each alternative. Then CSMs are presented for each alternative to illustrate potential exposures and consequences of such exposures associated with implementation and long-term performance of each alternative.

The primary goal of the remedial alternative to be implemented is to protect human health and the environment. Based on the CSMs and exposure pathways identified in Section 4.4, the following Remedial Action Objectives (RAOs) have been developed to achieve this goal:

- Minimize the risk of human exposure (through inhalation, ingestion, and dermal contact) to lead or other metals in the landfill material that could be available for exposures during and after implementation of the remedial alternatives.
- Minimize the risk of ecological receptor exposure (through inhalation, ingestion, and dermal contact) to lead or other metals in the landfill material that could be available for exposures during and after implementation of the remedial alternatives.
- Minimize the risk for migration of lead or other metals from landfill material to surface water or groundwater (i.e., prevent surface water or groundwater contact with landfill material containing lead or other metals).

The remedial alternatives were evaluated against the RAOs using the general criteria (criteria column in Table 1) to identify and analyze removal action alternatives, as specified in the USEPA document (1993a) *Guidance on Conducting Non-Time-Critical Removal Actions under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)*:

- Effectiveness (long-term and short-term risk) – the ability of each remedial alternative to meet the remedial action objectives
- Implementability – the ability of each remedial alternative to be implemented, technically, and administratively

The general criteria are evaluated by identifying several individual factors related to potential exposures or hazards or related to the implementation and long-term management of resources for each alternative. These factors are listed in Table 1 as indicators. The indicators are evaluated for each alternative to assist in determining which alternative provides the best balance of the criteria. Once the overall effectiveness and implementability of the alternatives are evaluated, a discussion comparing the estimated costs of implementation is presented.

The following are specific descriptions of the three remedial alternatives.

4.1 Alternative 1: Closure In Place

Alternative 1 assumes that the 11-acre landfill would be closed in place and there would be no excavation or crushing of the material currently in the landfill. Remaining capacity in cells 10 through 15 would be used for disposal of Class 2 waste, including treated slag that has been accumulated at the FRC pending a decision on the remediation requirements for the Class 2 landfill, and wastes generated during site closure and remediation activities. When the remaining capacity is filled, cells 10 through 15 would be capped.

A cross-section of the final cover design is presented in Figure 4. A 3-foot thick layer of compacted clay or an equivalent geosynthetic clay liner (GCL) system would be placed in those portions of the landfill that have not yet been capped, and the upper surface would be rolled smooth. A 60-mil linear low density polyethylene (LLDPE) geomembrane would then be installed over the compacted clay (or GCL) surface, followed by geotextile (to provide cushioning and protect the geomembrane/GCL from overlying layers and construction activity) followed by a 1-foot thick layer of general clean fill material. A 1-foot thick layer of topsoil would then be placed above the general clean fill layer. After placement, the topsoil layer would be hydroseeded. This cover design is enhanced from the 1995 design cover in that the geomembrane is thicker and the LLDPE has more favorable mechanical properties for this application than HDPE.

Because landfill material would remain in place under this alternative, it is assumed that groundwater monitoring would be implemented under the interim-approved, as well as any final groundwater monitoring plan. The interim-approved plan requires the monitoring of four existing groundwater wells, two newly installed replacement wells (installed in 2013 to replace wells that were plugged and abandoned due to insufficient well construction details), and three new wells (also installed in 2013/2014). The interim-approved monitoring plan specifies that the nine wells will be sampled quarterly for three years or until such a time that the monitoring plan is replaced by the requirements of a permit or other legal instrument governing the site. Cover inspection and maintenance is also assumed.

4.2 Alternative 2: On Site Ex-Situ Treatment

Alternative 2 assumes that materials in the Class 2 landfill (an estimated total volume of 130,000 yd^3) would be excavated from the landfill, crushed on-site to a specified size, retreated on site, tested to confirm adequate treatment, and placed back in the landfill. Pilot testing would need to be performed to identify an appropriate treatment additive and process and an analytical testing procedure that would be acceptable to TCEQ and USEPA. Landfill material would be retreated to attain TCLP results for lead and cadmium at levels below the UTS, and cells would be capped as described in Alternative 1 – with either a geomembrane or a 3-foot thick compacted clay layer or equivalent GCL system.

To implement Alternative 2, the existing cover vegetation and topsoil layer on cells 1 through 9 would be removed and pushed to the margins of the landfill, where it would be stockpiled for later reuse. The existing 40-mil geomembrane would be removed and either recycled or disposed of off-site in a municipal solid waste (MSW) landfill (geomembrane cannot be reused). The 3-foot thick compacted clay layer would also be removed and pushed to the margins of the landfill, where it would be stockpiled for later reuse. The intermediate cover immediately above the landfill material (estimated to be approximately 25,000 yd^3) would not be salvaged due to the high likelihood of mixing with the underlying landfill material during the excavation for landfill remediation. It is assumed that this material would be treated on-site as necessary and placed back in the landfill.

The landfill material would be excavated with a large excavator, assisted by a hydraulic breaker where necessary. Fragments of landfill material would be loaded into containers in or in the vicinity of the Class 2 landfill. This large-scale disturbance of the landfill material would be expected to generate potentially lead/metal-bearing dust. Landfill material would be excavated carefully near the bottom of the landfill to prevent any damage to the 60-mil geomembrane underlying the 2-foot thick protective soil layer. The protective soil layer would be restored to a 2-foot minimum thickness following the removal of landfill material.

Excavated landfill material fragments would be processed through an on-site rock crusher to produce a material with a maximum particle size of 3/8-inch, the same as for the original treatment process (USEPA 2010b). For the purposes of this analysis, it is assumed that the crushed landfill material would be mixed with 15 percent treatment additive and 12 percent Portland cement. This large-scale crushing operation would be expected to generate potentially lead/metal-bearing dust.

TCLP testing would be performed on each batch of treated material, and the treated material would not be placed in the landfill until TCLP results are received and it is verified that the material meets the applicable UTS.

After replacement of retreated material in the landfill, the remaining capacity of the landfill would then be used for stockpiled treated slag and closure/remediation-related Class 2 wastes, as described in Alternative 1. Stockpiled clay material would then be spread in uniform lifts over the top of the landfill material and compacted. Clay material would be imported as needed to provide a 3-foot thick layer of compacted clay (or an equivalent GCL system may also be used). The upper surface of this layer would be rolled smooth. A 60-mil LLDPE geomembrane would then be installed over the compacted clay (or GCL) surface, followed by geotextile (to provide cushioning and protect the geomembrane/GCL from overlying layers and construction activity) followed by a 1-foot thick layer of general clean fill material. A 1-foot thick layer of topsoil would then be placed above the general clean fill layer. Stockpiled general clean fill and topsoil would be used with additional material imported as necessary to attain the specified thicknesses. The cover surface would then be hydroseeded.

Construction dust would be controlled during excavation and crushing operations with watering by a water truck, spraying, and similar methods. It is assumed there will be requirements for perimeter air monitoring, including stop-work criteria for lead and cadmium monitor readings and for wind-speed and wind-shift factors. Potentially-contaminated water from construction operations and contact (precipitation) water would be collected while construction is being performed. It is assumed that the volume of this water can be handled by the existing solar evaporation pond and/or waste water treatment facilities.

As in Alternative 1, because landfill material would remain in place under this alternative after excavation and retreatment, it is assumed that groundwater monitoring would be required, and would be implemented under the interim-approved and any final groundwater monitoring plan. Cover inspection and maintenance is also assumed.

It is assumed that the duration of the excavation and retreatment of landfill material activities would be at least 2 years. The duration of covering and capping activities after the retreated material is placed back into the landfill and the remaining capacity is filled would be about 3 to 4 months. Overall, the implementation of this remedy would be close to 2.5 years in duration.

4.3 Alternative 3: Excavation and Off-Site Retreatment and Disposal

Alternative 3 assumes that all material in the Class 2 landfill (an estimated total volume of 130,000 yd^3) would be excavated and that this material and impacted portions of the cover/liner material (an aggregate volume of 155,000 yd^3) would be disposed of in a permitted off-site TSD.

As in Alternative 2, the existing cover vegetation and topsoil layer on cells 1 through 9 would be removed and pushed to the margins of the landfill, where it would be stockpiled for later reuse. The existing 40-mil geomembrane would be removed and either recycled or disposed of off-site in a MSW landfill. The 3-foot thick compacted clay layer would also be removed and pushed to the margins of the landfill, where it would be stockpiled for later reuse. The intermediate cover immediately above the landfill material would not be salvaged due to the high likelihood of mixing with the underlying landfill material during the excavation for remediation; it is assumed that the intermediate cover would be removed with the landfill material and disposed of off-site. The landfill material would be excavated with a large excavator, assisted by a hydraulic breaker where necessary. The protective soil layer below the landfill material would be assumed to be impacted and removed along with the landfill material. The 60-mil geomembrane would be removed from the bottom of the former landfill and either recycled or disposed of off-site in a MSW landfill. The compacted clay layer would be left in place at the bottom of the former landfill. After all removal operations have been completed, the excavation would be backfilled with general clean fill (imported as necessary) and stockpiled clay and graded to drain. Stockpiled topsoil would be spread over the backfilled area, and all disturbed areas would be hydroseeded.

Excavated intermediate cover material, landfill material, and the protective soil layer material would be loaded into trucks and hauled to the off-site TSD for retreatment and disposal. The total volume of material that would be hauled off site for disposal is estimated to be approximately 155,000 yd^3 (or 250,000 tons).

Assuming a 10-yd^3 truck for highway hauling, an estimated 15,500 truckloads would be required for off-site disposal. For purposes of this evaluation, it is assumed that existing material is removed along a working face across the width of the landfill (this prevents exposing the entire waste mass at once and thereby minimizes the potential for dust, infiltration, and surface water impacts). Given the length of the working face (about 500 feet) and the type of operations, it is reasonable to assume that a hydraulic breaker would work at one location, while an excavator would load treated slag that has been broken from another location a few hundred feet away to avoid interference. The existing waste is assumed to typically have the characteristics of a moderately strong limestone (i.e., concrete), and general industry guidelines (Atlas Copco 2006) suggest that production rates in the range of 50 to 100 tons per hour (tph) can be achieved. Each 10 yd^3 truck can carry about 16 tons of excavated waste material, so a 50-tph excavation rate fills about 3 trucks per hour, while a 100-tph rate would fill about 6 trucks per hour. If full production can be maintained for 7 hours per day, then between 21 and 42 trucks could leave the site per working day. Assuming a 5-day work week (to avoid disturbing the surrounding community on weekends), transport of excavated material from the site would occur for a duration of about 1.5 to 3 years.

The nearest off-site TSD identified to date that currently would accept this material is approximately 250 miles from the FRC. The number of truckloads and the hauling distance for transport of the landfill material to the off-site TSD (round trip) equates to an estimated total of 7,750,000 truck miles to be travelled. All of the landfill material loaded for transport to the off-site TSD will be tested to characterize the waste, as required for acceptance at the facility (one TCLP test per 1,000 tons of excavated material has been assumed for this evaluation). All of the material received at the off-site TSD will be crushed at the off-site TSD and treated at off-site TSD to meet UTS prior to disposal at that off-site TSD.

Dust would be controlled during breaking, excavation, and loading operations at the Class 2 landfill and crushing, retreatment and disposal operations at the off-site TSD with watering by a water truck, spraying, and other methods. It is assumed there will be requirements for perimeter air monitoring at the Class 2 landfill, including stop-work criteria for lead and cadmium monitor readings and, potentially, for wind-speed and wind-shift factors, which may impact the ability to maintain full production. Potentially-contaminated water from construction operations and contact (precipitation) water would be collected while construction is being performed. It is assumed that the volume of this water generated at the Class 2 landfill could be handled by the existing solar evaporation pond and/or waste water treatment facilities.

Because no landfill material would remain in place in the Class 2 landfill under this alternative, post-closure requirements for the Class 2 landfill (i.e., groundwater monitoring or cover inspection and maintenance) may not be required or may be very limited and therefore are not assumed for the Class 2 landfill. Groundwater monitoring may be required in the vicinity due to other requirements at the FRC.

The off-site TSD would have permits and monitoring requirements in place, as well as a robust liner and capping system design. Materials received at that facility would be crushed and retreated and then disposed in lined cells that would eventually be capped.

4.4 Conceptual Site Model

A CSM depicting the routes and mechanisms of contaminant transport, and the human or ecological receptors that could potentially become exposed to lead or other metals in the treated slag was produced for each of the three remediation alternatives, as shown in Figures 5, 6, and 7. The CSMs are an important tool to conceptualize the potential exposure routes of human and ecological receptors to affected media and other hazards related to the implementation of the three remedial alternatives for the landfill.

In addition to the potential exposure pathways, a semi-quantitative method of rating the likelihood and consequence was applied to each remedial alternative for long term and short term exposures based on best professional judgment by professional engineers, toxicologists and environmental scientists. The scoring used in this evaluation was developed to provide a high score for the minimization of risk or physical hazards, and a low score for increased probability of risk or physical hazards. With this approach, the higher scores reflect a more favorable outcome and the lower scores reflect a less favorable outcome.

4.4.1 Scoring Guide

For each exposure route and receptor combination, the likelihood of occurrence was evaluated and a value from one (almost certain likelihood) to five (rare likelihood) was assigned. Then the consequence of the potential exposure was evaluated and a second value from one (critical consequence) to five (minimal consequence) was assigned. These semi-quantitative risk values, assigned based on best professional judgment, were then multiplied to calculate CSM Indicator Score (on a scale of 1 to 25) for each long and short term exposure/receptor combination. Indicator Scores for each long- and short- term exposure/receptor combination are used as Indicator Scores for each Indicator, Sub-Groups and Criteria categories in the risk evaluation of the remedial alternatives, as described in Section 5.0. Examples of how to follow the steps presented in this report for determining the Indicator Scores are included in Attachment A, Readers' Guide to Risk Evaluation Scoring. The table below provides the scale used for categorizing the risk ratings derived from the likelihood and consequence evaluation.

Risk Analysis Matrix	
Risk Rating	**Risk Score**
Minimal Risk	19.6 - 25.0
Minor Risk	14.6 - 19.5
Medium Risk	7.6 - 14.5
Major Risk	3.6 - 7.5
Critical Risk	0.0 - 3.5

4.4.2 Exposure Assumptions

Scoring was based on best professional judgment, which included consideration of guidance from several resources that provide detailed evaluations of potentials for exposure, risk, and effects from environmental media. Key applicable USEPA guidance and technical support documents used as resources for developing this risk evaluation include (but are not limited to):

- Assessing Lead at Superfund Sites (USEPA 2012).
- Exposure Factors Handbook: 2011 Edition, EPA/600/R-090/052F (USEPA 2011).
- Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. EPA 540-R-97-006. (USEPA 1997).
- Ecological Soil Screening Levels, OWSER 9285.7-70 (USEPA 2005).
- Framework for Metals Risk Assessment. EPA 120/R-07/001. (USEPA 2007a).
- Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24. (USEPA 2002).
- Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4. EPA/240/B-06/001. Office of Environmental Information. February. (USEPA 2006).
- Human Health Toxicity Values in Superfund Risk Assessments. OSWER 9285.7-53 (USEPA 2003).
- Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part A), EPA/540/1-89/002 (USEPA 1989).
- Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals), OSWER Directive 9285.7-01B (USEPA 1991).
- Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments), OSWER Directive 9285.7-47 (USEPA 2001).
- Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), OSWER Directive 9285.7-02EP (USEPA 2004).
- Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment), OSWER Directive 9285.7-82 (USEPA 2009).

- Toxic and Hazardous Substances: Lead (Occupational Safety and Health Administration [OSHA] 1991).
- Toxicological Profile for Lead (Agency for Toxic Substances and Disease Registry [ATSDR] 2007).
- Users Guide for the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK). Prepared for The Technical Workgroup for Metals and Asbestos. 540-D-01-005. (USEPA 2007b).
- Wildlife Exposure Factors Handbook. Office of Research and Development. EPA/600/R-93/187. (USEPA 1993b).

4.4.2.1 Likelihood of Exposure

The likelihood of exposure is determined by evaluation of the physical exposure routes and activities that could result in releases to the environment or physical hazards. The CSMs in Figures 5, 6, and 7 illustrate the potential mode of release to the environment for each Alternative. First, the primary sources are identified (for example: treated slag in the landfill). Next, the potential release mechanisms are shown (for example: accidental digging into the cap or cap failure; lead/metal-bearing dust generation). Then the potential exposure medium for each release mechanism is shown (for example: landfill material, groundwater, surface water, sediment, and soil). The potential exposure routes for each affected exposure medium are shown (for example: ingestion, dermal contact, and inhalation).

For physical hazards, the activities that have the potential to cause a hazard are listed on the CSMs (for example: increased off-site traffic, on-site machinery). Similar to the releases to the environment, each hazard has a potential exposure medium (for example: increased traffic may lead to a potential incident; on-site crushing machinery may lead to generation of lead/metal-bearing dust, potential incidents, or increased noise).

The likelihood of exposure is further described in the two following examples for lead/metal-bearing dust generated by crushing or breaking activities, and releases from the landfill.

Example 1: Lead/Metal-Bearing Dust Generation Activities

The crushing or breaking of lead/metal-bearing materials results in particulate material (PM) that may also be lead/metal-bearing. The finer the PM, the more likely that it is to become airborne. The dispersion of dust or particulate is primarily controlled by the size distribution (large versus fine particulate), the moisture level of the material, and atmospheric conditions (such as rain or wind). In general, the finer the particulate, the easier it is to become airborne. Dust suppression activities, such as watering, serve to keep PM from becoming airborne. Monitoring conducted during crushing operations would alert operators when PM levels approach levels of concern, whereupon work stoppage or additional dust suppression would occur. Therefore, the likelihood scores for generation of lead/metal bearing dust are 4 or 5 (unlikely or rare) in Alternative 1 since no crushing or breaking occurs, and therefore minimal dust generating activities occur. The likelihood scores for Alternatives 2 and 3 range from 2 to 4 (likely to unlikely, depending on the receptor) due to the crushing activities (Alternative 2) or breaking activities (Alternative 3), which would generate lead/metal-bearing dust.

Example 2: Releases from the Landfill

The release of constituents, such as lead or other metals, from landfill material to surrounding environmental media is controlled by the landfill liner and cap design. The liner and cap system at the Class 2 landfill, and presumably at the off-site TSD, is designed to industry standards to be effective for at least 1,000 years in the protection of groundwater (and ultimately surface water and sediment which would be affected primarily by contact with affected groundwater). Failure of the system would require three occurrences: 1) failure of the cap, 2) failure of the liner, and 3) the occurrence of both failures in an area where slag contains constituents that leach to levels that may affect groundwater. Treated slag would contain effectively immobilized lead and other metals, Therefore, the likelihood of releases of lead or other metals in landfill material is limited by the landfill design, and the immobility of the treated slag, consequently the likelihood scores for potential releases from the landfill are typically scored 4 (unlikely) or 5 (rare).

4.4.2.2 Consequences of Exposure

Consequences are determined by evaluation of the modes of exposure to the various receptors, and the adverse effects that are expected from those exposures, depending on the route of exposure. For example, lead and other metals enter the human body mainly through three routes namely: ingestion, inhalation and dermal contact. In soil, depending on geochemistry, lead is generally immobile and persistent (USEPA 2005). Dermal contact with metals in soil represents a potential route of exposure, but the relatively low lipid solubility of most metals limits absorption through the skin (USEPA 2007b). Therefore, direct ingestion and inhalation remain as potentially important routes of exposure for people working at and living or otherwise regularly present near the site. General health effects associated with exposure to inorganic lead include neurotoxicity, developmental delays, hypertension, impaired hearing acuity, impaired hemoglobin synthesis, and male reproductive impairment (ATSDR 2007). The USEPA has not developed reference doses and references concentrations for exposure to lead, as is done with other non-carcinogenic compounds. Instead, the potential for adverse effects is calculated based on an estimated blood lead concentration. Effects from exposures to lead are dose dependent, meaning that as a person is exposed to more lead, they are at increased risk for adverse effects. The consequence scores related to exposure to landfill material or exposure to construction dust, where such dust may be lead/metal-bearing, are informed by a professional assessment of lead characteristics and toxicology in the context of the particular exposure pathway, duration of exposure and other factors. The following discussion focusses primarily on the potential consequences of exposure to lead, since lead is the likely risk driver for most exposures related to the Class 2 landfill materials.

The effects of lead exposure on both terrestrial and aquatic organisms include reduced survival, reproduction and growth as well as effects on behavior, development, and heme production (USEPA 2013). In the terrestrial environment, recent research confirms the generally low mobility of lead in soil. A small fraction of lead in soil is present as the free 2+ ion, which is the bioavailable form of the metal. The fraction of lead in this form is strongly dependent on soil pH. However, there is a complex variety of factors other than pH that influence lead retention in soil, including hydraulic conductivity, solid composition, organic matter content, clay mineral content, microbial activity, plant root channels, animal holes, geochemical reactions, colloid amounts, and colloidal surface charge (USEPA 2013). Leaf litter can be an important temporary sink for metals from the soil around and below leaves. Accumulation studies conducted with earthworms (Eisenia sp.) documented the difficulty of extrapolating accumulation kinetic constants from one soil type to another, and showed that many soil physiochemical properties, including pH, organic matter, and CEC, among others, affect metal bioavailability (USEPA 2013). This assessment conservatively assumes 100% bioavailability of lead in the soil to terrestrial organisms, but could be much lower depending on actual site soil conditions.

In water, lead is transported as free ions, soluble chelates, or on surfaces of iron-rich and organic-rich colloids (USEPA 2013). At many sites the majority of lead transport by runoff occurs at the beginning of a rainfall event. Lead is rapidly dispersed in water, and highest concentrations of lead are observed near sources where lead is deposited. Transport in surface waters is largely controlled by exchange with sediments. The cycling of lead between water and sediments is governed by chemical, biological, and mechanical processes, which are affected by many factors. Organic matter in sediments has a high capacity for accumulating trace elements like lead. Binding of anoxic sediments to sulfides is a particularly important process that affects lead bioavailability (USEPA 2013). Lead is relatively stable in sediments, with long residence times and limited mobility. However, lead-containing sediment particles can be remobilized into the water column. Resuspended lead is largely associated with organic matter or iron and manganese particles. This resuspension of contaminated sediments, if present, strongly influences the lifetime of lead in water bodies. Resuspension of sediments largely occurs during discrete events related to storms.

In aquatic ecosystems affected by lead, exposures are most likely characterized as low dose, chronic exposures (USEPA 2013). Once lead enters surface waters, its solubility and subsequent bioavailability are influenced by calcium concentration, pH, alkalinity, total suspended solids, and dissolved organic carbon, including humic acids. In sediments, lead bioavailability may be influenced by the presence of other metals, sulfides, iron and manganese oxides, and physical disturbance. Recent studies provide further evidence for the role of modifying factors such as pH, dissolved organic carbon, and hardness. Toxicity of the same concentration of lead can vary greatly under different experimental conditions (USEPA 2013). Consequently, the level at which lead elicits a specific effect is difficult to establish in terrestrial and aquatic systems, due to the influence of other environmental variables on both lead bioavailability and toxicity, and also to substantial species differences in lead susceptibility (USEPA 2013). There are large differences in species sensitivity to lead, and many environmental variables (e.g., pH, organic matter) determine the bioavailability and toxicity of lead. Again, this assessment conservatively assumes that there could be sensitive aquatic organisms present, and the lead that may enter the aquatic system would be 100% bioavailable.

Consequences are scored by the severity of potential effects that may occur as a result of the potential exposures. Consequences may be minimized by reducing the level of exposure. A few examples are provided to illustrate.

Example 1. Consequences of Exposure to Affected Off-Site Soil

In the event that lead/metal-bearing dust generated from on-site crushing or breaking activities in Alternatives 2 and 3 is dispersed aerially and deposited onto off-site soil, the consequences for off-site residents are likely minor (score = 4) because airborne lead concentrations would be controlled during implementation of this alternative, and the amount of lead transported would be relatively minor. At the off-site TSD, the off-site residents may have minimal (score = 5) consequences related to exposures to off-site soil because off-site residential areas are located farther from dust generation activities, and would be exposed less to affected media.. In this case, the lower exposures equates to lower consequences of exposure. The likelihoods of exposure to affected off-site soil are low due to the controls that would be required to suppress any dust production from any landfill activity. Alternative 1 includes minor dust generation activities related to placement of cover materials. However, because there are no intrusive activities into the landfill material, any potential dust generated from this activity would be from clean materials, resulting in a consequence score of 5 (minimal).

Example 2. Consequences of Potential Incidents from Increased Traffic

For Alternatives 1 and 2, there would be increased traffic during implementation, primarily for delivery of heavy equipment and materials (for example, cement for treatment, geomembrane for cover) to the Class 2 landfill. For Alternative 3, there would be approximately 21 to 42 trucks per day over a 1.5- to 3-year period entering and exiting the Class 2 landfill. The likelihood of potential incidents for Alternatives 1 and 2 are rare and unlikely (scores of 5 and 4), respectively (Alternative 2 scores less favorably than Alternative 1 because more equipment would be needed for Alternative 2). The likelihood of potential incidents for Alternative 3 is scored lower than the other alternatives (score = 3) due to the heavy increase in traffic required for hauling the landfill material. The consequences of potential incidents for

Alternatives 1 and 2 are medium (score = 3) to reflect the occasional deliveries of heavy equipment on trailers, which would be expected to travel relatively slow and in a careful controlled manner to their destination. However, the consequences of potential incidents for Alternative 3 is scored as major (score = 2) to reflect the increased potential severity of injuries related to the relatively faster speed of numerous haul trucks entering and exiting the landfill. Similarly, potential incidents along the transportation route (Alternative 3) are also rated to have major (score = 2) consequences due to the speed of travel expected for haul trucks along that route.

4.4.3 Conceptual Site Model Evaluation and Scoring

The observations made for each indicator and the rationale for scoring the CSM risk values are described below. In general, the text highlights the aspects of each remedial alternative that affects potential exposures or hazards, and the scores that are less favorable than "minimal" risk values (that is, scores less than 19.6) are summarized in more detailed bullets.

4.4.3.1 Conceptual Site Model for Alternative 1: Closure in Place

Figure 5 illustrates the CSM for Alternative 1 (closure in place). Currently, treated slag is present in the closed cells 1 through 9, and the uncapped cells 10 through 12. As described in Section 3.2, a small fraction of the analytical results during the period when the capped cells 1 through 9 were in operation were above the applicable UTS for lead and/or cadmium, and in-place investigation of cells 10 to 12 indicated material above the UTS primarily in the 0.0 to 0.5 foot depth interval and in discrete areas at greater depths. A smaller subset of these results was also above the concentration for characterization as hazardous waste.

The likelihood of long-term off-site resident exposure to lead/metal-bearing landfill material is expected to be minimal (the most favorable risk rating) because this alternative does not involve excavation, crushing, or transporting landfill material, which would generate potentially lead/metal-bearing dust, avoiding potential for aerial dispersion to off-site soils. On-site construction work would involve hauling and placing general clean fill material for capping. Although some dust may occur (which would be controlled by water trucks and other dust control measures), any potential migration of dust off-site would be expected to be dust from clean materials in contrast to Alternatives 2 and 3. Long-term effects to groundwater, surface water, and sediments are unlikely for this alternative because the liner and cap system is designed to be effective for at least 1,000 years. Failure of this alternative would require three occurrences: 1) failure of the cap, 2) failure of the liner, and 3) the occurrence of both failures in an area where treated slag has constituents that leach to levels that may affect groundwater. Groundwater level measurements and geologic data indicate that groundwater moves very slowly from the landfill area to the southwest across the site (Golder 2014).

The consequences of potential contact with the landfill material or any other abiotic media influenced by the landfill material are minimal to minor for most of the potential exposure routes since the landfill material has been treated once and there is only limited material that is above the UTS and even less that is characteristically hazardous (see Section 3.2.1). For this reason, and due to the geochemical considerations discussed in Section 4.4.2, the amount of dissolved lead in groundwater due to the failure of Alternative 1 would be extremely low, which would minimize the effects of using the groundwater as a drinking water source in the future. Aquatic organisms would be subject to more of an adverse effect than terrestrial organisms if lead leached into the groundwater and then to a stream, since aquatic organisms will have more contact with the lead in the water or sediment than terrestrial organisms that will only have occasional drinks from the water.

In the short-term, the highest consequences for off-site residents are from a potential incident with truck traffic. Since the lead waste in the landfill is not being disturbed, there is no concern for it spreading to areas outside the landfill during remedy implementation.

The CSM analysis for this alternative includes the following potential long-term risks that exceed the minimal risk rating (cells highlighted in green in Figure 5):

- There are minimal to minor long-term potential risks for off-site residents, future industrial workers and ecological receptors to accidentally dig into the landfill and have the potential for exposure to lead/metal-bearing landfill materials. The risks of these exposures are minimized due to the robust nature of the landfill cover and liner design, which is a proven technology for minimizing direct contact by human and ecological receptors.
- There are minimal to minor long-term potential risks for off-site residents and ecological receptors from potential exposure to affected groundwater, surface water and sediments. The risks of these exposures are minimized due to the robust nature of the landfill cover and liner design, which is a proven technology for minimizing releases to groundwater (which is the pathway to surface water and sediments), and by cover maintenance and groundwater monitoring.

The CSM analysis for this alternative includes the following potential short-term risks that exceed the minimal risk rating (cells highlighted in green in Figure 5):

- Minor risks to off-site residents and terrestrial organisms related to construction-related truck traffic – a small amount of heavy equipment would be transported to the site for remediation work.
- Minor risks related to on-site machinery and noise (remediation workers) – heavy equipment for hauling and capping activities have the potential for a minor increased risk of incidents and increased noise for on-site remediation workers. Standard safe work procedures can prevent these types of hazards; however, the consequences of a majority of these hazards can be major in the event that they occur. The machinery in this alternative will likely travel at relatively low speeds, which can minimize the potential for accidents and their severity.

- On-site construction machinery will pose minor short-term risks of increased noise to terrestrial organisms due to operation of heavy machinery in the landfill.

4.4.3.2 Conceptual Site Model for Alternative 2: On-Site Ex Situ Retreatment

Figure 6 illustrates the CSM for Alternative 2 (on-site ex situ retreatment). This alternative would require breaking and excavating the treated slag in the landfill, crushing the treated slag to a specified particle size, retreatment of the material, testing the material to ensure that UTS are met, and upon acceptable UTS results, replacing the material into the landfill.

Exide has completed a pilot test for removal and retreatment of slag in the landfill under a TCEQ Response Action Work Plan, which was confirmed to be successful for 70 of 73 samples of retreated material. Lessons learned from the on-site pilot test for retreating the slag in the landfill include ensuring that the analytical laboratory is using appropriate sample preparation and analysis methods. Additional pilot testing would be needed in order to develop a testing procedure that is acceptable to TCEQ and USEPA. Additional material from site closure and remediation activities and treated slag that has accumulated may be added to the open cells of the landfill before closure.

Under this alternative, the existing landfill space would be used, and the landfill material would be retreated to be below UTS (given successful completion). Potential long-term effects to groundwater, surface water and sediment are minimized, similar to Alternative 1 due to the landfill cap and liner design and other factors. In addition, if implemented successfully, this alternative would result in all of the material in the landfill being treated to be below the UTS.

The CSM analysis for this alternative includes the following potential long-term risks that exceed the minimal risk rating (cells highlighted in green and yellow in Figure 6):

- Emissions of potentially lead/metal-bearing dust from excavation, crushing, loading, and hauling 130,000 yd^3 of landfill material has the potential for aerial dispersion and deposition onto off-site soils. This would pose medium long-term potential risks to off-site residents and minimal to minor long-term risks to terrestrial and aquatic organisms. On-site dust suppression efforts would reduce this potential but may not eliminate it under all conditions.

- There are minimal long-term potential risks for terrestrial organisms to accidentally dig into the landfill and potentially have contact with treated landfill material. The risks of these exposures are minimized due to the robust nature of the landfill cover and liner design, which is a proven technology for minimizing direct contact by human and ecological receptors. The consequences of exposure to lead or other metals that may be exposed in the landfill are the same as Alternative 1.
- There are minimal to minor long-term potential risks for aquatic/riparian organisms related to the potential for lead and other metals to leach to the groundwater and travel to surface water and sediments. These risks have a rare likelihood (slightly, but not materially, lower than when there is no additional treatment), since confirmatory samples will be taken during treatment, but the risk values would remain the same as in

Alternative 1 since the consequences of exposure to lead or other metals if there was leaching from the landfill are the same regardless of retreatment.

The CSM analysis for this alternative includes the following potential short-term risks that exceed the minimal risk rating (cells highlighted in green, yellow and red on Figure 6):

- Emissions of potentially lead/metal-bearing dust from excavation, crushing, and loading 130,000 yd^3 of landfill material has the potential for aerial dispersion that would pose major inhalation risks to on-site remediation workers, medium inhalation risks to off-site residents and terrestrial organisms, and minor risks to aquatic organisms. On-site dust suppression efforts would reduce but not eliminate this potential. The risk is higher than Alternative 1 since the landfill material would not be disturbed in that scenario.
- There are medium short-term potential risks to off-site residents and terrestrial organisms and minimal risks to aquatic organisms due to the increased truck traffic while bringing additional machinery and materials on-site to implement this remedy.
- There is a major short-term potential risk of potential incidents to remediation workers in the landfill due to on-site construction machinery associated with the excavation, crushing, loading, and hauling of 130,000 yd^3 of landfill material (estimated to be at least 2 years in duration). Standard safe work procedures can minimize these types of hazards; however, the consequences of a majority of these hazards can be major in the event that they occur.
- There are major short-term potential risks to remediation workers and medium risks to off-site residents and terrestrial organisms related to increased noise levels due to excavation, crushing, loading, and hauling of 130,000 yd^3 of landfill material.
- Potential exposure to landfill material during implementation will pose medium short-term potential risks to remediation workers and terrestrial organisms during implementation of the remedy since the likelihood of ingesting this material is possible (score = 3), even though the consequence is minor to minimal (scores = 4 and 5) due to the metal(s) being bound in a chemical matrix.
- Treatment of landfill material with chemical stabilizers will pose medium short-term potential risks of a chemical incident to remediation workers during the implementation of the remedy since the consequence of exposure to these chemicals has the potential for medium adverse effects.

4.4.3.3 Conceptual Site Model for Alternative 3: Excavation and Off-Site Retreatment and Disposal

Figure 7 illustrates the CSM for Alternative 3 (excavation and off-site retreatment and disposal). This alternative includes complete breaking and excavation of the material in the Class 2 landfill, loading the material into trucks, hauling the material and impacted liner materials to an off-site TSD, crushing and retreatment of the material, and disposal of the treated material at the off-site TSD.

It is estimated that approximately 130,000 yd^3 of landfill material would be excavated, which would require some crushing or breaking of the material to allow excavation and handling. An additional estimated 25,000 yd^3 of cover and liner material would be removed as part of the complete removal of the Class 2 landfill. It is estimated that approximately 155,000 yd^3 of landfill material and cover/liner material, which corresponds to 15,500 truckloads, would be hauled 250 miles to the nearest off-site TSD that is expected to accept this material, at a rate of about 21 to 42 trucks per day over a 1.5- to 3-year period. This material would be crushed and treated at the off-site TSD prior to disposal at the off-site TSD.

The potential for long-term risks primarily include risks associated with release at the off-site TSD because the material in the Class 2 landfill would be removed and placed at that facility. The potential long-term risks in the vicinity of the Class 2 landfill and along the transportation route include off-site soil effects from potentially lead/metal-bearing dust generation and deposition related to on-site breakage, excavation, loading, and hauling of a substantial volume of landfill material. The consequences of exposure to this material is minimal to minor given that the lead and other metals are contained in a solid matrix and the fraction that is leachable/available is low.

There are short-term potential risks at the Class 2 landfill and the off-site TSD for activities during implementation of the remedy, and there are potential risks from hauling the materials along the transportation route from the Class 2 landfill to the off-site TSD.

The off-site TSD is expected to be located in a semi-industrial area that is relatively remote from residential areas and likely has reduced populations of terrestrial organisms compared with undisturbed areas. However, future development around such facilities is uncertain. The remoteness of the facility limits exposures, and thus risks, due to distance and limited contact with hazardous conditions.

The CSM analysis for this alternative includes the following potential long-term risks that exceed the lowest risk rating (cells highlighted in green in Figure 7):

Class 2 Landfill and Vicinity

- On-site breaking, loading, and hauling of landfill material at the Class 2 landfill will result in generation of potential lead/metal-bearing dust. Aerial deposition of this dust to off-site soil will pose minor long-term potential risks to off-site residents and ecological receptors. The consequence of this deposition onto soil is the same as for Alternative 2.

Off-site TSD and Vicinity

- The potential long-term risks of exposure to landfill material, groundwater, surface water and sediments at the off-site TSD are minimal for all receptors. The consequences of people or terrestrial and/or aquatic organisms coming into contact with releases of lead or other metals from the off-site TSD are minimal, given that the landfill material will be retreated to fix the metals in a matrix that is not bioavailable. These are similar to the consequences that would occur in Alternative 2, since the landfill material will be retreated in either case.

The CSM analysis for this alternative includes the following potential short-term risks that exceed the minimal risk rating (cells highlighted in green, yellow and red in Figure 7):

Class 2 Landfill and Vicinity

- Emissions of potentially lead/metal-bearing dust from excavation, breaking, loading, and hauling 155,000 yd^3 of landfill material will pose medium short-term potential risk to off-site residents, remediation workers and terrestrial organisms, and minor risk to aquatic organisms. On-site dust suppression efforts would reduce but not eliminate this potential. The consequence of exposure to this dust is the same as for Alternative 2.

- There are major short-term potential risks at the Class 2 landfill for off-site residents, medium risks for terrestrial organisms, and minimal risks for aquatic organisms related to significant truck traffic to haul 15,500 round trip truckloads from the Class 2 landfill to the off-site TSD. The consequence of an incident with the truck traffic is minor to major, depending on the receptor. This consequences for off-site residents are major (score = 2), which is higher than the Alternative 2 score (3) because of the substantially higher volume of truck traffic and higher speeds expected when hauling the landfill material off-site during the implementation of Alternative 3.
- There are major short-term potential risks at the Class 2 landfill for remediation worker incidents due to on-site construction machinery associated with the excavation, loading, and hauling of 130,000 yd^3 of landfill material (estimated at 1.5 to 3 years in duration). Standard safe work procedures can minimize these types of hazards; however, the consequences of these hazards can be major in the event that they occur. This is similar to Alternative 2, given increased heavy truck traffic compared to Alternative 1.
- The increased noise levels due to breakage, excavation, loading, and hauling of 130,000 yd^3 of landfill material will pose major short-term potential risks to remediation workers at the Class 2 landfill, and medium risks to off-site residents and terrestrial organisms in the vicinity of the Class 2 landfill. The consequence of exposure to noise is the same as for Alternative 2.
- Potential exposure to landfill material during implementation will pose medium short-term potential risks to on-site remediation workers and minor risks to terrestrial organisms during implementation of the remedy. The consequence of exposure to landfill material is the same as for Alternative 2.

Transportation Route

- There are minor short-term potential risks along the transportation route to off-site residents and terrestrial organisms related to potentially lead/metal-bearing dust generated while hauling 15,500 truckloads of landfill materials 250 miles each way between the Class 2 landfill and the off-site TSD. The consequence of encountering this lead/metal-bearing material is minor to minimal (scores = 4 and 5) since there would be a small volume of dust available for exposure to an individual along the transportation route (that is, if dust were generated by hauling landfill material, it would likely be spread out over the distance of the transportation route).
- There are medium short-term potential risks along the transportation route to off-site residents and terrestrial organisms and minor risks to aquatic organisms from potential incidents related to increased traffic to haul 15,500 truckloads of landfill materials 250 miles each way between the Class 2 landfill and the off-site TSD. The consequence of a traffic accident is difficult to predict, but has the potential to have major to medium (scores = 2 and 3) consequences of injury.
- There are minor short-term potential risks along the transportation route to off-site residents and ecological receptors related to the potential for spills during the hauling of 15,500 truckloads of landfill materials 250 miles one-way from the Class 2 landfill to the

off-site TSD. The consequence of a spill is expected to be minor (score = 4) given that the bulk of the landfill material is bound in a chemical matrix. .

Off-site TSD and Vicinity

- The potentially lead/metal-bearing dust from unloading and crushing operations will pose medium short-term potential risks to remediation workers and minor risks to terrestrial and aquatic organisms at or near the off-site TSD. The consequences of these exposures are similar to those posed at the Class 2 landfill, since the procedures to retreat the metals in the landfill material will be similar.
- At the off-site TSD, there are minor short-term potential risks to terrestrial organisms related to truck traffic during the hauling of 15,500 truckloads of landfill material to the facility. The likelihood of potential off-site resident incidents with truck traffic is lower than those posed at the Class 2 landfill because the off-site TSD is located in an area remote from residential areas.
- There are medium short-term potential risks to remediation workers of potential incidents related to on-site machinery during the unloading, and crushing of 15,500 truckloads of landfill material at the off-site TSD. The consequences of these exposures are scored higher (score = 3) than those posed at the Class 2 landfill (score = 2) because there are fewer machinery activities at the off-site TSD.
- The noise levels due to unloading and potential crushing 15,500 truckloads of landfill material will pose medium short-term potential risks to remediation workers, and minor risk to terrestrial organisms at or near the off-site TSD. The consequences of these exposures are scored higher (scores = 3 and 4, respectively) than those posed at the Class 2 landfill (scores = 2 and 3, respectively) because there are fewer machinery activities at the off-site TSD.
- Exposure to landfill material will pose minor short-term potential risks to remediation workers and terrestrial organisms during unloading and crushing operations at the off-site TSD. The consequences of these exposures are similar to those posed at the Class 2 landfill, since the procedures to retreat the metals in the landfill material will be similar.
- At the off-site TSD, the treatment of landfill material will pose minor short-term potential risks of a chemical incident to remediation workers during the implementation of the remedy. The consequences of these exposures are scored higher (score = 4) than at the Class 2 landfill (score = 3) because the facility commonly accepts and treats hazardous materials.

5.0 RISK EVALUATION

The risk evaluation for the three alternatives was conducted using the relevant criteria specified in *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA* (USEPA 1993a), plus the indicators identified in the CSM evaluation, and several other potential physical hazards identified for each remedial alternative. Costs are a relevant consideration and are estimated and discussed.

Each potential risk or hazard was developed into indicators for their respective receptors (i.e., off-site residents, workers, ecological receptors). The indicators were categorized into three general criteria:

- Long-term effectiveness (minimization of long-term risks or hazards)
- Short-term effectiveness (minimization of short-term risks or hazards)
- Implementability (technical and administrative feasibility)

Each potential exposure or hazard scenario developed in the CSMs (Section 4.0) is an indicator with Indicator Scores for each of the three alternatives listed in Table 1. Indicator Scores for non-exposure or non-hazard related indicators (for example, technical feasibility) were also developed based on best professional judgment. The scores of each of the indicators for the related criterion were then averaged into overall criterion scores and sub-group scores for each alternative, as shown in Table 1. The scoring used in this risk evaluation was developed to provide a high score for the minimization of risk or physical hazards, and provide a low score for increased risk or physical hazard. Using this approach, a higher score reflects a more favorable outcome.

Section 5.1 presents an overview of the methods used to assign scores to each indicator. Section 5.2 provides a description of the potential effects from each remedial alternative on each indicator, Indicator Scores, and rationale considered in the scoring of each indicator. Section 5.3 presents an evaluation of each alternative per the indicators, followed by a comparative evaluation of the alternatives. It also summarizes relative cost considerations.

5.1 Indicator Scoring

To clarify the scoring of each indicator, a chart providing descriptions of the scoring scales is included at the bottom of Table 1. Scores ranging between 1 and 25 are given to each indicator, where a score of 1 represents a critical risk, and a score of 25 represents a minimal risk. In cases where there are multiple risk values in the CSM (for example, ingestion and dermal contact with groundwater), the lowest of the scores (that is, the least favorable score) is used for the indicator score. For indicators related to long- and short-term effects, such as off-site resident exposure to affected groundwater, the scoring is based on the CSM risk score that takes into account the likelihood and consequence of exposure for each alternative, where the score of 25 represents the lowest risk, and a score of 1 represents the highest risk.

For indicators related to implementability, a score of 1 represents low implementability, and a score of 25 represents the optimal implementability.

For Alternative 3, scores are provided for indicators related to the Class 2 landfill, the transportation route, and the off-site TSD. The indicators were developed so that there will be a score for only one of these locations to be compared against the other two alternatives. For example, the potential risk for noise exposure to remediation workers at the Class 2 landfill (Indicator Number 31 in Table 1) is only given a score for on-site exposure (3a) and not for off-site exposure (3b), and this one score is compared to Indicator Scores for on-site exposures developed for Alternatives 1 and 2 for the same indicator.

In Alternative 3, indicators that occur only at the off-site TSD (for example, on-site machinery at the off-site TSD, Indicator Number 34) or along the transportation route (for example, potential effects to off-site residents from a spill along the transportation route, Indicator Number 25) are given scores for the activities at the off-site TSD (3b), not the FRC, and are compared to the scores developed for Alternatives 1 and 2. The indicators that receive a score for the transportation route or the off-site TSD only are given an optimal score of 25 for Alternatives 1 and 2. This is to indicate that no adverse effects occur for Alternatives 1 and 2 for those indicators where activities occur only along the transportation route or at the off-site TSD.

The scores for each indicator are presented in Table 1, with a highest/most favorable achievable score for each indicator of 25. The scores of all indicators within a criterion are averaged to attain a Criterion Score (for example, the long-term risk minimization criterion scores for Alternatives 1, 2, and 3 are 20.1, 19.7, and 20.7, respectively). In addition, Subgroup Scores are provided for the various sub-groups within each Criterion, based on the average of the Indicator Scores within each sub-group. For example, the sub-group scores for off-site residents in the long-term risk minimization criterion for Alternatives 1, 2, and 3 are 20.4, 19.4, and 23.2, respectively.

The scores assigned in this evaluation are not assigned weights; in effect, each score receives equal weight when averaged for criteria and sub-group scores. Each indicator can be compared on a relative basis across the three alternatives and whether or not the scores are weighted has no effect on such comparison.

5.2 Evaluation Criteria and Indicators

The indicator, indicator numbers, and Indicator Scores are presented in Table 1. The Indicator Scores are the CSM Risk Values from Figures 5, 6, and 7; developed by multiplying the scores for likelihood and consequence for each indicator. A description of the potential effects from each remedial alternative on each indicator is presented below, along with the Indicator Scores, and rationale considered in the scoring of each indicator.

5.2.1 Long-Term Risk Minimization

The long-term risk minimization criterion addresses community hazard minimization, occupational hazard minimization, ecological hazard minimization, and environmental effects sub-groups. The indicators for these sub-groups are described below.

5.2.1.1 Community Hazard Minimization

This sub-group evaluates the potential risks related to long-term impacts from each alternative to off-site residents near the Class 2 landfill, and for Alternative 3 it considers off-site residents along the transportation route to the off-site TSD and residents in the vicinity of the off-site TSD. The evaluated risks include potential exposures as described below.

1. Landfill material – This indicator reflects the potential exposure to lead/metal-bearing landfill materials. These exposures have a varying potential to occur if the landfill cap were to fail (Alternatives 1 or 2) or if security is breached and the material within the landfill is excavated (Alternatives 1, 2 or 3). These potential exposures are minimized by the low permeability, multi-layer capping system on the landfill that is designed to prevent releases to the environment (Alternatives 1 or 2). For Alternative 3, the siting and engineering requirements at the off-site TSD provides safeguards against release and potential exposure at that facility. The risks for this indicator are minimal for all three Alternatives.

2. Affected groundwater – This indicator reflects the potential exposure to groundwater impacted by the landfill. This could occur in the event of cap and liner failure in an area where slag contains constituents that leach to levels of concern. These potential exposures are minimized by the liner and cover systems which are designed to prevent migration of the landfill contents to groundwater. Under Alternatives 2 and 3, the landfill material would be retreated to levels that meet the UTS. The risks for this indicator are minor for Alternative 1, and minimal for Alternatives 2, and 3.

3. Affected surface water and sediments – This indicator reflects the potential exposure to surface water or sediment by groundwater impacted by the landfill. In order for these media to be affected, releases from the landfill (related to cap and liner failure) would need to affect groundwater, and affected groundwater would need to discharge to the creek. This is minimized by the cap and liner systems designed to be protective against migration of landfill contents to groundwater. Under Alternatives 2 and 3, the landfill material would be retreated to levels that meet the UTS. The risks for this indicator are minor for Alternative 1, and minimal for Alternatives 2, and 3.

4. Affected off-site soil – This indicator reflects the potential exposure to impacted off-site soil in the event of aerial dispersion and deposition of affected materials during construction activities at the landfill. In Alternative 1, no intrusive activities into the landfill material would occur, and any construction dust generated is expected to be from clean materials. In Alternatives 2 and 3, excavation and crushing or breaking of landfill material would generate lead/metal-bearing dust. The risk of aerial dispersion can be controlled but not eliminated by dust suppression and control activities. The risks for this indicator are minimal for Alternative 1, medium for Alternative 2, and minor for Alternative 3 in the vicinity of the Class 2 landfill.

5. Affected off-site soil (off-site TSD) – This indicator reflects the potential exposure to impacted off-site soil from aerial dispersion and deposition of affected materials from the

off-site TSD. In Alternative 3, crushing activities will create potentially lead/metal-bearing dust at the off-site TSD. The off-site TSD is expected to be located in a semi-industrial area that is remote from residential areas. Dust suppression and control activities would control aerial dispersion. The risks for this indicator are minimal for Alternative 3.

5.2.1.2 Occupational Hazard Minimization

This sub-group evaluates the potential risks related to long-term impacts from each alternative to on-site future industrial workers at the Class 2 landfill. The evaluated risks include potential exposures as described below.

6. Landfill material – This indicator reflects the potential exposure of on-site workers to lead/metal-bearing landfill materials after remediation is completed. These exposures could occur due to accidental excavation of cover material or cap failure that exposes landfill materials. These potential exposures are minimized by on-site security and institutional controls, as well as the low permeability, multi-layer capping system on the landfill that is designed to prevent releases to the environment (Alternatives 1 or 2). For Alternative 3, the siting and engineering requirements at the off-site TSD provides safeguards against release and potential exposure at that facility. The risks for this indicator are estimated to be minor for Alternative 1 and minimal for Alternatives 2 and 3.

7. Affected groundwater – This indicator reflects the potential exposure of on-site workers to groundwater affected by the contents of the landfill. This could occur in the event of cap and liner failure in an area where slag contains constituents that leach to levels of concern. These potential exposures are minimized by the liner and cover systems which are designed to protect against migration of landfill contents to groundwater. Under Alternatives 2 and 3, the landfill material would be retreated to levels that meet the UTS, which would stabilize the landfill contents. The risks for this indicator are minimal for all three Alternatives.

8. Affected surface water and sediments – This indicator reflects the potential exposure of on-site workers to surface water or sediment affected by groundwater impacted by the landfill. In order for these media to be affected, releases from the landfill (related to cap and liner failure) would need to affect groundwater and affected groundwater would need to discharge to the creek. This is minimized by the cap and liner systems designed to be protective against migration of landfill contents to groundwater. Under Alternatives 2 and 3, the landfill material would be retreated to levels that meet the UTS, which would stabilize the landfill contents. The risks for this indicator are minimal for all three Alternatives.

5.2.1.3 Ecological Hazard Minimization

This sub-group evaluates the potential risks related to long-term impacts from each alternative to terrestrial and aquatic receptors near the Class 2 landfill. The indicators in this sub-group reflect the potential exposure of terrestrial or aquatic receptors to on-site or off-site contaminants. The evaluated risks include potential exposures as described below.

Terrestrial Organisms

9. Landfill material – similar to on-site worker exposures (Indicator 6). The risks for this indicator are minor for Alternative 1 and minimal for Alternatives 2 and 3.

10. Affected groundwater – similar to on-site worker exposures (Indicator 7). Terrestrial organisms have little contact with groundwater. The risks for this indicator are minimal for all three Alternatives.

11. Affected surface water and sediments – similar to off-site resident exposures (Indicator 3). The risks for this indicator are minor for Alternative 1 and minimal for Alternatives 2 and 3.

12. Affected off-site soil – similar to off-site resident exposures (Indicator 4). The risks for this indicator are minimal for Alternative 1 and minor for Alternatives 2, and 3.

13. Affected off-site soil (off-site TSD) – crushing activities will create potentially lead/metal-bearing dust at the off-site TSD. The off-site TSD is expected to be located in a semi-industrial located, which likely has reduced populations of terrestrial organisms. The risks for this indicator are minimal.

Aquatic Organisms

14. Landfill material – similar to off-site resident exposures (Indicator 1). Aquatic organisms would have little or no contact with landfill material. The risks for this indicator are estimated to be minimal for all three Alternatives.

15. Affected groundwater – similar to on-site worker exposures (Indicator 7). Aquatic organisms have little contact with groundwater. The risks for this indicator are estimated to be minimal for all three Alternatives.

16. Affected surface water and sediments – similar to off-site resident and on-site worker exposures (Indicators 3 and 8, respectively). Aquatic organisms could have adverse effects from affected surface water and sediments. The risks for this indicator are estimated to be minor for Alternatives 1 and 2, and minimal for Alternative 3.

17. Affected off-site soil – similar to off-site resident exposures (Indicator 4), however aquatic organisms would have little contact with off-site soil. The risks for this indicator are estimated to be minimal for Alternative 1 and minor for Alternatives 2 and 3.

18. Affected off-site soil (off-site TSD) – similar to off-site resident exposures (Indicator 5). The risks for this indicator are estimated to be minimal.

5.2.1.4 Environmental Effects

The reduction of toxicity, mobility, or volume through treatment is evaluated in this sub-group.

19. Reduction of toxicity, mobility, or volume through treatment – This indicator reflects the ability of the treatment technology to permanently and significantly reduce the toxicity, mobility, or volume of contaminants. For Alternative 1, there is no reduction in toxicity because no further treatment will occur; but the volume of material will not increase. For Alternatives 2 and 3, there will be some reduction of toxicity due to treatment of the landfill material to levels below the UTS. Although treatment will reduce the toxicity, it will also increase the volumes due to the addition of treatment reagents and cement. A volume increase of about 50% was assumed in this evaluation. The risks for this indicator are estimated to be minor for Alternative 1 and minimal for Alternatives 2 and 3.

5.2.2 Short-Term Risk Minimization

The short-term risk minimization criterion addresses the following sub-groups: community hazard minimization occupational hazard minimization, ecological hazard minimization, and environmental effects. The indicators for these sub-groups are described below.

5.2.2.1 Community Hazard Minimization

This sub-group evaluates the potential risks related to short-term impacts from each alternative to off-site residents near the Class 2 landfill, and also near the off-site TSD for Alternative 3. The evaluated risks include potential exposures as described below.

Class 2 Landfill and Vicinity

20. Potential lead/metal-bearing dust – This indicator reflects the potential exposure of the community, by inhalation, to potentially lead/metal-bearing airborne dust from the site. In Alternative 1, no intrusive activities into the landfill material will occur, and any construction dust generated is expected to be from general clean materials. In Alternatives 2 and 3, excavation and crushing or breaking of landfill material would generate lead/metal-bearing dust. Aerial dispersion can be controlled by dust suppression and control activities but not eliminated. The risks for this indicator are estimated to be minimal for Alternative 1 and medium Alternatives 2 and 3.

21. Increased truck traffic in and out of the Class 2 landfill – This indicator reflects the potential exposure to increased truck traffic in the vicinity of the landfill. Alternative 1 will have minimal increased traffic to import general clean fill materials. Alternative 2 will require increased traffic to deliver heavy equipment, materials, and facilities for on-site crushing and excavation. Alternative 3 will require a very high volume of traffic to transport approximately 15,500 truckloads of landfill material from the Class 2 landfill to the off-site TSD. The risks for this indicator are estimated to be minor for Alternative 1, medium for Alternative 2, and major for Alternative 3.

22. Increased noise from the Class 2 landfill – This indicator reflects the potential exposure to noise for off-site residents. Alternative 1 will have little increased noise. Alternative 2 will have increased noise due to breaking, excavating and crushing operations on-site. Alternative 3 will have increased noise, slightly less than Alternative 2, for breaking and excavating landfill material. The risks for this indicator are estimated to be minimal for Alternative 1 and medium for Alternatives 2 and 3.

23. Transportation Route (Alternative 3 only) Potential lead/metal-bearing dust along the transportation route – This indicator reflects the potential effects of exposure to lead/metal-bearing dust from the transport of landfill materials to the off-site TSD. This can be reduced by appropriate controls, such as covering the loads. The dispersion of materials along the 250-mile route would limit exposures. The risks for this indicator are estimated to be minor.

24. Increased truck traffic along the transportation route – This indicator reflects the potential effects of exposure to increased traffic during transport of landfill materials to the off-site TSD. Approximately 15,500 truckloads of landfill material would be transported along the haul route and the trucks would make return trips. Incidents can be controlled by safe driving and pedestrian practices; however, the consequences in the event of an incident can be serious. The risks for this indicator are estimated to be medium.

25. Potential effects from for accidental spills along the transportation route – The significant truck traffic along the haul route has the potential for increased spills. The risks for this indicator are estimated to be minor.

26. Off-site TSD and Vicinity (Alternative 3 only) Potential for lead/metal-bearing dust – This indicator reflects the potential to minimize community exposures to potentially lead/metal-bearing airborne dust from the off-site TSD. The crushing operations prior to retreatment at this facility would result in a probability of community exposures. This exposure would be limited by the expected remoteness of the facility from residential areas. The risks for this indicator are estimated to be minimal.

27. Increased truck traffic at the off-site TSD – This indicator reflects the potential effects from exposure to increased truck traffic into and out of the off-site TSD during transport of the landfill material from the Class 2 landfill. This exposure would be limited by the expected remoteness of the facility from residential areas. The risks for this indicator are estimated to be minimal.

28. Increased noise at the off-site TSD – This indicator reflects the potential for community exposure to increased noise during the crushing and handling of materials at the off-site TSD. This exposure would be limited by the expected remoteness of the facility from residential areas. The risks for this indicator are estimated to be minimal.

5.2.2.2 Occupational Hazard Minimization

This sub-group evaluates the potential risks related to short-term impacts from each alternative to on-site remediation workers at the Class 2 landfill, and at the off-site TSD for Alternative 3. The evaluated risks include potential exposures as described below.

29. Class 2 Landfill Potential for lead/metal-bearing dust – This indicator reflects the potential exposure of remediation workers to potentially lead/metal-bearing construction dust during implementation of the remedial alternatives. For Alternative 1, standard earth moving equipment would be employed, and no intrusive activities are planned. For Alternatives 2 and 3, there would be considerable potential for increased lead/metal-bearing dust due to the breaking and loading landfill material. Alternative 2 would require crushing to a specified particle size, which would generate finer lead/metal-bearing dust than Alternative 3. It is assumed compliance with occupational health and safety standards will mitigate this risk. The risks for this indicator are estimated to be minimal for Alternative 1, major for Alternative 2, and medium for Alternative 3.

30. On-site machinery – This indicator reflects the potential risks for accidents to on-site workers related to on-site machinery. For Alternative 1, standard earth moving equipment would be employed, and no intrusive activities are planned. For Alternatives 2 and 3, heavy equipment for breaking, loading, crushing, and hauling landfill material would be employed. It is assumed compliance with occupational health and safety standards will mitigate this potential risk. The risks for this indicator are estimated to be minor for Alternative 1 and major for Alternatives 2 and 3 due to the crushing, breaking, or hauling activities that will occur for these alternatives.

31. Increased noise – This indicator reflects the potential risks due to increased noise levels for remediation workers. For Alternative 1, standard earth moving equipment would be employed, and no intrusive activities are planned. For Alternatives 2 and 3, there would be considerable increased noise due to the breaking, loading, crushing, or hauling landfill material. It is assumed compliance with occupational health and safety standards will

mitigate this risk. The risks for this indicator are estimated to be minor for Alternative 1 and major for Alternatives 2 and 3.

32. Landfill material – This indicator reflects the potential exposures of remediation workers to lead/metal-bearing slag. For Alternative 1, no intrusive activities are planned into the landfill material. For Alternatives 2 and 3, the landfill material would be excavated, crushed or broken, and hauled. It is assumed compliance with occupational health and safety standards will mitigate this risk. The risks for this indicator are estimated to be minimal for Alternative 1 and medium for Alternatives 2 and 3.

Off-site TSD (Alternative 3 Only)

33. Potential for lead/metal-bearing dust – This indicator reflects the potential exposure of remediation workers to potentially lead/metal-bearing construction dust during implementation of the remedial alternative. Crushing operations at the off-site TSD would have a high probability to generate potentially lead/metal-bearing dust. It is assumed compliance with occupational health and safety standards will mitigate this risk. The risks for this indicator are estimated to be medium for Alternative 3.

34. On-site machinery – This indicator reflects the potential for accidents to on-site workers related to on-site machinery. For Alternative 3, heavy equipment for hauling and crushing landfill material would be employed. It is assumed compliance with occupational health and safety standards will mitigate this potential risk. The risks for this indicator are estimated to be medium for Alternative 3, which is a higher score than for the on-site machinery score for the Class 2 landfill (Indicator 30) because most of the on-site machinery activities (breaking, loading, and hauling) will be at the Class 2 landfill compared to the off-site TSD (crushing).

35. Increased Noise – This indicator reflects the potential exposure to increased noise levels for remediation workers. For Alternative 3, there would be considerable increased noise due to the hauling and crushing of landfill material. It is assumed compliance with occupational health and safety standards will mitigate this risk. The risks for this indicator are estimated to be medium for Alternative 3 which is a higher score than for the noise score for the Class 2 landfill (Indicator 31) because most of the noise-making activities (breaking, loading, and hauling) will be at the Class 2 landfill compared to the off-site TSD (crushing).

36. Landfill material – This indicator reflects the potential exposure of remediation workers at the off-site TSD to lead/metal-bearing slag. Crushing operations at the off-site TSD could result in a direct contact with the material and a high probability of worker exposure. It is assumed compliance with occupational health and safety standards will mitigate this risk. The risks for this indicator are estimated to be minor for Alternative 3, which is a higher score than for the landfill material score for the Class 2 landfill (Indicator 32) because most of the landfill material exposures (breaking, loading, and hauling) will be at the Class 2 landfill compared to the off-site TSD (crushing).

Both Facilities

37. Chemical hazards – this indicator reflects the potential for worker exposure to chemical hazards during retreatment of landfill materials. For Alternative 1, no retreatment is required. For Alternatives 2 and 3, retreatment will be conducted on excavated and crushed landfill materials at the Class 2 landfill (Alternative 2) or the off-site TSD (Alternative 3). It is assumed compliance with occupational health and safety standards

will mitigate this risk. The risks for this indicator are estimated to be minimal for Alternative 1, medium for Alternative 2, and minor for Alternative 3.

5.2.2.3 Ecological Hazard Minimization

This sub-group evaluates the potential risks related to short-term impacts from each alternative to terrestrial and aquatic organisms near the Class 2 landfill and, for Alternative 3, along the 250-mile transportation route and in the vicinity of the off-site TSD. The evaluated risks include potential exposures as described below.

Terrestrial Organisms

Class 2 Landfill and Vicinity

38. Potential for lead/metal-bearing dust – similar to off-site resident exposures (Indicator 20). The risks for this indicator are minimal for Alternative 1 and medium for Alternatives 2 and 3.

39. Increased truck traffic – similar to off-site resident exposures (Indicator 21). The risks for this indicator are minor for Alternative 1, and medium for Alternatives 2 and 3.

40. Increased noise – similar to off-site resident and on-site worker exposures (Indicators 22 and 31, respectively). The risks for this indicator are minor for Alternative 1 and medium for Alternatives 2 and 3.

41. Landfill material – similar to on-site worker exposures (Indicator 36). The risks for this indicator are minimal for Alternative 1, medium for Alternative 2, and minor for Alternative 3.

42. Transportation Route (Alternative 3 only) Potential for lead/metal-bearing dust – similar to off-site resident exposures (Indicator 23). The risks for this indicator are minor.

43. Increased truck traffic – similar to off-site resident exposures (Indicator 24). The risks for this indicator are medium.

44. Potential for accidental spills – similar to off-site resident exposures (Indicator 25). The risks for this indicator are minor.

Off-site TSD

45. Potential for lead/metal-bearing dust – this indicator reflects terrestrial organism exposure to increased lead/metal-bearing dust generated during the crushing and handling of materials at the off-site TSD. The facility is expected to be located in a semi-industrial area, which likely has reduced populations of terrestrial organisms compared with undisturbed areas. The risks for this indicator are estimated to be minor.

46. Increased truck traffic – this indicator reflects terrestrial organism exposure to increased truck traffic at the off-site TSD. The facility is expected to be located in a semi-industrial area, which likely has reduced populations of terrestrial organisms compared to undisturbed areas. The risks for this indicator are minor.

47. Increased noise –this indicator reflects terrestrial organism exposure to increased noise during the crushing and handling of materials at the off-site TSD facility. The facility is expected to be located in a semi-industrial area, which likely has reduced populations of terrestrial organisms compared with undisturbed or residential areas. The risks for this indicator are estimated to be minor.

48. Landfill material – similar to on-site worker exposures (Indicator 36). The risks for this indicator are minor.

Aquatic Organisms

Class 2 Landfill and Vicinity

49. Potential for lead/metal-bearing dust – similar to terrestrial organism exposures (Indicator 38), although scores are lower because activities would be conducted remote from stream or riparian areas. The risks for this indicator are minimal for Alternative 1 and minor for Alternatives 2 and 3.

50. Increased truck traffic – similar to terrestrial organism exposures (Indicator 39), however most traffic would not occur in stream or riparian areas. The risks for this indicator are minimal for all three Alternatives.

51. Increased noise – similar to terrestrial organism exposures (Indicator 40), however these activities will be conducted remote from stream or riparian areas. The risks for this indicator are minimal for all three Alternatives.

52. Landfill material – landfill material operations will not occur in stream or riparian areas. The risks for this indicator are minimal for all three Alternatives.

Transportation Route (Alternative 3 only)

53. Potential for lead/metal-bearing dust – similar to terrestrial organism exposures (Indicator 42), however most of the route would not be stream or riparian areas. The risks for this indicator are minimal.

54. Increased truck traffic – similar to terrestrial organism exposures (Indicator 43), however most traffic would not occur in stream or riparian areas. The risks for this indicator are minor.

55. Potential for accidental spills – similar to terrestrial organism exposures (Indicator 44). The risks for this indicator are minor.

Off-site TSD (Alternative 3 only)

56. Potential for lead/metal-bearing dust – similar to terrestrial organism exposures (Indicator 45). The risks for this indicator are minor.

57. Increased truck traffic – similar to terrestrial organism exposures (Indicator 46), however most traffic would not occur in stream or riparian areas. The risks for this indicator are minimal.

58. Increased noise – similar to terrestrial organism exposures (Indicator 47), however these activities will be conducted remote from stream or riparian areas. The risks for this indicator are minimal.

59. Landfill material – landfill material operations will not occur in stream or riparian areas. The risks for this indicator are minimal.

5.2.2.4 Environmental Effects

This sub-group evaluates the potential environmental effects related to energy consumption and non-dust-related air emissions for each alternative.

60. Energy consumption – This indicator reflects the potential for minimization of energy consumption. Alternative 1 requires relatively low energy consumption for the construction and import of general clean materials to cap the landfill. Alternative 2 requires medium energy consumption to excavate and crush the landfill material, Alternative 3 requires significant energy consumption to excavate the landfill material, transport the material (15,500 truckloads over 250 miles each way, which equates to approximately 7,750,000 truck miles travelled), and crushing the material at the off-site TSD. The energy consumption is minimal for Alternative 1, medium for Alternative 2, and major for Alternative 3.

61. Non-dust air emissions – This indicator reflects the non-dust air emissions from equipment and trucks. Alternative 1 would produce relatively low emissions during the construction and import of general clean materials to cap the landfill. Alternative 2 would produce medium emissions while excavating and crushing the landfill material. Alternative 3 would produce significant emissions while excavating the landfill material, transporting the material (15,500 truckloads over 250 miles each way, which equates to approximately 7,750,000 truck miles travelled), and crushing the material at the off-site TSD. The produced non-dust air emissions are minimal for Alternative 1, medium for Alternative 2, and major for Alternative 3.

5.2.3 Implementability

The implementability criterion addresses the degree of difficulty in implementing each alternative. Implementability issues become more significant as the complexity of the alternative increases. Implementability issues are important because they incorporate the potential for the inability to obtain the necessary approvals to implement the remedy, delays and remedy failure. The implementability criterion addresses the following sub-groups: technical feasibility and administrative feasibility. The indicators for these sub-groups are described below.

5.2.3.1 Technical Feasibility

This sub-group has two indicators that reflect the potential ability of the remedial alternative to be implemented technically.

62. Technical Feasibility (Remediation Activities) – This indicator reflects the factors that could negatively affect the technical feasibility of each alternative, including problems occurring during implementation, uncertainties, the likelihood of delays due to technical problems, and the ease of modifying the alternative, if required. Alternative 1 involves a proven technology, and readily available equipment and personnel. Alternative 2 also

involves a proven technology, available equipment and personnel; however there is a need to develop a sound protocol for treatment, testing, and placement of landfill material to gain agency acceptance. Alternative 3 is technically feasible. The technical feasibility for this indicator is very high for Alternative 1 and high for Alternatives 2 and 3.

63. Technical Feasibility (Air Quality) – This indicator reflects the physical challenges of minimizing air quality impacts and avoiding emission levels that could potentially affect the timeline for attainment demonstration with the lead NAAQS. For Alternative 1, no intrusive activities are planned, and minimal dust generation (from general clean materials) would occur. For Alternatives 2 and 3, there would be considerable increased potential for lead/metal-bearing dust generation due to the breaking, loading, and crushing landfill material. Alternative 2 would require crushing to a specified particle size, which would generate finer lead/metal-bearing dust than Alternative 3. Implementation of Alternatives 2 and 3, which will generate lead/metal-bearing dust, must account for the lead NAAQS attainment demonstration status and timeline. Perimeter air monitoring with low action levels (that is, work stoppages would occur if action levels are exceeded) may increase the duration of the implementation of Alternatives 2 and 3. The technical feasibility for this indicator is very high for Alternative 1, low for Alternative 2 and medium for Alternative 3.

5.2.3.2 Administrative Feasibility

This sub-group reflects the potential ability to comply with and secure regulatory approvals required under applicable laws and regulations, and would be negatively impacted by the degree of difficulty anticipated due to regulatory constraints or community objections. The following indicators are evaluated in this sub-group:

64. Regulatory compliance – This indicator reflects the degree of difficulty in obtaining regulatory approval for the remedial alternatives. Increased effort may be required to achieve regulatory and community acceptance depending on the extent of potential dust, traffic, and noise impacts in the vicinity of the site. TCEQ waste-program approval of each of these remedial actions would be required. Alternative 1 would involve conventional construction activities. Alternatives 2 and 3 would involve substantial increased dust (including potential lead-bearing dust), traffic, and noise. As a result, considerable effort may be required to gain community and regulatory acceptance, and it is uncertain whether such acceptance could be achieved. The administrative feasibility for this indicator is high for Alternative 1 and medium for Alternatives 2 and 3. .

65. Regulatory Compliance - Air Quality – This indicator reflects the degree of difficulty in obtaining air-quality-related regulatory approvals for each alternative. The lead NAAQS non-attainment status of the area and considerations regarding the State Implementation Plan may result in increased difficulty in obtaining regulatory approval for Alternatives 2 or 3 due to the intrusive nature of these alternatives that have the potential for generating lead/metal-bearing dust during implementation. In addition, the duration of Alternative 2 could implicate air permitting for certain equipment that may be complicated by the lead NAAQS nonattainment status of the area. The administrative feasibility for this indicator is very high for Alternative 1, low for Alternative 2 and medium for Alternative 3.

66. Land or water use restrictions - This indicator reflects the ability to minimize property or water use restrictions. It is assumed that Exide will place the property under restriction as a non-residential property in perpetuity for all three alternatives. Groundwater use restrictions are anticipated for the site in any event, regardless of potential impact from

the Class 2 landfill. The potential for minimization of additional restrictions is estimated to be high for Alternatives 1 and 2, and very high for Alternative 3.

67. Local business effects - This indicator reflects the potential for impacts to local business during the implementation of the remedial alternatives, including potential for generation of business through purchase of local goods and services, accommodations for workers, or local employment opportunities. Alternative 1 is relatively short-term, and Alternatives 2 and 3 have the potential to be longer term and possibly employ more local resources. The potential for increased local business opportunities relating to the remediation project is estimated to be medium for Alternative 1 and high for Alternatives 2 and 3.

68. Visual aesthetics - This indicator evaluates the effect of aesthetic compatibility with local surroundings for each alternative. The final condition for all Alternatives is revegetated grassland. Alternative 2 could result in a vegetated mound due to the increased volume of landfill contents as a result of adding treatment reagents. The potential for impacts to visual aesthetics is estimated to be medium for Alternatives 1 and 2, and very low for Alternative 3.

69. Surrounding property values - This indicator evaluates the effect of remedial alternatives on real or perceived surrounding property values. It is widely acknowledged that despite Exide's presence and the potential negative effects of its operations, land values have increased in and around the FRC, significant high-end development occurred, and schools and other public buildings were constructed resulting in an increase in tax collections and generally a higher quality of life in Frisco. The potential for impacts to property values is estimated to be low for Alternatives 1 and 2, and very low for Alternative 3. The off-site TSD is currently in operation as a hazardous waste facility, the potential for impacts to property values is estimated to be very low.

5.2.4 Cost

The cost of implementation is estimated for each remedial alternative as an additional consideration.

70. Cost – This consideration includes both capital and post-closure costs (i.e., operation and maintenance and monitoring costs). Alternative costs are estimated for magnitude and compared relatively across the three alternatives. The score for cost is negatively affected by high costs. The costs are estimated to be very low for Alternative 1 (score = 25), medium for Alternative 2 (score = 8), and very high for Alternative 3 (score = 3).

5.3 Risk Evaluation of Remedial Alternatives

Table 1 presents the inputs and results of the risk evaluation of the three remedial alternatives. Figure 8 presents a diamond chart that illustrates the relative potential for each remedial alternative to achieve remedial objectives and optimize the criteria associated with the alternatives. Similar to the scoring scale, a larger area in the diamond figure reflects a more favorable outcome. Figure 9 presents bar charts illustrating the scores for each sub-group within each criterion. These charts allow a further detailed look at the individual factors contributing to the overall scores for each criterion. Figure 10 provides a bar chart for each individual indicator, which allows detailed comparison of each indicator across each alternative. As described above, the indicators are not weighted, and each indicator therefore carries equal weight.

The purpose of the charts in Figures 8, 9, and 10 is to illustrate the potential trade-offs among the remedial alternatives. Some of the alternatives optimize (that is, score high on) several parameters, but also score low on other parameters. Observing the trade-offs allows for a more objective review of the remedial alternatives when determining which alternative provides the best balance of all selection criteria.

5.3.1 Effectiveness

5.3.1.1 Long-Term Risk Minimization

Alternative 1: Closure In Place (Average Score = 20.1, Minimal Risk)

Scores for individual indicators indicate there are minimal to minor long-term risk to off-site resident and ecological receptors and future remediation workers for this alternative.

This alternative provides long-term protection of human health and the environment at the Class 2 landfill. The potential effects to groundwater, surface water and sediment are minimized with the existing liner and cover and installation of final cover on portions of the landfill that are not capped. The liner and underlying subgrade for the Class 2 landfill is comparable to the lower composite liner of the containment system required for a permitted TSD facility. The multi-layer cap would have a very low permeability, minimizing the potential for human or ecological exposure to landfill material, and minimizing the potential for surface water to contact landfill material or landfill contents to migrate to groundwater. The cover would be vegetated to minimize erosion, and long-term cover maintenance and inspections would be conducted. Groundwater monitoring would be performed as well. Given the analytical data for the material in the landfill, the typical low mobility of lead and other metals in treated slag, and the landfill design, the potential for releases that may cause adverse effects to the surrounding environment is minimal.

Aerial dispersion and off-site deposition of potentially lead/metal-bearing dust and long-term impacts to off-site soil would be negligible with this alternative because this alternative does not involve intrusive activities such as breaking, excavating, crushing, or transporting the landfill material.

Long-term reduction of toxicity and mobility through additional treatment would not occur under this alternative. However, lead and other metals in slag are not highly mobile, and the material was previously treated. Only a small fraction of laboratory analytical reports from the period cells 1 through 9 were in operation indicated results above the lead and/or cadmium UTS and the majority of the material above the lead and/or cadmium UTS in cells 10 through 12 occurs in the top 6 inches of those cells. Because no additional treatment would occur the volume of material would not increase as in the other two alternatives.

Alternative 2: On-Site Ex Situ Retreatment (Average Score = 19.7, Minimal Risk)

Scores for individual indicators indicate there are minimal to medium long-term risks to off-site residents, minimal risks to future remediation workers, and minimal to minor long-term risks to ecological receptors for this alternative.

This alternative provides long-term protection of human health and the environment at the Class 2 landfill. This alternative requires retreatment of the landfill material to levels below UTS criteria. As in Alternative 1, a multi-layer cover with very low permeability and the multi-layer bottom liner would provide physical containment of the retreated material, minimizing the potential for human or ecological exposure to the retreated material and minimizing the potential for surface water to contact landfill material or landfill contents to migrate to groundwater. The cover would be vegetated to minimize erosion and long-term cover maintenance and inspections would be conducted. Groundwater monitoring would be performed as well. Given the typical low mobility of lead and other metals in treated slag, the landfill design, and that the landfill material would be retreated, it is unlikely that there would be a release to the surrounding environment.

There are medium potential effects as a result of excavation and crushing operations required for this alternative that would generate potentially lead/metal-bearing dust that could be aerially dispersed and deposited onto off-site soil. The estimated long-term risks from affected off-site soil are medium for off-site residents and minor for ecological receptors.

Long-term reduction of toxicity and mobility through additional treatment would be implemented under this alternative. It would be important to verify treatment effectiveness by testing the material after retreatment and before replacing the material in the landfill. The addition of chemical stabilizers to retreat the material would result in an increased volume of material and, when capped, a mound a few feet above surrounding grade.

Alternative 3: Excavation and Off-Site Retreatment and Disposal (score = 20.7, Minimal Risk)

There are minor long-term risks to off-site residents near the Class 2 landfill from affected off-site soil related to the breaking and excavation of landfill material for this alternative. There are minimal long-term risks to all potential receptors at the off-site TSD.

This alternative removes all landfill material from that landfill. The materials would be transferred to the off-site TSD to be retreated and disposed, with minimal long-term risks to all potential receptors at the off-site TSD.

Potential effects in the vicinity of the Class 2 landfill include minor risk associated with aerial dispersion and off-site deposition of potentially lead/metal-bearing dust generated from the breakage, excavation, and transport of landfill material required for this alternative. At the off-site TSD, there would be minimal risks of effects from exposure to landfill material, groundwater, surface water, and sediments due to the siting and engineering requirements at that facility.

Long-term reduction of waste toxicity and mobility through additional treatment would be implemented under this alternative as material would be retreated prior to placement at the off-site TSD facility. It would be important to verify treatment effectiveness by testing the material after retreatment. The addition of chemical stabilizers to retreat the material would result in an increased volume of material being disposed.

5.3.1.2 Short-Term Risk Minimization

Alternative 1: Closure In Place (score = 23.0, Minimal Risk)

The short-term potential risks to off-site resident and ecological receptors and onsite workers from exposure to landfill material and the potential for occupational hazards would be minimal to minor for Alternative 1. This alternative would require approximately 3 to 4 months to implement (once regulatory approval is received and the remaining capacity is filled). The short-term risks for occupational hazards associated with Alternative 1 are lower than the other alternatives because this alternative involves less landfill excavation and construction activities.

This alternative does not require intrusive activities that would disturb the landfilled waste material and does not involve excavation, crushing, or transport activities that would generate emissions of potentially lead/metal-bearing dust or otherwise expose the landfill material during implementation.

Risks to off-site resident and ecological receptors and onsite workers from truck traffic and noise associated with this alternative would also be minimal to minor. Compared with the other alternatives, this alternative would also have minimal energy consumption and air emissions from trucks and construction equipment.

Alternative 2: On-Site Ex Situ Retreatment (score = 19.5, Minimal Risk)

There are minimal to major short-term risks for this alternative due to the excavation and crushing operations required for retreatment of the landfill material. This alternative would require at least 2 years to implement for retreatment (once regulatory approval is received) and about 3 to 4 months for cap construction (once the remaining capacity is filled).

The overall short-term risk minimization score for this alternative is attenuated by the optimal scores given for Alternatives 1 and 2 for indicators that describe activities that occur only along the transportation route or at the off-site TSD. The sub-group scores provide more insight into short-term risk minimization effects for this alternative. The site worker sub-group risks are minor (score = 15.2) relative to Alternative 1 (score = 21.9) due to medium to major risks for several indicators within this subgroup.

During implementation, excavation, and crushing operations performed under this alternative potentially lead/metal-bearing airborne dust would be generated, creating medium risk for off-site residents and minor to medium risk for ecological receptors. The increased traffic and noise from these operations would result in minimal to medium risks to off-site residents and ecological receptors. This alternative would also result in minimal to medium risks for ecological receptors becoming exposed to landfill material.

For on-site remediation workers, a substantial increase in on-site machinery during implementation would result in major risks of incidents, noise effects, and inhalation of lead/metal-bearing dust. This alternative would require at least 2.5 years of implementation. During implementation, there are medium risks for on-site workers from exposure to landfill material as the landfill material is excavated, crushed, retreated and put back in the landfill. In addition, because the landfill material will be retreated, on-site workers have a medium risk of chemical incidents from retreatment chemicals.

This alternative would have medium energy consumption and non-dust air emissions (including nitrogen oxide (NO_x) emissions – an ozone precursor) from excavation and crushing operations due to the intensity of operations and duration required for implementation. This could result in increased impacts to the community (for example increased diesel emissions) during the implementation of this alternative.

Alternative 3: Excavation and Off-Site Retreatment and Disposal (score = 14.5, Medium Risk)

There are minimal to major short-term risks for this alternative due to the excavation and crushing operations required for retreatment of the landfill material at the Class 2 landfill. This alternative would require from 1.5 to 3 years to implement (once regulatory approval is received).

This alternative would require hauling an estimated 15,500 truckloads of landfill material at a rate of about 21 to 42 trucks per day to the off-site TSD that is expected to be 250 miles away from the FRC.

Excavation and breakage operations performed under this alternative would generate potentially lead/metal-bearing dust during implementation, resulting in a medium short-term potential risks to off-site residents and on-site workers, and a minor to medium risk to ecological receptors at the Class 2 landfill. Contact with landfill material during implementation of this alternative at the Class 2 landfill would pose a medium risk to on-site workers, a minor risk to terrestrial organisms, and a minimal risk to aquatic organisms.

During implementation, increased traffic in the vicinity of the Class 2 landfill would result in major risks to off-site residents, medium risks to terrestrial organisms, and minimal risks to aquatic organisms. Due to the frequency and duration of use of on-site construction equipment at the Class 2 landfill, this alternative poses a major risk of potential incidents for on-site workers. Excavation and transportation activities in the vicinity of the Class 2 landfill would result in medium short-term risks of noise effects to off-site residents and terrestrial organisms, minimal risks to aquatic organisms, and major risk to remediation workers.

Along the transportation route, the increased traffic for this alternative would result in medium risks to off-site residents and terrestrial receptors and to minor risks with aquatic receptors. There would be minimal to minor risks to off-site residents and ecological receptors related to lead/metal-bearing dust and potential spills along the transportation route.

At the off-site TSD and vicinity, there would be minimal risks to off-site residents and aquatic organisms, and minor risks for ecological receptors due to increased traffic near the facility. There would be medium risks to on-site workers related to on-site machinery due to potential incidents, and increased noise. The effects of increased noise on ecological receptors would be minimal to minor. The crushing activities at the off-site TSD would result in generation of potentially lead/metal-bearing dust that would result in a minimal risk to off-site residents, minor risks to ecological receptors, and medium risks to on-site workers. Workers at the off-site TSD would have minor risks of contact with landfill material and from chemical retreatment activities.

This alterative would result in very high energy consumption and non-dust air emissions (including NO_x emissions – an ozone precursor) from equipment operations associated with breaking, excavation, crushing, retreatment, and hauling 15,500 truckloads of landfill material 250 miles one way. This alternative scores the least favorably for energy consumption and air emission indicators.

5.3.2 Implementability

The scores assigned to the implementability of the alternatives are described below.

Alternative 1: Closure In Place (score = 17.8, Minor Risk)

This alternative scored 25 (the optimal score) for the technical feasibility sub-group because it involves conventional on-site construction and does not involve any retreatment activity or activities that would generate potentially lead-bearing dust. There would be much less traffic and noise for this alternative compared to Alternatives 2 and 3. This alternative received an administrative feasibility sub-group score of 15.3. TCEQ waste-program approval of this remedial action would be required and ultimate community acceptance of this alternative is unknown.

Alternative 2: On-Site Ex Situ Retreatment (score = 12.5, Medium Risk)

This alternative received a technical feasibility sub-group score of 11.0, and an administrative feasibility score of 13.0 for several reasons. The potential for significant off-site impacts (i.e., potentially lead/metal-bearing dust, truck traffic and noise) could negatively impact regulatory approval and community acceptance. Dust generation could result in an increase in the duration of the remediation process due to dust suppression and perimeter air monitoring requirements. In addition, the duration of the project (likely involving at least 2 years of crushing activities) could require air permitting authorizations for certain equipment, which may be complicated by the lead nonattainment status of the area. The dust-generating nature of the activities to implement this alternative, including potentially lead-bearing dust, is likely to receive increased scrutiny for regulatory acceptance in light of the requirement to attain and maintain the lead NAAQS.

In addition, TCEQ waste-program approval of this remedial action would be required. Implementation is expected to require additional development of and agency acceptance of protocols to demonstrate the effectiveness and reliability of the retreatment and the analytical confirmation of the landfill material. Treatment has been used and proven to work at the site, but further pilot testing would need to be performed to identify an appropriate treatment additive and analytical confirmation process that would be acceptable to TCEQ and USEPA. A rigorous quality assurance and quality control (QA/QC) process would also need to be put in place.

Alternative 3: Excavation and Off-Site Retreatment and Disposal (score = 16.6, Minor Risk)

This alternative received a technical feasibility score of 14, and an administrative feasibility score of 17.5 for several reasons. The potential for significant off-site impacts (i.e., potentially lead/metal-bearing dust, noise, and truck traffic) could negatively impact regulatory approval and community acceptance of this alternative. Community acceptance would involve a balance of the long-term benefits against the long-term impacts (from potentially lead-bearing dust deposition onto soil) and short-term impacts related to dust, traffic, and noise. Dust generation from breaking and excavating could result in an increase in the duration of the remediation process due to dust suppression and perimeter air monitoring requirements. The dust-generating nature of the activities to implement this alternative is likely to receive increased scrutiny for regulatory acceptance in light of the requirement to attain and maintain the lead NAAQS.

TCEQ waste-program approval of this remedial action would be required. As in Alternative 2, the retreatment process has already been tested in a pilot program. Because similar retreatment would occur at the off-site TSD, it will be necessary to identify an analytical confirmation procedure that would be acceptable to the applicable state agency (TCEQ) and USEPA. A rigorous QA/QC process would likely already be in place at the off-site TSD to ensure that landfill material has been adequately treated.

5.3.3 Cost

Cost is represented by cost estimates that have been prepared for each alternative based on the descriptions presented in Section 4.0. Cost estimates include capital costs for construction and post-remediation costs (i.e., groundwater monitoring and cover inspection and maintenance). The cost evaluation for the three alternatives is summarized below.

- Alternative 1 (Score = 25, Minimal) – The estimated cost for this alternative is less than $2 million, approximately an order of magnitude less than the estimated cost for Alternative 2 and 1/40 (less than 3%) the cost of Alternative 3.
- Alternative 2 (Score = 8, Medium) – The estimated cost for this alternative is over $30 million, which is more than an order of magnitude higher that Alternative 1.

Alternative 3 (Score = 3, Critical) – The estimated cost for this alternative is nearly $80 million, which is more than twice as much as the cost estimated for Alternative 2, and approximately 40 times the costs of Alternative 1.

In addition to the implementation rating process for this assessment described above, the cost of each of the various alternatives is an important consideration. Alternatives 2 and 3 are significantly more costly. Yet, despite the substantial cost differential, neither Alternatives 2 or 3 would achieve a distinguishable difference in long-term risks or the ultimate goal of long-term effectiveness while both would carry less favorable potential short-term risks when compared to Alternative 1. Accordingly, a responsible party making environmentally and financially responsible decisions would conclude that Alternatives 2 and 3 are less implementable than Alternative 1. Further to this point, Exide is currently a debtor and debtor in possession pursuant to chapter 11 of the United States Bankruptcy Code. Currently, Exide's ongoing operations including its ordinary course environmental remediation and closure obligations are funded by proceeds received from ordinary course operations and funding provided by its post-petition debtor in possession financing facility (the "DIP Financing"). Assuming Exide emerges pursuant to a plan of reorganization, it will require funding on a go-forward basis pursuant to an "exit" financing facility (the "Exit Financing") which would be effective upon Exide's emergence from chapter 11. The DIP Financing does not now (nor does Exide anticipate the Exit Financing will) contemplate $30M or $80M to address the Class 2 landfill. Therefore it may be inappropriate to assume Exide could implement Alternatives 2 and 3.

6.0 CONCLUSIONS

The main conclusions of this evaluation are:

- For long-term risk minimization, all three alternatives scored as presenting minimal risks (Scores for Alternatives 1, 2, and 3 are 20.1, 19.7, and 20.7, respectively).
- For short-term risk minimization, Alternative 1 (Closure in Place, score = 23.0) scores 15% higher than Alternative 2 (On-Site Ex Situ Retreatment, score = 19.5) and 37% higher than Alternative 3 (Excavation and Off-Site Retreatment and Disposal, score = 14.5). Alternatives 2 and 3 score lower because they involve removing and processing the existing waste material, creating the potential for lead/metal-bearing dust generation, and traffic and noise issues, among other considerations.
- For implementability, Alternative 1 (score = 17.8) scores 30% higher than Alternative 2 (score = 12.5) and 6% higher than Alternative 3 (score = 16.6). The Alternative 2 implementability score is medium, which is lower than the other alternatives because it involves removing and processing the existing waste material, creating the potential for lead/metal-bearing dust generation, developing analytical procedures, more complex regulatory approval, and community acceptance challenges. The Alternative 3 implementability score is high, but lower than Alternative 1 due to the challenges to be faced in gaining acceptance for landfill material excavation, lead/metal-bearing dust, long-distance hauling, retreatment, and disposal.

Figure 8 provides a diamond chart illustrating the relative overall criteria scores for the three remedial alternatives. As discussed in Section 5.3, a larger area in the diamond figure reflects a better outcome (i.e. higher score) for the associated alternative.

The long-term risk is scored as minimal for all three alternatives, with comparable scores ranging between 19.7 and 20.7. This indicates that all three alternatives are expected to present minimal long-term risks, and to have high potential to provide long-term protection, to human and ecological receptors and the environment.

For short-term risks, Alternative 1 (score = 23.0) is expected to present minimal short-term risks, as it does not involve intrusive removal or processing of the existing landfill material or the attendant, the generation of lead/metal-bearing dust, and clean cover material would be applied to the landfill. The short-term risk score for Alternative 2 is less favorable (score = 19.5) because this alternative involves removing and processing the existing landfill material and has the potential to generate lead/metal-bearing dust. It should be noted that the score for short-term risk minimization for Alternative 2 is averaged over 42 indicators (which tends to attenuate the individual scores), and that 11 indicators scored medium, and 3 indicators scored major for this Alternative. The score for Alternative 3 (14.5) is lower than Alternative 2 and much lower than Alternative 1 because this alternative involves the same removal and processing as Alternative 2, plus significantly increased transportation and traffic related to hauling excavated landfill material 250 miles to the off-site TSD. Similar to Alternative 2, the Alternative 3 average score for short-term risk minimization also attenuates the individual scores, and 11 indicators scored medium, and 5 indicators scored major for this alternative. For Alternatives 2 and 3, the potential to generate lead/metal-bearing dust (and off-site soil impacts), noise, and on- and off-site traffic presents risks and hazards to off-site resident and ecological receptors and remediation workers. Although mitigation measures would be implemented, these measures might not fully eliminate the risk.

The implementability score for Alternative 1 (17.8) is higher than the scores for Alternatives 2 (12.5) and 3 (16.6). Alternative 1 involves conventional on-site construction; however some landfill material above the UTS would remain in place, which may require some effort to gain regulatory approval and community acceptance. The scores for Alternatives 2 and 3 are lower because these alternatives involve removing and processing the existing waste material, and developing analytical procedures and a protocol, creating air emission issues, and may pose a challenge in terms of gaining regulatory approval and community acceptance. For Alternatives 2 and 3, there will also likely be physical challenges of minimizing air quality impacts and avoiding emission levels that could potentially affect the timeline for attainment demonstration with the lead NAAQS.

The estimated cost for Alternative 1 (estimated to be less than $2 million) is more than an order of magnitude less than the estimated cost for Alternative 2 (estimated to be over $30 million), and the cost for Alternative 3 (estimated to be about $80 million) is over twice the cost for Alternative 2, and approximately 40 times the cost of Alternative 1. Despite entailing significantly higher cost, implementation of the two higher cost alternatives (2 and 3) would not achieve a distinguishable difference in long-term risks or the ultimate goal of long-term effectiveness. Potential short-term effects during implementation of Alternatives 2 and 3 would result in increased short-term risks relative to Alternative 1.

Given that all three Alternatives score comparably for long-term risk minimization and Alternative 1 scores higher than Alternatives 2 and 3 with respect to short-term risk minimization and implementability, from a risk evaluation standpoint, Alternative 1 would be the best option.

7.0 QUALIFICATIONS

This report was prepared to present our evaluation of potential remedial alternatives for the FRC Class 2 landfill from a relative risk perspective, in a systematic and comprehensive manner to determine which alternative provides the best balance of the criteria. While this report does not present a quantitative analysis under fully developed fate and transport evaluation of exposure scenarios, receptor uptake, and other processes, it uses extensive existing data and careful analysis to provide a rigorous comparative analysis.

The results presented in this report depend to some extent on the scoring factors assumed for this evaluation, which were based on best professional judgment after reviewing extensive data. However, a qualitative review of the evaluation process suggests that these results would unlikely change significantly over a reasonable range of values, reflecting the major differences between the three alternatives.

Please provide any comments to the undersigned.

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TABLE

Table 1: Risk Evaluation of Remedial Alternatives

Criteria	Subgroup	Receptors	Indicator Number	Means of Potential Exposure	Location	Indicator Names	Alternative 1: Closure In Place (with cell reference from CSM Figure 5)	Alternative 2: Ex Situ On-Site Re-Treatment (with cell reference from CSM Figure 6)	Alternative 3a: Excavation and Off-Site Re-Treatment and Disposal): FRC Facility and Vicinity Only (with cell reference from CSM Figure 7)	Alternative 3b: Excavation and Off-Site Re-Treatment and Disposal: Off-Site TSD Facility and Vicinity Only (with cell reference from CSM Figure 7)	Scoring Criteria	Indicator Scores					Subgroup Scores			Criteria Scores		
												1	2	3a On-Site	3b Off-Site	3	1	2	3	1	2	3
		Off-Site Residents	1	Cover Failure	Class 2 Landfill and Off-Site TSD Facility	Off-Site Resident Exposure to Landfill Material	A1, A2 Minimal - Landfill would have low permeability, multi-layer capping system to prevent release of landfill contents to the environment. Some materials within the landfill exceed UTS.	A1, A2 Minimal - landfill material would be re-treated to below UTS, minimizing the potential for exposure to material above UTS. Landfill would have low permeability, multi-layer capping system to prevent release of landfill contents to the environment.	NA - all material in the Class 2 landfill will be removed from the site under this alternative.	H1, H2 Minimal - the landfill material would be treated to below UTS, minimizing the potential for exposure to material above UTS. The expected remoteness of facility to residential areas would result in lowered consequences of exposure due to lower potential frequency of contact.	Probability minimized 1 High probability 25 Low probability	20	20		25	25						
		Off-Site Residents	2	Affected Groundwater	Class 2 Landfill and Off-Site TSD Facility	Off-Site Resident Exposure to Affected Groundwater	A3, A4 Minor - the liner and cover system is designed according to industry standards to protect groundwater. The data on the extent of material above the hazardous waste criteria (and/or UTS), inherent low mobility of lead and other metals in the slag, and prior treatment further minimizes risk for migration to groundwater.	A3, A4 Minimal - landfill material would be re-treated to below UTS, which would result in less potential for migration to groundwater compared to Alternative 1. The liner and cover system is designed according to industry standards to protect groundwater.	NA - all material in the Class 2 landfill will be removed from the site under this alternative.	H3, H4 Minimal - the siting and engineering requirements at a TSD provide safeguards against release and potential exposure from such a facility, compared to Alternatives 1 and 2. The landfill material would be treated to below UTS, minimizing the potential for exposure to material above UTS.	Probability minimized 1 High probability 25 Low probability	16	20		25	25						
		Off-Site Residents	3	Affected Surface Water and Sediment	Class 2 Landfill and Off-Site TSD Facility	Off-Site Resident Exposure to Affected Surface Water and Sediment	A5, A6, A7, A8 Minor - same as for groundwater. In the unlikely event that groundwater becomes affected, then surface water and sediment in the vicinity could also become affected.	A5, A6, A7, A8 Minimal - same as for groundwater. In the unlikely event that groundwater becomes affected, then surface water and sediment in the vicinity could also become affected.	NA - all material in the Class 2 landfill will be removed from the site under this alternative.	H5, H6, H7, H8 Minimal - same as for groundwater. In the event that groundwater becomes affected, then surface water and sediment in the vicinity could also become affected.	Probability minimized 1 High probability 25 Low probability	16	20		25	25						
	Community Hazard Minimization	Off-Site Residents	4	Construction Activities	Class 2 Landfill and Vicinity	Off-Site Resident Exposure to Affected Off-Site Soil	A10, A11 Minimal - landfill material will be capped to prevent off-site migration of materials to off-site soil. Construction dust is expected to be from clean material, compared to lead/metal-bearing materials that would be handled in Alternatives 2 and 3. **The score for this indicator assumes that there would be controls in place for dust suppression, such as watering trucks, air monitoring, and safe engineering practices.**	A10, A11 Medium - the lead/metal-bearing landfill material would be crushed to a fine particle size, excavated, and hauled on-site prior to re-treatment. The fine particulate has greater potential for aerial dispersion and deposition onto off-site soil, and exposures to the lead/metal-bearing materials in soil could lead to adverse health effects. **The score for this indicator assumes that there would be controls in place for dust suppression, such as watering trucks, air monitoring, safe engineering practices; and emissions would be controlled to comply with the lead NAAQS.**	A12, A13 Minor - the lead/metal-bearing landfill material would be broken into pieces to allow excavation, but particle sizes not as fine as Alternative 2. The landfill material would be handled such that there is some potential for aerial dispersion and deposition onto off-site soil, and exposures to the lead or other metals in soil could lead to adverse health effects. The score for this indicator assumes that there would be controls in place for dust suppression, such as watering trucks, air monitoring, and safe engineering practices; and emissions would be controlled to comply with the lead NAAQS.	NA - this indicator applies to the Class 2 landfill only	Probability minimized 1 High probability 25 Low probability	25	12	16		16	20.4	19.4	23.2			
Long Term Risk Minimization		Off-Site Residents	5	Construction Activities	Off-Site TSD Facility Only	Off-Site Resident Exposure to Affected Off-Site Soil (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	H10, H11 Minimal - the crushing and excavation of landfill material prior to re-treatment at the off-site TSD facility has the potential for lead/metal-bearing dust generation, and deposition onto off-site soil. However, the off-site TSD facility is expected to be located in a large paved, semi-industrial area that is remote from residential soil. The expected remoteness of facility to residential areas would result in lowered consequences of exposure due to lower potential frequenc of contact. **The score for this indicator assumes that there would be controls in place for dust suppression, such as watering trucks, air monitoring, and safe engineering practices.**	Probability minimized 1 High probability 25 Low probability	*25*	*25*		25	25				20.1	19.7	20.7
		Future Industrial Workers	6	Cover Failure	Class 2 Landfill and Off-Site TSD Facility	Future Industrial Worker Exposure to Landfill Material	C1, C2 Minor - landfill would have low permeability, multi-layer capping system to prevent release of landfill contents to the environment.	C1, C2 Minimal - landfill material would be re-treated to below UTS. Landfill would have low permeability, multi-layer capping system to prevent release of landfill contents to the environment.	NA - all material in the Class 2 landfill will be removed from the site under this alternative.	J1, J2 Minimal - the siting and engineering requirements at a TSD provide safeguards against release and potential exposure from such a facility. The landfill material would be treated to below UTS, minimizing the potential for exposure to material above UTS.	Probability minimized 1 High probability 25 Low probability	16	20		25	25						
	Occupational Hazard Minimization	Future Industrial Workers	7	Affected Groundwater	Class 2 Landfill and Off-Site TSD Facility	Future Industrial Worker Exposure to Affected Groundwater	C3, C4 Minimal - the liner and cover system is designed according to industry standards to protect groundwater. The inherent low mobility of lead and other metals in the slag, and prior treatment further minimizes migration to groundwater.	C3, C4 Minimal - the liner and cover system is designed according to industry standards to protect groundwater. Material in the landfill would be treated to below UTS, which would result in less potential for migration to groundwater compared to Alternative 1.	NA - all material in the Class 2 landfill will be removed from the site under this alternative.	J3, J4 Minimal - the siting and engineering requirements at a TSD provide safeguards against release and potential exposure from such a facility. The landfill material would be treated to below UTS, minimizing the potential for exposure to material above UTS.	Probability minimized 1 High probability 25 Low probability	20	20		20	20	18.7	20.0	21.7			
		Future Industrial Workers	8	Affected Surface Water and Sediment	Class 2 Landfill and Off-Site TSD Facility	Future Industrial Worker Exposure to Affected Surface Water and Sediment	C5, C6, C7, C8 Minimal - same as for groundwater. In the unlikely event that groundwater becomes affected, then surface water and sediment in the vicinity could also become affected.	C5, C6, C7, C8 Minimal - same as for groundwater. In the unlikely event that groundwater becomes affected, then surface water and sediment in the vicinity could also become affected. The landfill material would be re-treated to below UTS, minimizing the potential for exposure to material above UTS.	NA - all material in the Class 2 landfill will be removed from the site under this alternative.	J5, J6, J7, J8 Minimal - the siting and engineering requirements at a TSD provide safeguards against release and potential exposure from such a facility. The landfill material would be re-treated to below UTS, minimizing the potential for exposure to material above UTS.	Probability minimized 1 High probability 25 Low probability	20	20		20	20						

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Criteria	Subgroup	Receptors	Indicator Number	Means of Potential Exposure	Location	Indicator Names	Alternative 1: Closure In Place (with cell reference from CSM Figure 5)	Alternative 2: Ex Situ On-Site Re-Treatment (with cell reference from CSM Figure 6)	Alternative 3a: Excavation and Off-Site Re-Treatment and Disposal): FRC Facility and Vicinity Only (with cell reference from CSM Figure 7)	Alternative 3b: Excavation and Off-Site Re-Treatment and Disposal: Off-Site TSD Facility and Vicinity Only (with cell reference from CSM Figure 7)	Scoring Criteria	Indicator Scores					Subgroup Scores			Criteria Scores		
												1	2	3a On-Site	3b Off-Site	3	1	2	3	1	2	3
		Terrestrial Organisms	9	Cover Failure	Class 2 Landfill and Off-Site TSD Facility	Terrestrial Organism Exposure to Landfill Material	D1, D2 Minor - landfill would have low permeability, multi-layer capping system to prevent release of landfill contents to the environment.	D1, D2 Minimal - landfill material would be re-treated to below UTS, therefore dust or landfill material could be accidentally spread to nearby areas during re-treatment. **Dust supression activities would minimize this route of exposure.** After re-treatment, landfill would have low permeability, multi-layer capping system to prevent release of landfill contents to the environment.	NA - all material in the Class 2 landfill will be removed from the site under this alternative.	K1, K2 Minimal - the siting and engineering requirements at a TSD provide safeguards against release and potential exposure from such a facility. The landfill material would be re-treated to below UTS, minimizing the potential for exposure to material above UTS. However, during re-treatment, dust or landfill material could be accidentally spread to nearby areas. **Dust supression activities would minimize this route of exposure.**	Probability minimized 1 High probability 25 Low probability	16	20		20	20						
		Terrestrial Organisms	10	Affected Groundwater	Class 2 Landfill and Off-Site TSD Facility	Terrestrial Organism Exposure to Affected Groundwater	D3, D4 Minimal - **the liner and cover system is designed according to industry standards to protect groundwater.** Terrestrial organisms have very limited contact with groundwater.	D3, D4 Minimal - landfill material would be re-treated to below UTS. **The liner and cover system is designed according to industry standards to protect groundwater.** Terrestrial organisms have very limited contact with groundwater.	NA - all material in the Class 2 landfill will be removed from the site under this alternative.	K3, K4 Minimal - **the siting and engineering requirements at a TSD provide safeguards against release and potential exposure from such a facility**. The landfill material would be re-treated to below UTS, minimizing the potential for exposure to material above UTS. Terrestrial organisms have very limited contact with groundwater.	Probability minimized 1 High probability 25 Low probability	20	20		20	20						
		Terrestrial Organisms	11	Affected Surface Water and Sediment	Class 2 Landfill and Off-Site TSD Facility	Terrestrial Organism Exposure to Affected Surface Water and Sediment	D5, D6, D7, D8, D9 Minor - similar to groundwater. In the unlikely event that groundwater becomes affected, then surface water and sediment in the vicinity could also become affected. Terrestrial organisms have a higher likelihood of exposure to surface water than groundwater.	D5, D6, D7, D8, D9 Minimal - similar to groundwater. In the unlikely event that groundwater becomes affected, then surface water and sediment in the vicinity could also become affected. Terrestrial organisms have a higher likelihood of exposure to surface water than groundwater. Lower **long-term** likelihood than Alternative 1 since waste will be re-treated.	NA - all material in the Class 2 landfill will be removed from the site under this alternative.	K5, K6, K7, K8, K9 Minimal - **the siting and engineering requirements at a TSD provide safeguards against release and potential exposure from such a facility**. The landfill material would be re-treated to below UTS, minimizing the potential for exposure to material above UTS. Terrestrial organisms have a higher likelihood of exposure to surface water than groundwater.	Probability minimized 1 High probability 25 Low probability	16	20		20	20						
		Terrestrial Organisms	12	Affected Soil	Class 2 Landfill and Vicinity	Terrestrial Organism Exposure to Affected Off-Site Soil	D10, D11 Minimal - landfill material will be capped without disturbing the waste material to prevent off-site migration of materials to off-site soil. Construction dust is expected to be from clean material, compared to lead/metal-bearing materials that would be handled in Alternatives 2 and 3. **Dust suppression activities would be performed to minimize this potential.**	D10, D11 Minor - the lead- and metal-bearing landfill material would be crushed to a fine particle size, excavated, and handled on-site prior to re-treatment. The fine particulate has greater potential for aerial dispersion and deposition onto off-site soil, and exposures to the lead or other metals in soil could lead to adverse health effects. **Dust suppression activities would be performed to minimize this potential.**	C12, C13 Minor - the landfill material will be broken for excavation (to a lesser extent than the crushing activities in Alternative 2), excavated, and loaded for transport to an off-site facility, and will have the potential for lead/metal-bearing dust generation, off-site transport and deposition onto off-site soil. Dust suppression activities will be performed to minimize this potential.	NA - this indicator applies to the Class 2 landfill only	Probability minimized 1 High probability 25 Low probability	25	16	16		16						
Long Term Risk Minimization	Ecological Hazard Minimization	Terrestrial Organisms	13	Construction Activities	Off-Site TSD Facility Only	Terrestrial Organism Exposure to Affected Off-Site Soil (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	K10, K11 Minimal - the crushing and excavation of landfill material prior to re-treatment has the potential for generation and deposition of lead/metal-bearing dust onto off-site soil. **Dust suppression activities will be performed to minimize this potential.** The expected remoteness of the facility limits exposures.	Probability minimized 1 High probability 25 Low probability	*25*	*25*		20	20	**20.7**	**19.7**	**19.2**	**20.1**	**19.7**	**20.7**
		Aquatic Organisms	14	Cover Failure	Class 2 Landfill and Off-Site TSD Facility	Aquatic Organism Exposure to Landfill Material	E1, E2 Minimal - **landfill would have low permeability, multi-layer capping system to prevent release of landfill contents to the environment.** The data on the extent of material above the hazardous waste criteria (and/or UTS), inherent low mobility of lead and other metals in the slag, and prior treatment further minimizes migration to surface water. It is considered a rare likelihood that this could migrate to surface water.	E1, E2 Minimal - landfill material would be re-treated to below UTS. **Landfill would have low permeability, multi-layer capping system to prevent release of landfill contents to the environment.** It is considered a rare likelihood that this could migrate to surface water.	NA - all material in the Class 2 landfill will be removed from the site under this alternative.	L1, L2 Minimal - **the siting and engineering requirements at a TSD provide safeguards against release and potential exposure from such a facility.** It is considered a rare likelihood that this could migrate to surface water.	Probability minimized 1 High probability 25 Low probability	20	20		20	20						
		Aquatic Organisms	15	Affected Groundwater	Class 2 Landfill and Off-Site TSD Facility	Aquatic Organism Exposure to Affected Groundwater	E3, E4 Minimal - the liner and cover system is designed according to industry standards to protect groundwater. Aquatic organisms have limited contact with groundwater.	E3, E4 Minimal - landfill material would be re-treated to below UTS. The liner and cover system is designed according to industry standards to protect groundwater. Aquatic organisms have limited contact with groundwater.	NA - all material in the Class 2 landfill will be removed from the site under this alternative.	L3, L4 Minimal - the siting and engineering requirements at a TSD provide safeguards against release and potential exposure from such a facility. The landfill material would be re-treated to below UTS minimizing the potential for exposure to material above UTS. Aquatic organisms have limited contact with groundwater.	Probability minimized 1 High probability 25 Low probability	20	20		20	20						
		Aquatic Organisms	16	Affected Surface Water and Sediment	Class 2 Landfill and Off-Site TSD Facility	Aquatic Organism Exposure to Surface Water and Sediment, Food Web Uptake	E5, E6, E7, E8, E9 Minor - In the unikely event that groundwater becomes affected, then surface water and sediment in the vicinity could also become affected. Aquatic organisms could then have deleterious effects from affected surface water, sediments, and aquatic food items.	E5, E6, E7, E8, E9 Minor - in the unlikely event that groundwater becomes affected, then surface water and sediment in the vicinity could also become affected. Aquatic organisms could then have deleterious effects from affected surface water, sediments, and aquatic food items.	NA - all material in the Class 2 landfill will be removed from the site under this alternative.	L5, L6, L7, L8, L9 Minimal - in the unlikely event that groundwater becomes affected, then surface water and sediment in the vicinity could also become affected. Aquatic organisms could then have deleterious effects from affected surface water, sediments, and aquatic food items. Lower probability than the other alternatives given the remoteness and siting and engineering requirements at this facility.	Probability minimized 1 High probability 25 Low probability	15	15		20	20						
		Aquatic Organisms	17	Construction Activities	Class 2 Landfill and Vicinity	Aquatic Organism Exposure to Affected Off-Site Soil	E10, E11 Minimal - landfill material will be capped to prevent off-site migration of materials to off-site soil. Construction dust is expected to be from clean material, compared with the other alternatives. Aquatic organisms have minor contact with off-site soil.	E10, E11 Minor - the excavation and crushing of landfill material prior to re-treatment has the potential for lead/metal-bearing dust generation, off-site transport and deposition onto soil. **Dust suppression activities would be performed to minimize this potential.** Aquatic organisms have minor contact with off-site soil.	D12, D13 Minor - the excavation and crushing of landfill material prior to re-treatment has the potential for lead/metal-bearing dust generation, off-site transport and deposition onto soil. **Dust suppression activities would be performed to minimize this potential.** Aquatic organisms have minor contact with off-site soil.	NA - this indicator applies to the Class 2 landfill only	Probability minimized 1 High probability 25 Low probability	25	16	16		16						

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Long Term Risk Minimization	Ecological Hazard Minimization	Aquatic Organisms	18	Affected Soil	Off-Site TSD Facility Only	Aquatic Organism Exposure to Affected Off-Site Soil (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	L10, L11 Minimal - the crushing and excavation of landfill material prior to re-treatment has the potential for dust generation and deposition onto off-site soil. **The remoteness of the facility limits exposures.**	Probability minimized 1 High probability 25 Low probability	*25*	*25*		20	20	**20.7**	**19.7**	**19.2**	**20.1**	**19.7**	**20.7**
	Environmental Effects	Environmental Effects	19	Long Term Environmental Effects	Class 2 Landfill and Off-Site TSD Facility	Reduction of Toxicity, Mobility, or Volume through Treatment	Little or no reduction in toxicity or mobility as no further treatment of material would occur. Volume would not be increased. Constituents are currently not very mobile, but no further reduction would occur.	Reduction of mobility will occur upon re-treament, but the volume of treated material will increase with additional treatment.	NA - all material in the Class 2 landfill will be removed from the site under this alternative.	High reduction of mobility will occur, but the volume of treated material will increase with additional treatment.	Probability minimized 1 High probability 25 Low probability	16	20		20	20	**16.0**	**20.0**	**20.0**			
Short-Term Risk Minimization	Community Hazard Minimization	Off-Site Residents	20	Construction Activities	Class 2 Landfill and Vicinity	Off-Site Resident Exposure to Construction Dust (Class 2 Landfill and Vicinity)	A12 Minimal - material will remain undisturbed in situ and the entire landfill will have a multi-layer cap. Construction dust would be from clean materials. Appropriate controls, such as watering, will minimize dust generation.	A12 Medium - landfill material will be excavated, loaded into trucks, and crushed on-site to a fine particle size, creating potential lead/metal-bearing dust which may become airborne and travel off-site. Appropriate controls such as watering can minimize dust generation.	A14 Medium - landfill material will be broken to manageable pieces (to a lesser extent than the crushing activities in Alternative 2), loaded into trucks, and transported off site for disposal, creating lead/metal-bearing dust which may become airborne and travel off-site. Appropriate controls such as watering can minimize dust generation.	NA - this indicator applies to the Class 2 landfill only	Probability minimized 1 High probability 25 Low probability	25	12	12		12	**23.3**	**20.3**	**15.6**	**23.0**	**19.5**	**14.5**
		Off-Site Residents	21	Construction Activities	Class 2 Landfill and Vicinity	Off-Site Resident Exposure to Increased Truck Traffic (Class 2 Landfill and Vicinity)	A13 Minor - some increased truck traffic in the vicinity of the site when importing cover materials.	A13 Medium - increased operations in the vicinity of the site for excavation, crushing, loading, treatment, and hauling over an approximate 2.5-year period.	A15 Major - very high volume of truck traffic into and out of the site to transport material for a 1.5- to 3-year period.	NA - this indicator applies to the Class 2 landfill only	Truck traffic minimized 1 High traffic 25 Low traffic	15	12	6		6						
		Off-Site Residents	22	Construction Activities	Class 2 Landfill and Vicinity	Off-Site Resident Exposure to Increased Noise (Class 2 Landfill and Vicinity)	A15 Minimal - some increased noise during cover construction from standard earth moving equipment.	A15 Medium - increased noise due to crushing, excavation, loading, and hauling.	A17 Medium - increased noise due to truck traffic, breakage, excavation, loading, and hauling.	NA - this indicator applies to the Class 2 landfill only	Noise levels minimized 1 High noise levels 25 Low noise levels	20	9	12		12						
		Off-Site Residents	23	Transportation	Transportation Route	Off-Site Resident Exposure to Construction Dust (Transportation Route)	No off-site transportation	No off-site transportation	NA - off-site transportation is scored under Alternative 3b	E20 Minor - approximately 15,500 truck loads will haul the landfill material 250 miles one way to move the material to the off-site TSD facility. Lead/metal-bearing dust could potentially be generated from transport of landfill material. Appropriate controls, such as covering truck loads, will minimize dust generation. However, any dust dispersion would likely be spread over a wide area, minimizing localized exposures.	Probability minimized 1 High probability 25 Low probability	*25*	*25*		16	16						
		Off-Site Residents	24	Transportation	Transportation Route	Off-Site Resident Exposure to Increased Traffic (Transportation Route)	No off-site transportation	No off-site transportation	NA - off-site transportation is scored under Alternative 3b	E21 Medium - approximately 15,500 truck loads will haul the landfill material 250 miles each way for a total of 7,750,000 miles of increased truck traffic to move the material to the off-site TSD facility.	Probability minimized 1 High probability 25 Low probability	*25*	*25*		8	8						
		Off-Site Residents	25	Transportation	Transportation Route	Off-Site Resident Effects from Accidental Spill (Transportation Route)	No off-site transportation	No off-site transportation	NA - off-site transportation is scored under Alternative 3b	E22, E23 Minor - approximately 15,500 truck loads will haul the landfill material 250 miles one way to move the material to the off-site TSD facility, with the attendant the risk of spillage or accidents.	Probability minimized 1 High probability 25 Low probability	*25*	*25*		16	16						
		Off-Site Residents	26	Construction Activities	Off-Site TSD Facility Only	Off-Site Resident Exposure to Construction Dust (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	H24 Minimal - landfill material crushed on-site, creating potential lead/metal-bearing dust which may become airborne and travel off-site. However, the off-site TSD facility is expected to be located in remote area, which minimizes potential exposures.	Probability minimized 1 High probability 25 Low probability	*25*	*25*		25	25						
		Off-Site Residents	27	Transportation	Off-Site TSD Facility Only	Off-Site Resident Exposure to Increased Truck Traffic (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	H25 Minor - approximately 15,500 truck loads of landfill material will enter and exit the off-site TSD facility to deliver material. However, the facility is expected to be remote from residential areas.	Truck traffic minimized 1 High traffic 25 Low traffic	*25*	*25*		20	20						
		Off-Site Residents	28	Construction Activities	Off-Site TSD Facility Only	Off-Site Resident Exposure to Noise (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	H27 Minimal - an estimated 15,500 truckloads of material from the Class 2 landfill will be received at the off-site facility. However, the facility is expected to be remote, which minimizes noise exposure to residents in the vicinity.	Probability minimized 1 High probability 25 Low probability	*25*	*25*		25	25						
	Occupational Hazard Minimization	Site Remediation Worker	29	Construction Activities	Class 2 Landfill and Vicinity	Site Remediation Worker Exposure to Construction Dust (Class 2 Landfill and Vicinity)	B12 Minimal - operations will involve moving clean material for cover over a 3 to 4 month period.	B12 Major - increased operations for crushing, excavation, loading, and hauling over an approximate 2.5-year period will result in increased potentailly lead/metal-bearing dust. Appropriate controls, such as watering, will minimize exposure.	B14 Medium - Increased operations for breakage and excavation of landfill material and loading into trucks for off site disposal over a 1.5- to 3-year period will generate potential lead/metal-bearing dust.	NA - this indicator applies to the Class 2 landfill only	Probability minimized 1 High probability 25 Low probability	20	6	9		9	**21.9**	**15.2**	**10.9**			
		Site Remediation Worker	30	Construction Activities	Class 2 Landfill and Vicinity	Site Remediation Worker Occupational Hazards (Class 2 Landfill and Vicinity)	B14 Minor - operations will involve standard earth moving equipment over a 3 to 4 month period.	B14 Major - landfill materials crushing, excavation, loading, and hauling operations will occur over an approximate 2.5-year period.	B16 Major - significant increased truck traffic; landfill material breakage, excavation, loading, and hauling will occur over a 1.5- to 3-year period.	NA - this indicator applies to the Class 2 landfill only	Probability minimized 1 High probability 25 Low probability	16	6	6		6						
		Site Remediation Worker	31	Construction Activities	Class 2 Landfill and Vicinity	Site Remediation Worker Exposure to Noise (Class 2 Landfill and Vicinity)	B15 Minor - some increased noise during cover construction from standard earth moving equipment.	B15 Major - increased noise due to crushing, excavation, loading, and hauling.	B17 Major - increased noise due to truck traffic, breakage, excavation, loading, and hauling. Noise would be less than Alternative 2 because crushing to fine particle size is not required.	NA - this indicator applies to the Class 2 landfill only	Probability minimized 1 High probability 25 Low probability	16	4	6		6						

Table 1: Risk Evaluation of Remedial Alternatives

Criteria	Subgroup	Receptors	Indicator Number	Means of Potential Exposure	Location	Indicator Names	Alternative 1: Closure In Place (with cell reference from CSM Figure 5)	Alternative 2: Ex Situ On-Site Re-Treatment (with cell reference from CSM Figure 6)	Alternative 3a: Excavation and Off-Site Re-Treatment and Disposal): FRC Facility and Vicinity Only (with cell reference from CSM Figure 7)	Alternative 3b: Excavation and Off-Site Re-Treatment and Disposal: Off-Site TSD Facility and Vicinity Only (with cell reference from CSM Figure 7)	Scoring Criteria	Indicator Scores 1	Indicator Scores 2	Indicator Scores 3a On-Site	Indicator Scores 3b Off-Site	Indicator Scores 3	Subgroup Scores 1	Subgroup Scores 2	Subgroup Scores 3	Criteria Scores 1	Criteria Scores 2	Criteria Scores 3
Short-Term Risk Minimization	Occupational Hazard Minimization	Site Remediation Worker	32	Construction Activities	Class 2 Landfill and Vicinity	Site Remediation Worker Exposure to Landfill Material (Class 2 Landfill and Vicinity)	B16, B17 Minimal - landfill material will not be disturbed by placement of clean cover materials.	B16, B17 Medium - landfill material will be handled by remediation workers while crushing, excavating, loading, and hauling.	B18, B19 Medium - landfill material will be handled by remediation workers while excavating, loading, and hauling.	NA - this indicator applies to the Class 2 landfill only	Probability minimized 1 High probability 25 Low probability	20	12	12		12	21.9	15.2	10.9	23.0	19.5	14.5
		Site Remediation Worker	33	Construction Activities	Off-Site TSD Facility Only	Site Remediation Worker Exposure to Construction Dust (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	I24 Medium - landfill material will be crushed on-site, generating potential lead/metal-bearing dust. Appropriate controls, such as watering, will minimize exposure.	Probability minimized 1 High probability 25 Low probability	25	25		12	12						
		Site Remediation Worker	34	Construction Activities	Off-Site TSD Facility Only	Site Remediation Worker Exposure to On-Site Machinery (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	I26 Medium - an estimated 15,500 truckloads of material from the Class 2 landfill will be received at the off-site TSD facility, requiring heanling while crushing, re-treating, and placement into the facility.	Probability minimized 1 High probability 25 Low probability	25	25		12	12						
		Site Remediation Worker	35	Construction Activities	Off-Site TSD Facility Only	Site Remediation Worker Exposure to Noise (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	I27 Medium - increased noise due to truck traffic, crushing, and hauling.	Probability minimized 1 High probability 25 Low probability	25	25		9	9						
		Site Remediation Worker	36	Construction Activities	Off-Site TSD Facility Only	Site Remediation Worker Exposure to Landfill Material (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	I28, I29 Minor - the landfill material will be handled at the off-site TSD facility, which commonly accepts and treats materials.	Probability minimized 1 High probability 25 Low probability	25	25		16	16						
		Site Remediation Worker	37	Chemical Treatment	Class 2 Landfill and Off-Site TSD Facility	Site Remediation Worker Exposure to Chemical Hazards	B18 Minimal - no further treatment activities will occur.	B18 Medium - most of landfill material will be treated on-site.	NA - treatment will occur at the Off-site TSD (Alternative 3b)	I30 Minor - landfill material will be treated upon receipt in the off-site TSD facility, which commonly accepts and treats materials.	Probability minimized 1 High probability 25 Low probability	25	9		16	16						
	Ecological Hazard Minimization	Terrestrial Organisms	38	Construction Activities	Class 2 Landfill and Vicinity	Terrestrial Organism Exposure to Construction Dust (Class 2 Landfill and Vicinity)	D12 Minimal - material will remain relatively intact while cover is placed over existing material. Construction dust would be from clean materials. Appropriate controls, such as watering, will minimize exposure.	D12 Medium - landfill material will be excavated, loaded into trucks, and crushed on-site, creating potential lead/metal-bearing dust which may become airborne and travel off-site. Appropriate controls such as watering can minimize exposure. Highest consequences would be for plant deposition compared with wildlife inhalation.	C14 Medium - landfill material will be broken to manageable pieces, loaded into trucks, and transported off site for disposal, creating potential lead/metal-bearing dust which may become airborne and travel off-site. Appropriate controls such as watering can minimize exposure. Highest consequences would be for plant deposition compared with wildlife inhalation.	NA - this indicator applies to the Class 2 landfill only	Probability minimized 1 High probability 25 Low probability	25	12	12		12	23.7	21.6	16.5			
		Terrestrial Organisms	39	Construction Activities	Class 2 Landfill and Vicinity	Terrestrial Organism Exposure to Increased Truck Traffic (Class 2 Landfill and Vicinity)	D13 Minor - operations will involve standard heavy equipment over a 3 to 4 month period.	D13 Medium - increased operations for excavation, crushing, loading, treatment, and hauling over an approximate 2.5-year period, hence a higher likelihood and consequence of a potential incident than Alternative 1.	C15 Medium - very high volume of truck traffic into and out of the landfill to transport material over a 1.5- to 3-year period, hence a higher likelihood and consequence of a potential incident than Alternatives 1 or 2.	NA - this indicator applies to the Class 2 landfill only	Probability minimized 1 High probability 25 Low probability	15	12	9		9						
		Terrestrial Organisms	40	Construction Activities	Class 2 Landfill and Vicinity	Terrestrial Organism Exposure to Noise (Class 2 Landfill and Vicinity)	D15 Minor - some increased noise during cover construction from standard earth moving equipment.	D15 Medium - increased noise due to crushing, excavation, loading, and hauling. Longer duration than Alternative 1.	C17 Medium - increased noise due to truck traffic, breakage, excavation, loading, and hauling. Longer duration than Alternatives 1 or 2.	NA - this indicator applies to the Class 2 landfill only	Probability minimized 1 High probability 25 Low probability	16	9	9		9						
		Terrestrial Organisms	41	On-Site Construction Activities	Class 2 Landfill and Vicinity	Terrestrial Organism Exposure to Landfill Material (Class 2 Landfill and Vicinity)	D16, D17 Minimal - landfill material will not be disturbed or exposed by placement of a new cover.	D16, D17 Medium - landfill material will be crushed, excavated, loaded, retreated and dedeposited. Therefore it is a higher likelihood that terrestrial organisms would encounter this material compared with Alternative 1.	C18, C19 Minor - landfill material will be broken, excavated, loaded, and hauled. Therefore it is a higher likelihood that terrestrial organisms would encounter this material compared with Alternative 1, but will be at a slower pace than Alternative 2.	NA - this indicator applies to the Class 2 landfill only	Probability minimized 1 High probability 25 Low probability	20	12	16		16						
		Terrestrial Organisms	42	Transportation	Transportation Route	Terrestrial Organism Exposure to Construction Dust (Transportation Route)	No off-site transportation	No off-site transportation	NA - off-site transportation is scored under Alternative 3b	F20 Minor - approximately 15,500 truck loads will haul the landfill material 250 miles to the off-site TSD facility. Lead/metal-bearing dust could potentially be generated from transport of landfill material. Appropriate controls, such as covering truck loads, will minimize exposure.	Probability minimized 1 High probability 25 Low probability	25	25		16	16						
		Terrestrial Organisms	43	Transportation	Transportation Route	Terrestrial Organism Exposure to Increased Traffic (Transportation Route)	No off-site transportation	No off-site transportation	NA - off-site transportation is scored under Alternative 3b	F21 Medium - approximately 15,500 truck loads will haul the landfill material 250 miles to the off-site TSD facility, which with return trips would be a total of 7,750,000 miles of increased truck traffic. Even though the likelihood of an incident is low, the consequences are relatively high.	Probability minimized 1 High probability 25 Low probability	25	25		8	8						
		Terrestrial Organisms	44	Transportation	Transportation Route	Terrestrial Organism Effects from Accidental Spill (Transportation Route)	No off-site transportation	No off-site transportation	NA - off-site transportation is scored under Alternative 3b	F22, F23 Minor - approximately 15,500 truck loads will haul the landfill material 250 miles to the off-site TSD facility, with the attendant the risk of spillage or accidents.	Probability minimized 1 High probability 25 Low probability	25	25		16	16						
		Terrestrial Organisms	45	Construction Activities	Off-Site TSD Facility Only	Terrestrial Organism Exposure to Construction Dust (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	K24 Minor - landfill material crushed on-site, creating potential lead/metal-bearing dust which may become airborne and travel off-site. However, the facility is located in a semi-industrial area, which likely has reduced populations of terrestrial organisms compared with undisturbed or residential areas.	Probability minimized 1 High probability 25 Low probability	25	25		16	16						
		Terrestrial Organisms	46	Construction Activities	Off-Site TSD Facility Only	Terrestrial Organism Exposure to Increased Truck Traffic (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	K25 Minor - very high volume of truck traffic into and out of the off-site TSD facility to deliver material. However, the facility is located in a semi-industrial area, which likely has reduced populations of terrestrial organisms compared with undisturbed areas.	Probability minimized 1 High probability 25 Low probability	25	25		15	15						

Table 1: Risk Evaluation of Remedial Alternatives

Criteria	Subgroup	Receptors	Indicator Number	Means of Potential Exposure	Location	Indicator Names	Alternative 1: Closure In Place (with cell reference from CSM Figure 5)	Alternative 2: Ex Situ On-Site Re-Treatment (with cell reference from CSM Figure 6)	Alternative 3a: Excavation and Off-Site Re-Treatment and Disposal): FRC Facility and Vicinity Only (with cell reference from CSM Figure 7)	Alternative 3b: Excavation and Off-Site Re-Treatment and Disposal: Off-Site TSD Facility and Vicinity Only (with cell reference from CSM Figure 7)	Scoring Criteria	Indicator Scores 1	Indicator Scores 2	Indicator Scores 3a On-Site	Indicator Scores 3b Off-Site	Indicator Scores 3	Subgroup Scores 1	Subgroup Scores 2	Subgroup Scores 3	Criteria Scores 1	Criteria Scores 2	Criteria Scores 3
Short-Term Risk Minimization	Ecological Hazard Minimization	Terrestrial Organisms	47	Construction Activities	Off-Site TSD Facility Only	Terrestrial Organism Exposure to Noise (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	K27 Minor - increased noise due to truck traffic, crushing, and hauling. However, the facility is located in a semi-industrial area, which likely has reduced populations of terrestrial organisms compared with undisturbed or residential areas.	Probability minimized 1 High probability 25 Low probability	25	25		16	16	23.7	21.6	16.5	23.0	19.5	14.5
		Terrestrial Organisms	48	Construction Activities	Off-Site TSD Facility Only	Terrestrial Organism Exposure to Landfill Material (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	K28, K29 Minor - landfill material will be broken, excavated, loaded, and hauled at the off-site TSD facility. However, the facility is located in a semi-industrial area, which likely has reduced populations of terrestrial organisms compared with undisturbed or residential areas.	Probability minimized 1 High probability 25 Low probability	25	25		16	16						
		Aquatic Organisms	49	Construction Activities	Class 2 Landfill and Vicinity	Aquatic Organism Exposure to Construction Dust (Class 2 Landfill and Vicinity)	E12 Minimal - operations will not occur near stream or riparian areas. Construction dust would be from clean materials.	E12 Minor - crushing operations could increase potential dispersion of potential lead/metal-bearing dust to aquatic and riparian areas.	D14 Minor - Excavation and breakage operations could increase potential dispersion of potential lead/metal-bearing dust to aquatic and riparian areas.	NA - this indicator applies to the Class 2 landfill only	Probability minimized 1 High probability 25 Low probability	25	16	16		16						
		Aquatic Organisms	50	Construction Activities	Class 2 Landfill and Vicinity	Aquatic Organism Exposure to Increased Truck Traffic (Class 2 Landfill and Vicinity)	E13 Minimal - operations will not occur near stream or riparian areas. Consequences of exposure would be minor.	E13 Medium - increased operations for excavation, crushing, loading, retreating and redepositing over an approximate 2.5-year period. Increased likelihood and consequence of any incident compared with Alternative 1.	D15 Minimal - significantly increased traffic will occur, remote from aquatic and riparian areas.	NA - this indicator applies to the Class 2 landfill only	Probability minimized 1 High probability 25 Low probability	20	20	20		20						
		Aquatic Organisms	51	Construction Activities	Class 2 Landfill and Vicinity	Aquatic Organism Exposure to Noise (Class 2 Landfill and Vicinity)	E15 Minimal - operations will not occur near stream or riparian areas.	E15 Minimal - landfill material operations will not occur in stream or riparian areas. Crushing activities will be noisier than other activities for Alternative 1 or 3.	D17 Minimal - landfill material operations will not occur in stream or riparian areas. Breaking activities will be noisier than other activities for Alternative 1.	NA - this indicator applies to the Class 2 landfill only	Probability minimized 1 High probability 25 Low probability	25	20	20		20						
		Aquatic Organisms	52	Construction Activities	Class 2 Landfill and Vicinity	Aquatic Organism Exposure to Landfill Material (Class 2 Landfill and Vicinity)	E16, E17 Minimal - landfill material will not be disturbed or exposed by placement of a new cover.	E16, E17 Minimal - landfill material operations will not occur in stream or riparian areas.	D18, D19 Minimal - landfill material operations will not occur in stream or riparian areas.	NA - this indicator applies to the Class 2 landfill only	Probability minimized 1 High probability 25 Low probability	25	25	25		25						
		Aquatic Organisms	53	Transportation	Transportation Route	Aquatic Organism Exposure to Construction Dust (Transportation Route)	No off-site transportation	No off-site transportation	NA - off-site transportation is scored under Alternative 3b	G20 Minimal - significantly increased traffic will occur, potential lead/metal-bearing dust could be generated. Effects would be remote from aquatic and riparian areas.	Probability minimized 1 High probability 25 Low probability	25	25		20	20						
		Aquatic Organisms	54	Transportation	Transportation Route	Aquatic Organism Exposure to Increased Traffic (Transportation Route)	No off-site transportation	No off-site transportation	NA - off-site transportation is scored under Alternative 3b	G21 Minor - significantly increased traffic will occur, remote from aquatic and riparian areas.	Probability minimized 1 High probability 25 Low probability	25	25		15	15						
		Aquatic Organisms	55	Transportation	Transportation Route	Aquatic Organism Effects from Accidental Spill (Transportation Route)	No off-site transportation	No off-site transportation	NA - off-site transportation is scored under Alternative 3b	G22, G23 Minor - approximately 15,500 truck loads will haul the landfill material 250 miles to the off-site TSD facility, with the attendant the risk of spillage or accidents.	Probability minimized 1 High probability 25 Low probability	25	25		16	16						
		Aquatic Organisms	56	Construction Activities	Off-Site TSD Facility Only	Aquatic Organism Exposure to Construction Dust (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	L24 Minor - the crushing facility is remote from riparian areas, however crushing operations could increase potential dispersion of potential lead/metal-bearing dust to aquatic and riparian areas. This could be controlled but not eliminated with dust suppression methods.	Probability minimized 1 High probability 25 Low probability	25	25		16	16						
		Aquatic Organisms	57	Construction Activities	Off-Site TSD Facility Only	Aquatic Organism Exposure to Increased Truck Traffic (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	L25 Minor - very high volume of truck traffic into and out of the permitted facility to deliver material. However the traffic would be remote from riparian areas.	Probability minimized 1 High probability 25 Low probability	25	25		20	20						
		Aquatic Organisms	58	Construction Activities	Off-Site TSD Facility Only	Aquatic Organism Exposure to Noise (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	L27 Minimal - the crushing facility is remote from riparian areas.	Probability minimized 1 High probability 25 Low probability	25	25		20	20						
		Aquatic Organisms	59	Construction Activities	Off-Site TSD Facility Only	Aquatic Organism Exposure to Landfill Material (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	L28, L29 Minimal - landfill material operations will not occur in stream or riparian areas.	Probability minimized 1 High probability 25 Low probability	25	25		25	25						
	Environmental Effects	Environmental Effects	60	Environmental	NA	Energy Consumption	Minimal - minimal energy consumption, mostly due to construction and import of materials to the site over a 3 to 4 month period.	Medium - medium energy consumption associated with excavation and treatment activities over an approximate 2.5-year period.	Critically high - extremely high energy consumption, because a total of 7,750,000 miles of truck travel would be required to and from the off-site TSD facility over a 1.5- to 3-year period.	NA - overall energy consumption is scored under Alternative 3a	Energy consumption minimized 1 Very high energy consumption 25 Very low energy consumption	20	12		5	5	20.0	12.0	5.0			
		Environmental Effects	61	Environmental	NA	Non-Dust Air Emissions	Minimal - air emissions mostly due to construction and import of materials to the site over a 3 to 4 month period.	Medium - air emissions would be associated with excavation and treatment activities over an approximate 2.5-year period.	Critically high - extremely high vehicle emissions from excavation activities and a total of 7,750,000 miles of truck travel to and from the off-site TSD facility over a 1.5- to 3-year period.	NA - overall air emissions are scored under Alternative 3a	Air emissions minimized 1 Very high air emissions 25 Very low air emissions	20	12		5	5						
Implementability	Technical feasibility	NA	62	NA	NA	Technical Feasibility - Material Handling	Very high feasibility - the required equipment, personnel, and materials are readily available for cover construction activities. It is a proven technology.	High feasibility - the required equipment, personnel, and materials are readily available for cover construction activities. Slag treatment is a proven technology. Need to develop a protocol for treatment, testing, and placement of materials in the landfill, based on past analytical issues, and gain agency acceptance.	High feasibility - technically feasible, although the best methods for excavating, handling the waste will need to be determined.	NA - overall technical feasibility for material handling is scored under Alternative 3a	Technical feasibility 1 Very low feasibility 25 Very high feasibility	25	16	16		16	25.0	11.0	14.0	17.8	12.5	16.6

Table 1: Risk Evaluation of Remedial Alternatives

Criteria	Subgroup	Receptors	Indicator Number	Means of Potential Exposure	Location	Indicator Names	Alternative 1: Closure In Place (with cell reference from CSM Figure 5)	Alternative 2: Ex Situ On-Site Re-Treatment (with cell reference from CSM Figure 6)	Alternative 3a: Excavation and Off-Site Re-Treatment and Disposal): FRC Facility and Vicinity Only (with cell reference from CSM Figure 7)	Alternative 3b: Excavation and Off-Site Re-Treatment and Disposal: Off-Site TSD Facility and Vicinity Only (with cell reference from CSM Figure 7)	Scoring Criteria	Indicator Scores					Subgroup Scores			Criteria Scores		
												1	2	3a On-Site	3b Off-Site	3	1	2	3	1	2	3
Implementability	Technical feasibility	NA	63	NA	NA	Technical Feasibility - Air Quality	High feasibility - Construction dust would be from clean materials. Lead/metal-bearing materials would not be disturbed.	Low feasibility - On-site crushing and loading operations will generate lead/metal-bearing dust. Implementation must account for the lead NAAQS attainment demonstration status and timeline. Perimeter air monitoring with very low action levels may increase the duration of the remediation process.	Medium Feasibility - On-site breaking and loading operations will generate lead/metal-bearing dust, but at lower levels than Alternative 2 (materials will be broken rather than crushed to finer particles). Implementation must account for the lead NAAQS attainment demonstreation status and timeline. Perimeter air monitoring with low action levels may increase the duration of the remediation process.	NA - overall technical feasibility for air quality is scored under Alternative 3a	Technical feasibility 1 Very low feasibility 25 Very high feasibility	25	6	12		12	25.0	11.0	14.0			
	Administrative Feasibility	NA	64	NA	NA	Regulatory Compliance	High feasibility - the work involves conventional on-site construction. TCEQ waste program approval would be required for this alternative. The data on the extent of material above the hazardous waste criteria and UTS, inherent low mobility of lead and other metals in the slag, and prior treatment provide support for regulatory and community acceptance.	Medium feasibility - TCEQ waste program approval would be required for this alternative. Increased effort may be needed to achieve regulatory and community acceptance due to the potential for significant off-site impacts (lead/metal-bearing dust and noise).	Medium Feasibility - TCEQ waste program approval would be required for this alternative. Increased effort may be required to achieve regulatory and community acceptance due to the potential for significant off-site impacts (lead/metal-bearing dust, noise, and truck traffic) at the Class 2 landfill, along the transportation route, and at the off-site TSD facility.	NA - overall regulatory compliance is scored under Alternative 3a	Administrative feasibility 1 Very low feasibility 25 Very high feasibility	16	12	12		12						
		NA	65	NA	NA	Air Monitoring Requirements	High feasibility - the work involves construction capping with clean materials. Lead/metal-bearing materials would not be disturbed.	Low feasibility - on-site crushing and loading operations will generate lead/metal-bearing dust, resulting in regulatory scrutiny toward the requirement to attain and maintain the lead NAAQS. The duration of the project could implicate air permitting authorization for certain equipment, which may be complicated by the lead NAAQS nonattainment status of the area.	Medium Feasibility - On-site breaking and loading operations will generate lead/metal-bearing dust, resulting in regulatory scrutiny toward the requirement to attain and maintain the lead NAAQS.	NA - overall air monitoring requirements are scored under Alternative 3a	Administrative feasibility 1 Very low feasibility 25 Very high feasibility	20	6	12		12	15.3	13.0	17.5			
		NA	66	NA	NA	Land or Water Use Restrictions	High potential - land use and groundwater restrictions are in progress. Long-term groundwater monitoring will be needed.	High potential - land use and groundwater restrictions are in progress. Long-term groundwater monitoring will be needed.	NA - all landfill material will be removed under this alternative. Landuse and groundwater restrictions are in progress, tough not required in relation to the Class 2 landfill. Long-term groundwater monitoring related to the removed landfill, if any, would be limited and therefore are not assumed.	Very high potential - the off-site TSD facility is already in compliance with regulatory requirements. Disposal requirements will need to be met.	Potential for minimization of additional land or water use restrictions 1 Very low potential 25 Very high potential	16	16		20	20				17.8	12.5	16.6
	Administrative Feasibility	NA	67	NA	NA	Local Business Effects	Medium potential - some increased local business in response to the need for construction materials and equipment.	High potential - there is potential for increased local business in response to the need for construction materials and equipment. More intensive site operations (associated with crushing, excavation, loading, and retreatment) and a longer construction period (estimated to be 2.5 years) may provide additional opportunities for local businesses.	High potential - There is potential for increased local business in response to the need for construction materials and equipment. More intensive site operations (associated with breakage, excavation, loading, and hauling) and a long construction period (estimated to be 1.5- to 3-years) may provide additional opportunities for local businesses.	NA - overall local business effects are scored under Alternative 3a	Potential for increased business 1 Very low potential 25 Very high potential	12	16	16		16						
		NA	68	NA	NA	Visual Aesthetics	Medium potential - the landfill cover will result in a vegetated mound.	Medium potential - the addition of treatment reagent will result in a vegetated mound.	Very high potential - excavation of all landfill material and recovering to a well drained area will not adversely affect visual aesthetics.	NA - overall visual aesthetics are scored under Alternative 3a	Potential for impacts to visual aesthetics 1 Very high potential 25 Very low potential	12	12	20		20	15.3	13.0	17.5			
		NA	69	NA	NA	Surrounding Property Values	Low potential - previous plant operations that resulted in emissions did not result in negative effects on land values around the plant, as witnessed by significant high-end development of homes, schools and public buildings in the surrounding area.	Low potential - previous plant operations that resulted in emissions did not result in negative effects on land values around the plant, as witnessed by significant high-end development of homes, schools and public buildings in the surrounding area.	Very low potential - All landfill material will be excavated, and the area will be recovered to a well-drained revegetated area, which will have minimal effects on property values. The off-site TSD facility that would currently accept the material is already in place in a semi-industrial area, is in operation, and surrounding property values will be little effected by disposal of additional materials.	NA - overall surrounding property values are scored under Alternative 3a	Potential impacts to property values 1 Very high potential 25 Very low potential	16	16		25	25						
Cost	Cost	NA	70	NA	NA	Cost	Relatively low costs - approximately less than $2 million.	Relatively high costs - greater than $30 million, approximately an order of magnitude greater than Alternative 1.	Very high costs - approximately $80 million, more than two times greater than Alternative 2.	NA - overall costs are scored under Alternative 3a only	Estimated economy of project 1 Very high project costs 25 Very low project costs	25	8	3		3	25.0	8.0	3.0	25.0	8.0	3.0

Notes:

A1, A2	Cell reference numbers - providing cross reference to risk values in Figures 5, 6, and 7
25 (italicized)	Not applicable for this alternative, optimal score of 25 assigned to represent no negative impacts.
CSM	Conceptual site model
NA	Not applicable
NAAQS	National Ambient Air Quality Standards
TCEQ	Texas Commission on Environmental Quality
TSD facility	Treatment, storage, and disposal facility
UTS	Universal Treatment Standards

Risk Analysis Matrix

Risk Rating	Score
Minimal Risk	19.6 - 25.0
Minor Risk	14.6 - 19.5
Medium Risk	7.6 - 14.5
Major Risk	3.6 - 7.5
Critical Risk	0.0 - 3.5

Implementability Matrix

Feasibility or Potential	Score
Very High	19.6 - 25.0
High	14.6 - 19.5
Medium	7.6 - 14.5
Low	3.6 - 7.5
Very Low or Negligible	0.0 - 3.5

FIGURES

LEGEND

- Approximate Class 2 Landfill Extent
- Exide Site
- Undeveloped Buffer Property

300 150 0 300
Feet

REFERENCE

1. SITE FEATURES - GOLDER, 2014
2. AERIAL IMAGERY - SOURCE: ESRI, DIGITALGLOBE, GEOEYE, I-CUBED, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEX, GETMAPPING, AEROGRID, IGN, IGP, SWISSTOPO, AND THE GIS USER COMMUNITY

CLIENT
EXIDE TECHNOLOGIES

PROJECT
LANDFILL EVALUATION REPORT

TITLE
SITE LOCATION

CONSULTANT
Golder Associates

YYYY-MM-DD	2014-08-22
PREPARED	JWT
DESIGN	DGC
REVIEW	DGC
APPROVED	FSS

PROJECT No.	CONTROL	Rev.	FIGURE
13-02086	1302086G001.mxd	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI B

LEGEND

- Approximate Class 2 Landfill Extent
- Exide Site
- Undeveloped Buffer Property

NOTES

1. THE CELL LAYOUT IS APPROXIMATE AND IS FOR CONCEPTUAL PURPOSES ONLY.

REFERENCE

1. SITE FEATURES - GOLDER, 2014
2. LANDFILL CELLS - TITAN ENGINEERING, INC. 2000. INTERIM/FINAL COVER CONCEPTUAL MODEL; LANDFILL LAYOUT DRAWINGS. PROVIDED TO EXIDE TECHNOLOGIES, PROJECT NUMBER 13-04 ON NOVEMBER 21, 2000.
3. AERIAL IMAGERY - SOURCE: ESRI, DIGITALGLOBE, GEOEYE, I-CUBED, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEX, GETMAPPING, AEROGRID, IGN, IGP, SWISSTOPO, AND THE GIS USER COMMUNITY

100 50 0 100
Feet

CLIENT
EXIDE TECHNOLOGIES

PROJECT
LANDFILL EVALUATION REPORT

TITLE
LAYOUT OF LANDFILL CELLS

CONSULTANT
Golder Associates

YYYY-MM-DD	2014-08-22
PREPARED	JWT
DESIGN	DGC
REVIEW	DGC
APPROVED	FSS

PROJECT No.	CONTROL	Rev.	FIGURE
13-02086	1302086G002.mxd	0	2

0 1 in IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI B

LEGEND

- Soil Sample Location
- Approximate Class 2 Landfill Extent
- Exide Site
- Undeveloped Buffer Property

LMW-9 — Location Code
<0.002900 — Lead Result (mg/L)

REFERENCE

1. SITE FEATURES - GOLDER, 2014
2. AERIAL IMAGERY - SOURCE: ESRI, DIGITALGLOBE, GEOEYE, I-CUBED, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEX, GETMAPPING, AEROGRID, IGN, IGP, SWISSTOPO, AND THE GIS USER COMMUNITY

100 50 0 100
Feet

CLIENT
EXIDE TECHNOLOGIES

PROJECT
LANDFILL EVALUATION REPORT

TITLE
SOIL SAMPLE LOCATIONS NEAR THE CLASS II LANDFILL

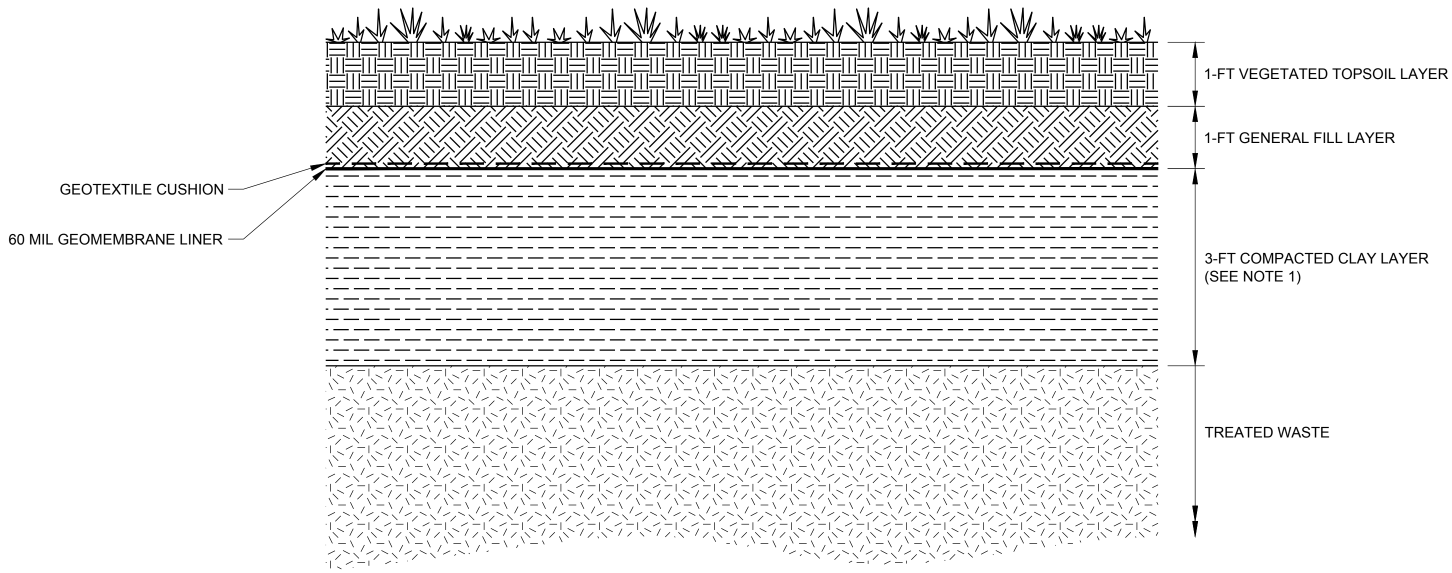
CONSULTANT
Golder Associates

YYYY-MM-DD	2014-08-22
PREPARED	JWT
DESIGN	DGC
REVIEW	DGC
APPROVED	FSS

PROJECT No.	CONTROL	Rev.	FIGURE
13-02086	1302086G005.mxd	0	3

NOTES

1. ALTERNATIVELY, THE 3-FT COMPACTED CLAY LAYER COULD BE REPLACED WITH A 1-FT COMPACTED CLAY LAYER, OVERLAIN BY A GEOSYNTHETIC CLAY LINER (GCL).



REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW

PROJECT

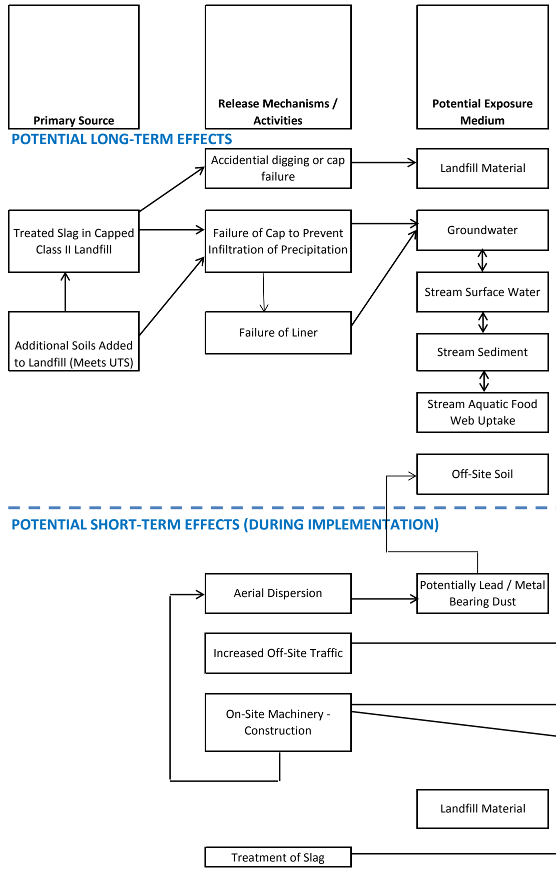
EXIDE TECHNOLOGIES
LANDFILL EVALUATION REPORT

TITLE

FINAL COVER CROSS SECTION FOR ALTERNATIVES 1 AND 2

Golder Associates

PROJECT No.		130-02086.1012	FILE No.	130-2086.1012_Final Cover Cross Section
DESIGN	VMR	2014-05-15	SCALE	NTS
CADD	ACF	2014-08-22	FIGURE	
CHECK	FSS	2014-05-15		4
REVIEW	DC	2014-05-15		



Potential Exposure Medium	Potential Exposure Route	Likelihood: Off-Site Residents	Likelihood: Remediation Workers	Likelihood: Future Industrial Workers	Likelihood: Terrestrial Organisms	Likelihood: Aquatic/Riparian Organisms	Consequence A: Off-Site Residents	Consequence B: Remediation Workers	Consequence C: Future Industrial Workers	Consequence D: Terrestrial Organisms	Consequence E: Aquatic/Riparian Organisms	Cell Reference	CSM Risk Values A: Off-Site Residents	CSM Risk Values B: Remediation Workers	CSM Risk Values C: Future Industrial Workers	CSM Risk Values D: Terrestrial Organisms	CSM Risk Values E: Aquatic/Riparian Organisms
POTENTIAL LONG-TERM EFFECTS																	
Landfill Material	Ingestion	5	NA	4	4	5	4	NA	4	4	4	1	20	NA	16	16	20
	Dermal Contact	5	NA	4	4	5	4	NA	5	4	5	2	20	NA	20	16	25
Groundwater	Ingestion	4	NA	5	5	5	4	NA	4	4	4	3	16	NA	20	20	20
	Dermal Contact	4	NA	5	5	5	5	NA	5	5	5	4	20	NA	25	25	25
Stream Surface Water	Ingestion	4	NA	5	4	5	4	NA	4	4	3	5	16	NA	20	16	15
	Dermal Contact	4	NA	5	4	5	5	NA	5	5	5	6	20	NA	25	20	25
Stream Sediment	Ingestion	4	NA	5	4	5	4	NA	4	4	3	7	16	NA	20	16	15
	Dermal Contact	4	NA	5	4	5	5	NA	5	5	5	8	20	NA	25	20	25
Stream Aquatic Food Web Uptake	Ingestion	NA	NA	NA	4	5	NA	NA	NA	4	3	9	NA	NA	NA	16	15
Off-Site Soil	Ingestion	5	NA	NA	5	5	5	NA	NA	5	5	10	25	NA	NA	25	25
	Dermal Contact	5	NA	NA	5	5	5	NA	NA	5	5	11	25	NA	NA	25	25
POTENTIAL SHORT-TERM EFFECTS (DURING IMPLEMENTATION)																	
Potentially Lead / Metal Bearing Dust	Inhalation	5	4	NA	5	5	5	5	NA	5	5	12	25	20	NA	25	25
Increased Off-Site Traffic	Potential Incident	5	NA	NA	5	5	3	NA	NA	3	4	13	15	NA	NA	15	20
On-Site Machinery - Construction	Potential Incident	NA	4	NA	NA	NA	NA	4	NA	NA	NA	14	NA	16	NA	NA	NA
	Noise Effects	5	4	NA	4	5	4	4	NA	4	5	15	20	16	NA	16	25
Landfill Material	Ingestion	NA	5	NA	5	5	NA	4	NA	4	5	16	NA	20	NA	20	25
	Dermal Contact	NA	5	NA	5	5	NA	4	NA	4	5	17	NA	20	NA	20	25
Treatment of Slag	Chemical Incident	NA	5	NA	NA	NA	NA	5	NA	NA	NA	18	NA	25	NA	NA	NA

Risk Analysis Matrix

Likelihood	Score	Consequence: Minimal 5	Minor 4	Medium 3	Major 2	Critical 1
Rare	5	25	20	15	10	5
Unlikely	4	20	16	12	8	4
Possible	3	15	12	9	6	3
Likely	2	10	8	6	4	2
Almost Certain	1	5	4	3	2	1

Risk Rating

Risk Rating	Risk Score
Minimal Risk	19.6 - 25.0
Minor Risk	14.6 - 19.5
Medium Risk	7.6 - 14.5
Major Risk	3.6 - 7.5
Critical Risk	0.0 - 3.5

Potential exposures or hazards potentially are related to remedial activites at the Class 2 landfill

L = Long Term
S = Short Term

CLIENT
EXIDE TECHNOLOGIES

CONSULTANT
Golder Associates

YYYY-MM-DD 2014-08-22
PREPARED A.PARKIN
DESIGN D.C
REVIEW D.C
APPROVED F.S.

PROJECT
LANDFILL EVALUATION PROJECT

TITLE
CONCEPTUAL SITE MODEL FOR THE CLASS II LANDFILL: ALTERNATIVE 1 - CLOSE IN PLACE

PROJECT No. 13-02086

FIGURE 5

Primary Source: Treated Slag in Capped Class II Landfill; Additional Soils Added to Landfill (Meets UTS)

Release Mechanisms / Activities: Accidential digging or cap failure; Failure of Cap to Prevent Infiltration of Precipitation; Failure of Liner; Aerial Dispersion; Increased Off-Site Traffic; On-Site Machinery - Excavation and Crushing; Re-Treatment of Slag

POTENTIAL LONG-TERM EFFECTS

Potential Exposure Medium	Potential Exposure Route	Likelihood: Off-Site Residents	Likelihood: Remediation Workers	Likelihood: Future Industrial Workers	Likelihood: Terrestrial Organisms	Likelihood: Aquatic/Riparian Organisms	Consequence: Off-Site Residents	Consequence: Remediation Workers	Consequence: Future Industrial Workers	Consequence: Terrestrial Organisms	Consequence: Aquatic/Riparian Organisms	Cell Reference	CSM Risk Values: A Off-Site Residents	B Remediation Workers	C Future Industrial Workers	D Terrestrial Organisms	E Aquatic/Riparian Organisms
Landfill Material	Ingestion	5	NA	4	5	5	4	NA	5	4	4	1	20	NA	20	20	20
	Dermal Contact	5	NA	4	5	5	4	NA	5	4	5	2	20	NA	20	20	25
Groundwater	Ingestion	5	NA	5	5	5	4	NA	4	4	4	3	20	NA	20	20	20
	Dermal Contact	5	NA	5	5	5	5	NA	5	5	5	4	25	NA	25	25	25
Stream Surface Water	Ingestion	5	NA	5	5	5	4	NA	4	4	3	5	20	NA	20	20	15
	Dermal Contact	5	NA	5	5	5	5	NA	5	5	5	6	25	NA	25	25	25
Stream Sediment	Ingestion	5	NA	5	5	5	4	NA	4	4	3	7	20	NA	20	20	15
	Dermal Contact	5	NA	5	5	5	5	NA	5	5	5	8	25	NA	25	25	25
Stream Aquatic Food Web Uptake	Ingestion	NA	NA	NA	5	5	NA	NA	NA	4	3	9	NA	NA	NA	20	15
Off-Site Soil	Ingestion	3	NA	NA	4	4	4	NA	NA	4	4	10	12	NA	NA	16	16
	Dermal Contact	3	NA	NA	4	4	5	NA	NA	4	5	11	15	NA	NA	16	20

POTENTIAL SHORT-TERM EFFECTS (DURING IMPLEMENTATION)

Release Mechanisms / Activities	Potential Exposure Medium	Potential Exposure Route	Likelihood: Off-Site Residents	Likelihood: Remediation Workers	Likelihood: Future Industrial Workers	Likelihood: Terrestrial Organisms	Likelihood: Aquatic/Riparian Organisms	Consequence: Off-Site Residents	Consequence: Remediation Workers	Consequence: Future Industrial Workers	Consequence: Terrestrial Organisms	Consequence: Aquatic/Riparian Organisms	Cell Reference	A	B	C	D	E
Aerial Dispersion	Potentially Lead / Metal Bearing Dust	Inhalation	3	2	NA	3	4	4	3	NA	4	4	12	12	6	NA	12	16
Increased Off-Site Traffic		Potential Incident	4	NA	NA	4	5	3	NA	NA	3	4	13	12	NA	NA	12	20
On-Site Machinery - Excavation and Crushing		Potential Incident	NA	3	NA	NA	NA	NA	2	NA	NA	NA	14	NA	6	NA	NA	NA
		Noise Effects	3	2	NA	3	4	3	2	NA	3	5	15	9	4	NA	9	20
	Landfill Material	Ingestion	NA	3	NA	3	5	NA	4	NA	4	5	16	NA	12	NA	12	25
		Dermal Effects	NA	3	NA	3	5	NA	4	NA	4	5	17	NA	12	NA	12	25
Re-Treatment of Slag		Chemical Incident	NA	3	NA	NA	NA	NA	3	NA	NA	NA	18	NA	9	NA	NA	NA

Potential exposures or hazards potentially are related to remedial activites at the Class 2 landfill

CLIENT
EXIDE TECHNOLOGIES

PROJECT
LANDFILL EVALUATION PROJECT

CONSULTANT
Golder Associates

YYYY-MM-DD	2014-08-22
PREPARED	A.PARKIN
DESIGN	D.C.
REVIEW	D.C.
APPROVED	F.S

TITLE
CONCEPTUAL SITE MODEL FOR THE CLASS II LANDFILL: ALTERNATIVE 2 - EX SITU ON-SITE TREATMENT

PROJECT No. 13-02086

FIGURE 6

Primary Source | Release Mechanisms / Activities | Potential Exposure Medium | Potential Exposure Route

POTENTIAL LONG-TERM EFFECTS

Off-Site TSD Facility

- Primary Source: Treated Slag in Permitted Facility; Additional Materials Added to Permitted Facility
- Release Mechanisms / Activities: Breakage into Secure Facility, Cap Vandalization or; Failure of Cap to Prevent Infiltration of Precipitation; Failure of Liner

Class 2 Landfill

POTENTIAL SHORT-TERM EFFECTS (DURING IMPLEMENTATION)

Class 2 Landfill

Transportation Route

Off-Site TSD Facility

Likelihood

Cell Reference	Location	Release Mechanism / Activity	Potential Exposure Medium	Potential Exposure Route	Class 2 Landfill and Vicinity: Off-Site Residents	Class 2 Landfill and Vicinity: Remediation Workers	Class 2 Landfill and Vicinity: Terrestrial Organisms	Class 2 Landfill and Vicinity: Aquatic/Riparian Organisms	Transportation Route: Off-Site Residents	Transportation Route: Terrestrial Organisms	Transportation Route: Aquatic/Riparian Organisms	Off-Site TSD Facility: Off-Site Residents	Off-Site TSD Facility: Remediation Workers	Off-Site TSD Facility: Future Industrial Workers	Off-Site TSD Facility: Terrestrial Organisms	Off-Site TSD Facility: Aquatic/Riparian Organisms
1	Off-Site TSD Facility	Breakage into Secure Facility, Cap Vandalization or	Treated Landfill Material	Ingestion	NA	NA	NA	NA	NA	NA	NA	5	NA	5	5	5
2				Dermal Contact	NA	NA	NA	NA	NA	NA	NA	5	NA	5	5	5
3		Failure of Cap to Prevent Infiltration of Precipitation / Failure of Liner	Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	5	NA	5	5	5
4				Dermal Contact	NA	NA	NA	NA	NA	NA	NA	5	NA	5	5	5
5			Stream Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	5	NA	5	5	5
6				Dermal Contact	NA	NA	NA	NA	NA	NA	NA	5	NA	5	5	5
7			Stream Sediment	Ingestion	NA	NA	NA	NA	NA	NA	NA	5	NA	5	5	5
8				Dermal Contact	NA	NA	NA	NA	NA	NA	NA	5	NA	5	5	5
9			Stream Aquatic Food Web Uptake	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5	5
10			Off-Site Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	5	NA	NA	5	5
11				Dermal Contact	NA	NA	NA	NA	NA	NA	NA	5	NA	NA	5	5
12	Class 2 Landfill		Off-Site Soil	Ingestion	4	NA	4	4	NA	NA	NA	NA	NA	NA	NA	NA
13				Dermal Contact	4	NA	4	4	NA	NA	NA	NA	NA	NA	NA	NA
14	Class 2 Landfill	Aerial Dispersion	Potential Lead / Metal Bearing Dust	Inhalation	3	3	3	4	NA	NA	NA	NA	NA	NA	NA	NA
15		Increased Traffic (near Class 2		Potential Incident	3	NA	3	5	NA	NA	NA	NA	NA	NA	NA	NA
16		On-Site Machinery - Breaking and Excavating		Potential Incident	NA	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
17				Noise Effects	4	3	3	4	NA	NA	NA	NA	NA	NA	NA	NA
18			Landfill Material	Ingestion	NA	3	4	5	NA	NA	NA	NA	NA	NA	NA	NA
19				Dermal Contact	NA	3	4	5	NA	NA	NA	NA	NA	NA	NA	NA
20	Transportation Route	Increased Traffic	Potential Lead / Metal Bearing Dust	Inhalation	NA	NA	NA	NA	4	4	4	NA	NA	NA	NA	NA
21				Potential Incident	NA	NA	NA	NA	4	4	5	NA	NA	NA	NA	NA
22			Spill	Ingestion	NA	NA	NA	NA	4	4	4	NA	NA	NA	NA	NA
23				Dermal Contact	NA	NA	NA	NA	4	4	4	NA	NA	NA	NA	NA
24	Off-Site TSD Facility	Aerial Dispersion	Potential Lead / Metal Bearing Dust	Inhalation	NA	NA	NA	NA	NA	NA	NA	5	4	NA	4	4
25		Increased Traffic (near Off-Site TSD		Potential Incident	NA	NA	NA	NA	NA	NA	NA	5	NA	NA	5	5
26		On-Site Machinery - Crushing, Hauling and Dumping		Potential Incident	NA	NA	NA	NA	NA	NA	NA	NA	4	NA	NA	NA
27				Noise Effects	NA	NA	NA	NA	NA	NA	NA	5	3	NA	4	4
28			Treated Landfill Material	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	4	NA	4	5
29				Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	4	NA	4	5
30		Treatment of Slag		Chemical Incident	NA	NA	NA	NA	NA	NA	NA	NA	4	NA	NA	NA

Consequence

Cell Reference	Class 2 Landfill and Vicinity: Off-Site Residents	Class 2 Landfill and Vicinity: Remediation Workers	Class 2 Landfill and Vicinity: Terrestrial Organisms	Class 2 Landfill and Vicinity: Aquatic/Riparian Organisms	Transportation Route: Off-Site Residents	Transportation Route: Terrestrial Organisms	Transportation Route: Aquatic/Riparian Organisms	Off-Site TSD Facility: Off-Site Residents	Off-Site TSD Facility: Remediation Workers	Off-Site TSD Facility: Future Industrial Workers	Off-Site TSD Facility: Terrestrial Organisms	Off-Site TSD Facility: Aquatic/Riparian Organisms
1	NA	NA	NA	NA	NA	NA	NA	5	NA	5	4	4
2	NA	NA	NA	NA	NA	NA	NA	5	NA	5	4	5
3	NA	NA	NA	NA	NA	NA	NA	5	NA	4	4	4
4	NA		NA	NA	NA	NA	NA	5	NA	5	5	5
5	NA	NA	NA	NA	NA	NA	NA	5	NA	4	4	4
6	NA	NA	NA	NA	NA	NA	NA	5	NA	5	5	5
7	NA	NA	NA	NA	NA	NA	NA	5	NA	4	4	4
8	NA	NA	NA	NA	NA	NA	NA	5	NA	5	5	5
9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4	4
10	NA	NA	NA	NA	NA	NA	NA	5	NA	NA	4	4
11	NA	NA	NA	NA	NA	NA	NA	5	NA	NA	4	5
12	4	NA	4	4	NA	NA	NA	NA	NA	NA	NA	NA
13	5	NA	4	5	NA	NA	NA	NA	NA	NA	NA	NA
14	4	3	4	4	NA	NA	NA	NA	NA	NA	NA	NA
15	2	NA	3	4	NA	NA	NA	NA	NA	NA	NA	NA
16	NA	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
17	3	2	3	5	NA	NA	NA	NA	NA	NA	NA	NA
18	NA	4	4	5	NA	NA	NA	NA	NA	NA	NA	NA
19	NA	4	4	5	NA	NA	NA	NA	NA	NA	NA	NA
20	NA	NA	NA	NA	4	4	5	NA	NA	NA	NA	NA
21	NA	NA	NA	NA	2	2	3	NA	NA	NA	NA	NA
22	NA	NA	NA	NA	4	4	4	NA	NA	NA	NA	NA
23	NA	NA	NA	NA	4	4	4	NA	NA	NA	NA	NA
24	NA	NA	NA	NA	NA	NA	NA	5	3	NA	4	4
25	NA	NA	NA	NA	NA	NA	NA	4	NA	NA	3	4
26	NA	NA	NA	NA	NA	NA	NA	NA	3	NA	NA	NA
27	NA	NA	NA	NA	NA	NA	NA	5	3	NA	4	5
28	NA	NA	NA	NA	NA	NA	NA	NA	4	NA	4	5
29	NA	NA	NA	NA	NA	NA	NA	NA	4	NA	4	5
30	NA	NA	NA	NA	NA	NA	NA	NA	4	NA	NA	NA

CSM Risk Values

Cell Reference	A Class 2 Landfill and Vicinity: Off-Site Residents	B Class 2 Landfill and Vicinity: Remediation Workers	C Class 2 Landfill and Vicinity: Terrestrial Organisms	D Class 2 Landfill and Vicinity: Aquatic/Riparian Organisms	E Transportation Route: Off-Site Residents	F Transportation Route: Terrestrial Organisms	G Transportation Route: Aquatic/Riparian Organisms	H Off-Site TSD Facility: Off-Site Residents	I Off-Site TSD Facility: Remediation Workers	J Off-Site TSD Facility: Future Industrial Workers	K Off-Site TSD Facility: Terrestrial Organisms	L Off-Site TSD Facility: Aquatic/Riparian Organisms
1	NA	NA	NA	NA	NA	NA	NA	25	NA	25	20	20
2	NA	NA	NA	NA	NA	NA	NA	25	NA	25	20	25
3	NA	NA	NA	NA	NA	NA	NA	25	NA	20	20	20
4	NA	NA	NA	NA	NA	NA	NA	25	NA	25	25	25
5	NA	NA	NA	NA	NA	NA	NA	25	NA	20	20	20
6	NA	NA	NA	NA	NA	NA	NA	25	NA	25	25	25
7	NA	NA	NA	NA	NA	NA	NA	25	NA	20	20	20
8	NA	NA	NA	NA	NA	NA	NA	25	NA	25	25	25
9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	20	20
10	NA	NA	NA	NA	NA	NA	NA	25	NA	NA	20	20
11	NA	NA	NA	NA	NA	NA	NA	25	NA	NA	20	25
12	16	NA	16	16	NA	NA	NA	NA	NA	NA	NA	NA
13	20	NA	16	20	NA	NA	NA	NA	NA	NA	NA	NA
14	12	9	12	16	NA	NA	NA	NA	NA	NA	NA	NA
15	6	NA	9	20	NA	NA	NA	NA	NA	NA	NA	NA
16	NA	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
17	12	6	9	20	NA	NA	NA	NA	NA	NA	NA	NA
18	NA	12	16	25	NA	NA	NA	NA	NA	NA	NA	NA
19	NA	12	16	25	NA	NA	NA	NA	NA	NA	NA	NA
20	NA	NA	NA	NA	16	16	20	NA	NA	NA	NA	NA
21	NA	NA	NA	NA	8	8	15	NA	NA	NA	NA	NA
22	NA	NA	NA	NA	16	16	16	NA	NA	NA	NA	NA
23	NA	NA	NA	NA	16	16	16	NA	NA	NA	NA	NA
24	NA	NA	NA	NA	NA	NA	NA	25	12	NA	16	16
25	NA	NA	NA	NA	NA	NA	NA	20	NA	NA	15	20
26	NA	NA	NA	NA	NA	NA	NA	NA	12	NA	NA	NA
27	NA	NA	NA	NA	NA	NA	NA	25	9	NA	16	20
28	NA	NA	NA	NA	NA	NA	NA	NA	16	NA	16	25
29	NA	NA	NA	NA	NA	NA	NA	NA	16	NA	16	25
30	NA	NA	NA	NA	NA	NA	NA	NA	16	NA	NA	NA

Potential exposures or hazards are assigned to the locations where they have the potential to occur
Class 2 Landfill - Landfill and vicinity where landfill material currently is located
Transportation Route - the route between the Class 2 Landfill and the TSD along which landfill material would be hauled
TSD (Treatment, Storage, and Disposal) Facility - Off-site permitted facility where the landfill material from the Class 2 landfill would be transported for treatment and disposal

CLIENT
EXIDE TECHNOLOGIES

CONSULTANT
Golder Associates

YYYY-MM-DD 2014-08-22
PREPARED A.PARKIN
DESIGN D.C.
REVIEW D.C.
APPROVED F.S.

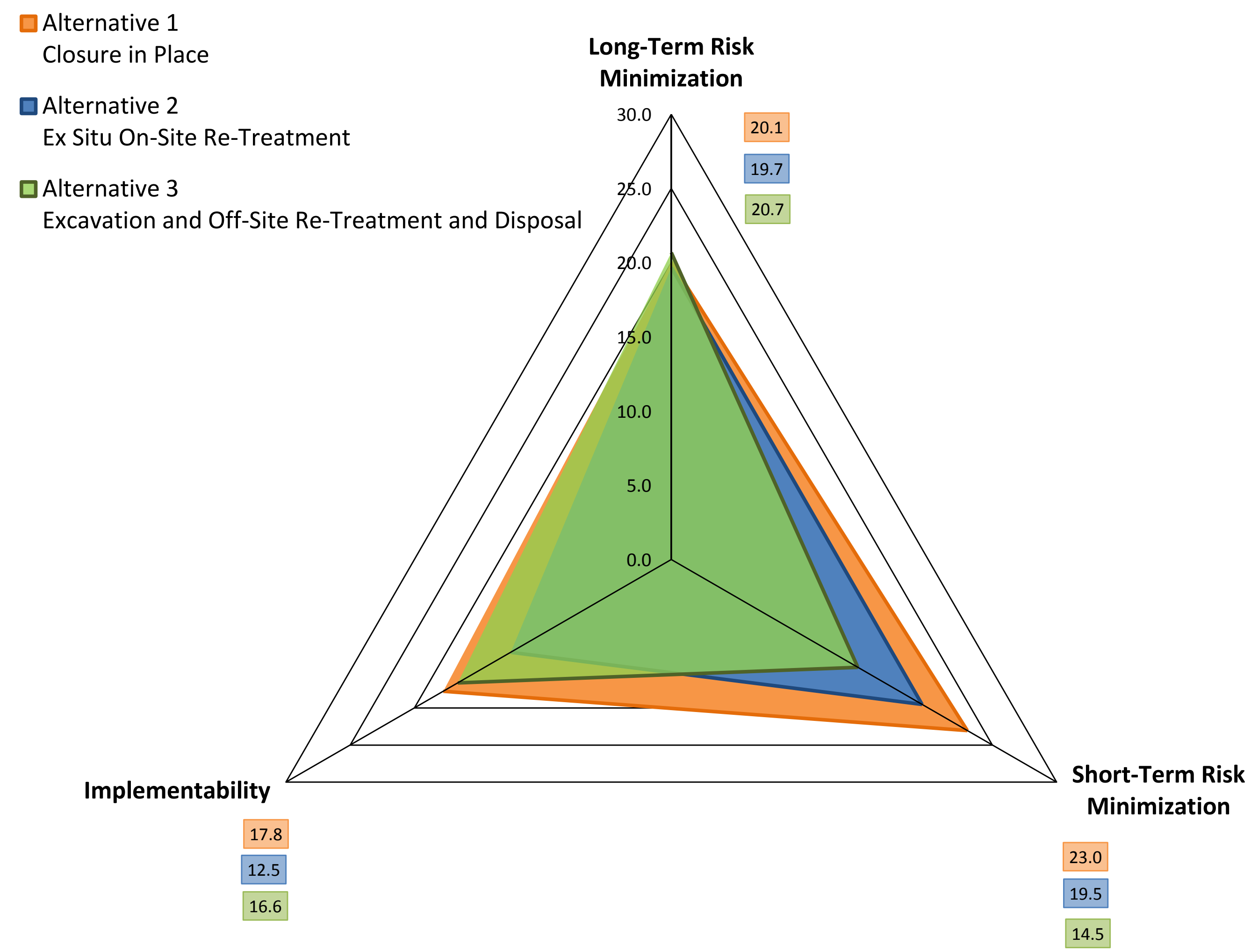
PROJECT
LANDFILL EVALUATION PROJECT

TITLE
CONCEPTUAL SITE MODEL FOR THE CLASS II LANDFILL: ALTERNATIVE 3 - EXCAVATE AND HAUL

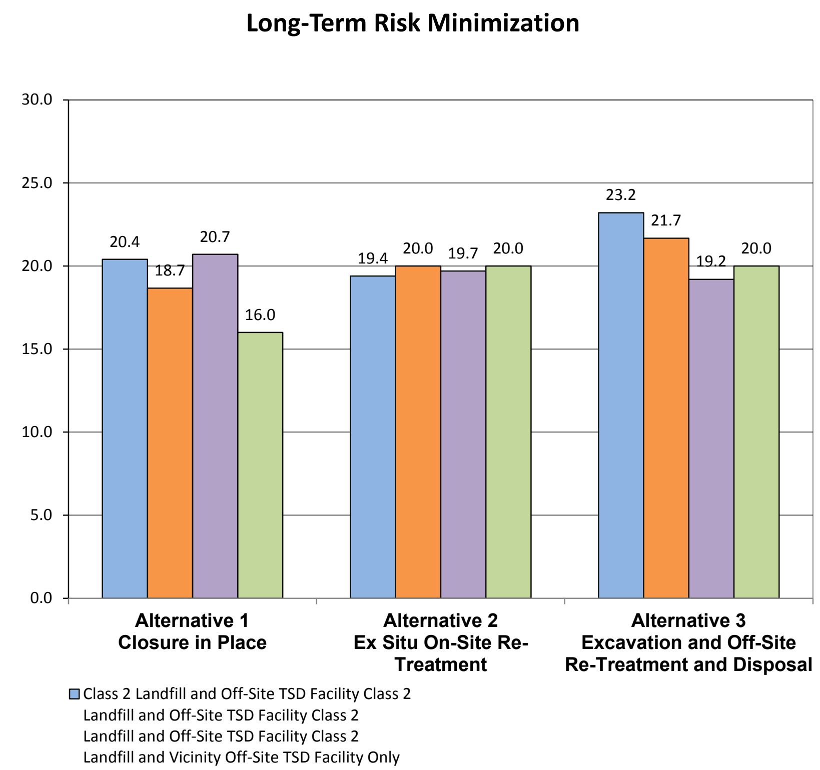
PROJECT No. 13-02086

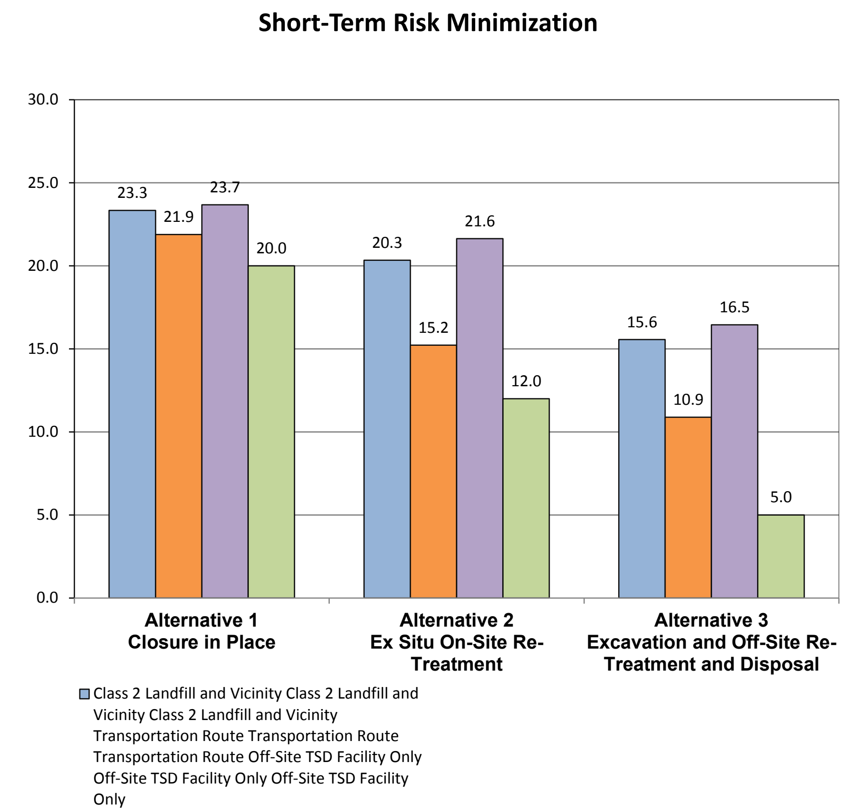
FIGURE 7

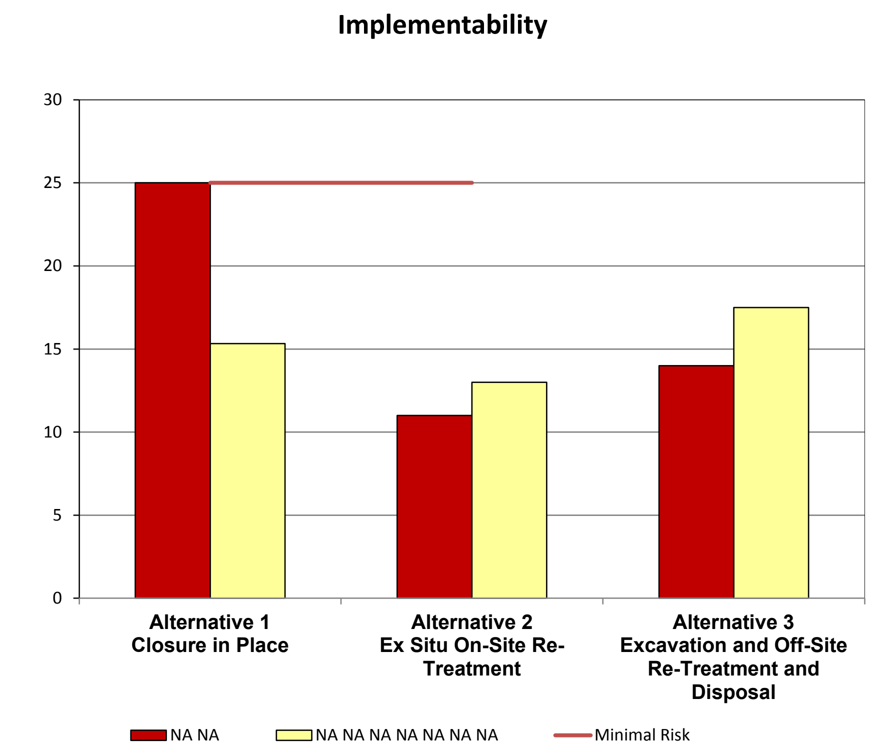
Diamond Chart of Weighted Average Scores for the Three Remedial Alternatives

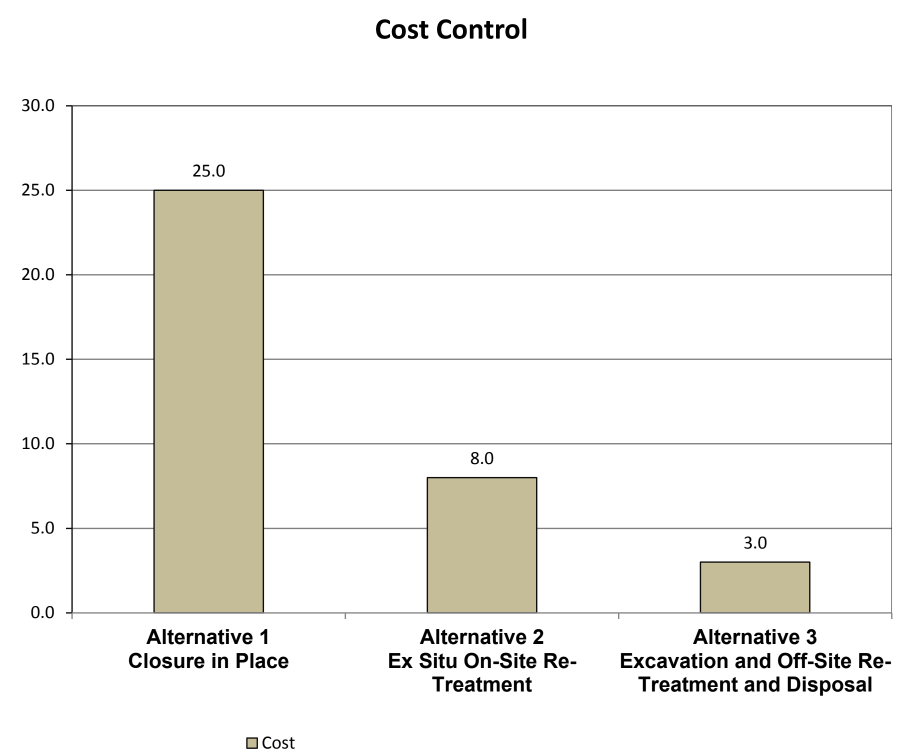


CLIENT EXIDE TECHNOLOGIES	PROJECT LANDFILL EVALUATION PROJECT
CONSULTANT Golder Associates YYYY-MM-DD 2014-08-22 PREPARED A.PARKIN DESIGN D.C REVIEW D.C APPROVED F.S	TITLE **DIAMOND CHART OF WEIGHTED AVERAGE SCORES FOR THE THREE REMEDIAL ALTERNATIVES** PROJECT No. 13-02086 FIGURE 8









CLIENT		PROJECT	
EXIDE TECHNOLOGIES		LANDFILL EVALUATION PROJECT	
CONSULTANT	YYYY-MM-DD: 2014-08-22	TITLE	
Golder Associates	PREPARED: A.PARKIN	BAR CHARTS FOR COMPARING REMEDIAL ALTERNATIVES FOR THE CLASS 2 LANDFILL	
	DESIGN: D.C.		
	REVIEW: D.C.	PROJECT No. 13-02086	FIGURE 9
	APPROVED: F.S.		

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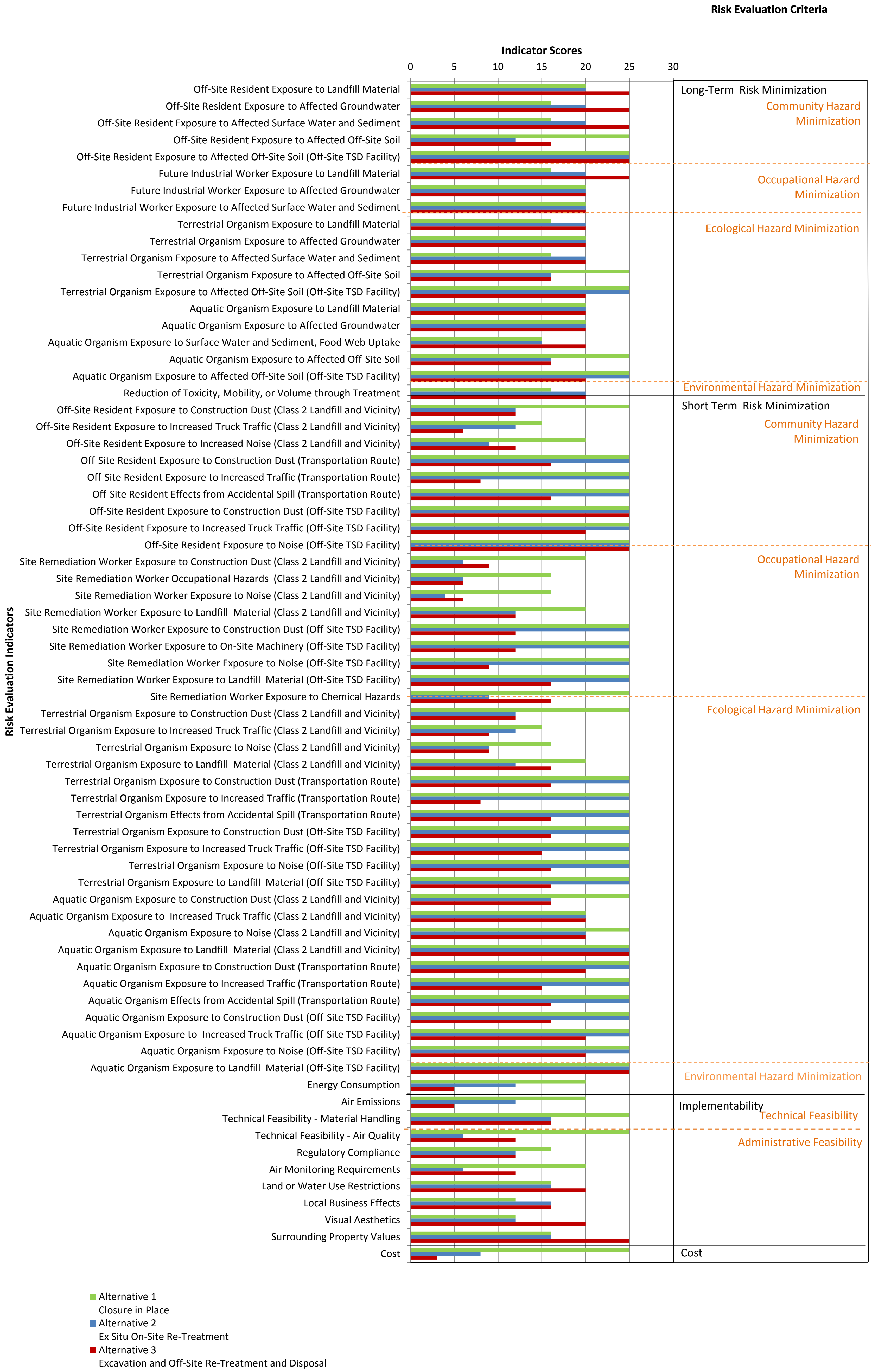

CLIENT	PROJECT
EXIDE TECHNOLOGIES	LANDFILL EVALUATION PROJECT

CONSULTANT: Golder Associates

YYYY-MM-DD	2014-08-22
PREPARED	A.PARKIN
DESIGN	D.C.
REVIEW	D.C.
APPROVED	F.S.

TITLE
BAR CHART COMPARING INDICATORS FOR REMEDIAL ALTERNATIVES FOR THE CLASS 2 LANDFILL

PROJECT No. 13-02086

FIGURE 10

ATTACHMENT A
READERS' GUIDE TO RISK EVALUATION SCORING

Attachment A: Readers' Guide to Risk Evaluation Scoring

The Exide Class 2 Landfill Risk Evaluation of Remedial Alternatives evaluates each of the three remediation alternatives against three major categories called "criteria." The criteria evaluated in the report are Long-term Risk, Short-term Risk, and Implementability. The heart of this evaluation is presented in Table 1, Risk Evaluation of Remedial Alternatives, which incorporates information from the three Conceptual Site Models ("CSM") contained in Figures 5, 6 and 7. For each remediation alternative, the report assesses various potential scenarios of concern, called "Indicators" and calculates scores for these Indicators based on the Indicator's likelihood of occurrence and its projected consequence. These scores are contained in both Table 1 and in Figures 5, 6 and 7.

Given the high level of detail in the report, however, it is easiest to guide the reader through Figures 5, 6 and 7 and Table 1 using a specific example. Included with this guide are an Example Figure 5 and an Example Table 1, which have annotated circles corresponding to the sections of the tables and figures discussed below.

<u>Conceptual Site Models (Figures 5, 6 and 7) – Source of Scores on Table 1</u>

For the Long-term Risk and Short-term Risk criteria presented in Table 1, Figures 5, 6 and 7 (the "Figures") are the sources of the "Indicator Scores." Each Figure presents one of the three alternatives evaluated. Each of the Figures includes columns identifying the source of contamination that might be released ("Primary Source"), the potential manner in which the contamination might be released ("Release Mechanism/Activities"), the impacted material to which there might be exposure ("Potential Exposure Media"), and the manner in which the exposure might occur ("Potential Exposure Route"). These columns are indicated in Circle 1 on Example Figure 5.

For the Long-term Risk and Short-term risk criteria, Indicator Scores are obtained by following the Conceptual Site Model for each alternative. These Indicator Scores are calculated by multiplying two scores: a score reflecting the likelihood that the Indictor will occur (see Example Figure 5, Circle 2), and a score reflecting the consequence of the Indicator occurring (see Example Figure 5, Circle 3).

The Likelihood and Consequence sections of the CSM are subdivided into five categories of humans or organisms that might be exposed (potential receptors). Based on best professional judgment, scores from 1 to 5 are assigned to each potential receptor/exposure or receptor/hazard scenario to denote the likelihoods and consequences of each scenario. Those two scores are multiplied to obtain a risk value (the "CSM Risk Value"), as shown in Circle 4 in Example Figure 5. Table A-1, below, explains the scores: the lowest level of risk receives the highest score, with a maximum/best score of 25.

On Table 1, each non-exposure/hazard-related indicator also receives a score up to 25, with a higher score indicating fewer or less significant challenges to Implementability. Table A-1, below, explains the implementability scores.

Table A-1: Risk Analysis Matrix

		Consequence				
		Minimal	Minor	Medium	Major	Critical
Likelihood	Score	5	4	3	2	1
Rare	5	25	20	15	10	5
Unlikely	4	20	16	12	8	4
Possible	3	15	12	9	6	3
Likely	2	10	8	6	4	2
Almost Certain	1	5	4	3	2	1

Risk Rating	Risk Score
Minimal Risk	19.6 - 25
Minor Risk	14.6 - 19.5
Medium Risk	7.6 - 14.5
Major Risk	3.6 - 7.5
Critical Risk	0.0 - 3.5

Table A-2: Implementability Matrix

Implementability Rating	Implementability Score
Very High	19.6 - 25
High	14.6 - 19.5
Medium	7.6 - 14.5
Low	3.6 - 7.5
Very Low or Negligible	0.0 - 3.5

<u>Risk Evaluation of Remedial Alternatives (Table 1) – Summary of Evaluation</u>

A comprehensive view of the evaluation is captured in Table 1. The three alternatives evaluated are located in four columns, as shown in Example Table 1, Circle 1. For each alternative, many potential scenarios or "Indicators" are identified and evaluated. The Indicators are given a number and a name, as shown in Example Table 1, Circles 2 and 3.

The Indicators are placed into one of three major categories ("Criteria"), and under those umbrellas the Indicators are also placed in smaller categories ("Sub-groups"). The Criteria and Sub-groups are shown in Example Table 1, Circles 4 and 5.

For each remedial alternative, scores are calculated for individual Indicators. Indicator Scores are then averaged to calculate subgroup scores and averaged to calculate criteria scores for that alternative. The Indicator, Sub-group, and Criteria scores are located in right-hand columns of Example Table 1. The scores are used to draw conclusions from the evaluation.

Example: What are the potential short-term effects to an off-site resident (the receptor) in the vicinity of the Class 2 landfill from inhalation (the potential exposure route) of potentially lead/metal-bearing dust (the potential exposure medium) caused by construction activities that create aerial dust dispersion at the landfill during implementation of an alternative remedy?

<u>The Potential Exposure Mechanism</u>

Figures 5, 6 and 7 show there are potential short-term effects associated with implementation of the alternative remedies. During implementation, on-site machinery are used for construction activities and the potential resultant aerial dispersion of dust is a potential "release mechanism" that can result in the potential exposure medium of construction dust, including in some circumstances potentially lead/metal-bearing dust (see Example Figure 5, Circle 5). Although there would be appropriate dust suppression and monitoring plans in place, these measures may not eliminate the risk that the construction dust could be inhaled (the potential exposure route) by off-site residents (the receptor) in some circumstances.

For illustration, provided below is a step wise narrative discussion of the evaluation process for Alternatives 1 and 3.

Alternative 1: Closure in Place

To determine the risk of an off-site resident inhaling dust, including potentially lead/metal-bearing dust, caused by construction activities, look at Example Figure 5. On Example Table 1, this scenario corresponds to Indicator 20, "Off-site resident exposure to construction dust," as shown in Example Table 1, Circle 6.

Example Figure 5, Circle 6 shows that the likelihood for inhalation by off-site residents of construction dust scores a "5," the score for "Rare." As explained in Example Table 1, Circle 7, this is because, under Alternative 1, the material will remain in-place and undisturbed and the entire landfill will have a multi-layer cap so there is not expected to be dust generating activity. Further, any general construction dust would be expected to be associated with uncontaminated material. In addition, appropriate controls such as watering and perimeter air monitoring would further mitigate off-site dust exposure.

Looking again at Example Figure 5, proceeding right to the next set of columns (Example Figure 5, Circle 7), the consequences if off-site residents are exposed to construction dust scored a "5." This indicates that, if an off-site resident inhaled dust caused by construction activities at the landfill, under Alternative 1, the potential effects would be expected to be minimal. This is because the dust generated by activities in this Alternative would be expected to be from uncontaminated, non-lead/metal-bearing materials such as clean fill.

The final column cluster in Example Figure 5 gives the "CSM Risk Values" (see Example Figure 5, Circle 8). The risk to off-site residents from inhaling construction dust scored a 25, minimal risk, which was obtained by multiplying 5 (rare likelihood) by 5 (minimal consequence). Thus, based on this assessment, there is expected to be minimal potential risk to off-site residents associated with inhaling construction dust, including potentially lead/metal-bearing dust, if Alternative 1 is the selected remedy.

Example Table 1 uses the CSM Risk Value from Example Figure 5 as the Indicator Score. The row for Indicator 20 (see Example Table 1, Circle 6) provides both the Indicator Score and the rationale behind that score. In Example Table 1, the cell that describes Indicator 20 under Alternative 1 (Example Table 1, Circle 7) also cross-references the location of the CSM Risk Value on Example Figure 5 at A15 (see Example Figure 5, Circle 8). Where an Indicator Score is risk-based, the CSM Risk Value was placed in the Indicator Score column. Thus, here, under the column labeled "#1" for Alternative 1 (Example Table 1, Circle 8), the risk score is shown as 25. The report averages the Indicator Score for Indicator 20 with other Indicator Scores from the Community Hazard Sub-group to obtain a Sub-group score of 23.3 for Alternative 1. This Sub-group score is then averaged with other Sub-group scores under the Short-term Risk criterion to obtain a criterion score of 23.0 for Alternative 1.

Alternative 3: Excavation and Off-Site Retreatment and Disposal

The CSM for Alternative 3 is shown in Figure 7, which can be read in the same manner as Example Figure 5. To determine the risk of an off-site resident inhaling dust, including potentially lead/metal-bearing dust, caused by construction activities, look at Figure 7.

For Alternative 3, the likelihood of off-site residents in the vicinity of the Class 2 landfill inhaling construction dust scored a "3," the score for "Possible." As explained in Example Table 1, Indicator 20, Alternative 3a, this is because Alternative 3 requires that landfill material be broken and, to a limited extent, crushed into manageable pieces to facilitate excavation, loading and off-site transport. In contrast to Alternative 2, Alternative 3 would not require the landfill material to be crushed into fine particles for retreatment at the Class 2 landfill. For this reason, Alternative 3 would result in less likelihood of aerial dispersion of potentially lead/metal-bearing dust in the vicinity of the Class 2 landfill than Alternative 2. The impacts of crushing for retreatment that would occur at the off-site TSD facility are evaluated under Indicator 26. Dust suppression measures would be put in place at both facilities to minimize dust generation.

Looking again at Figure 7 and proceeding right to the next set of columns, the consequences of an off-site resident in the vicinity of the Class 2 landfill inhaling construction dust scored a “4,” indicating “Minor” consequence. This is the same consequence score as in Alternative 2, but it is a worse score than in Alternative 1. This is because, under both Alternatives 2 and 3, the construction dust may potentially include lead/metal-bearing dust due to the breaking, excavating, crushing, loading, and hauling of treated slag material in the landfill.

The final column cluster in Figure 7 gives the “CSM Risk Values.” The risk to off-site residents in the vicinity of the Class 2 landfill from inhaling dust during Alternative 3 construction activities scored a 12, obtained by multiplying 3 (possible likelihood) by 4 (minor consequence). This cell is color-coded yellow to indicate that this scenario poses a medium potential risk. Because the breaking, excavation, crushing, and loading of treated slag material in the landfill has the potential to generate potentially lead/metal-bearing dust, which may be inhaled by off-site residents, Alternative 3, like Alternative 2, receives a worse risk score than Alternative 1.

Example Table 1 also contains some of this information. The CSM Risk Value is also shown in Example Table 1, in the row for Indicator 20, under the columns labeled “Indicator Scores” under “#3a On-site.” The cell in Example Table 1 that describes Indicator 20, Alternative 3a also cross-references the location of the CSM Risk Value on Figure 7 at A14.

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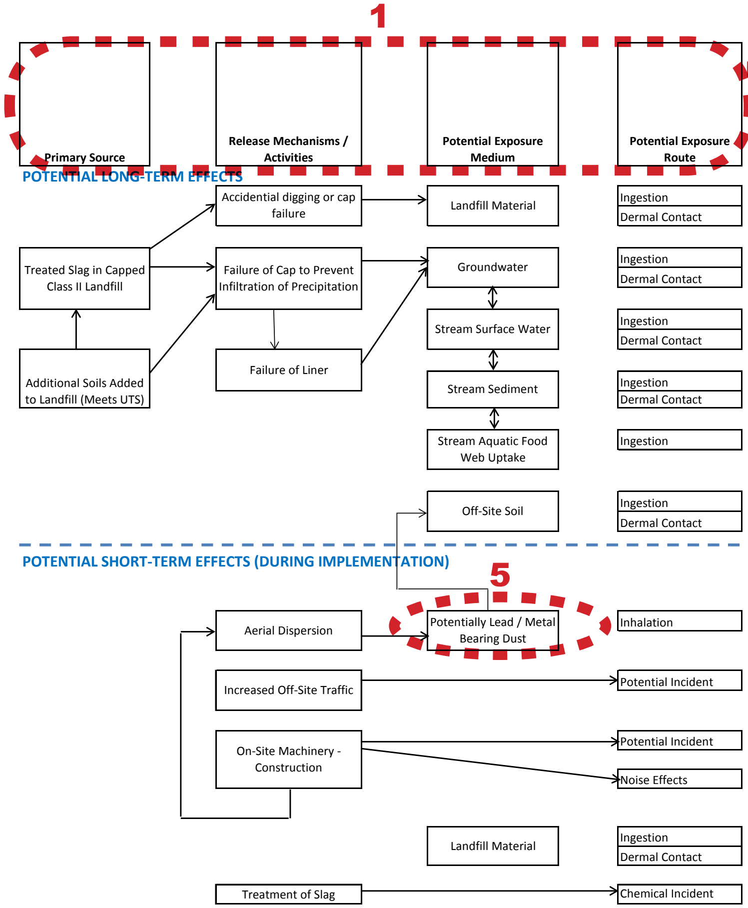

A = Off-Site Residents; B = Remediation Workers; C = Future Industrial Workers; D = Terrestrial Organisms; E = Aquatic/Riparian Organisms

Cell Reference	Potential Exposure Medium	Potential Exposure Route	Likelihood A	Likelihood B	Likelihood C	Likelihood D	Likelihood E	Consequence A	Consequence B	Consequence C	Consequence D	Consequence E	CSM Risk Values A	CSM Risk Values B	CSM Risk Values C	CSM Risk Values D	CSM Risk Values E
1	Landfill Material	Ingestion	5	NA	4	4	5	4	NA	4	4	4	20	NA	16	16	20
2		Dermal Contact	5	NA	4	4	5	4	NA	5	4	5	20	NA	20	16	25
3	Groundwater	Ingestion	4	NA	5	5	5	4	NA	4	4	4	16	NA	20	20	20
4		Dermal Contact	4	NA	5	5	5	5	NA	5	5	5	20	NA	25	25	25
5	Stream Surface Water	Ingestion	4	NA	5	4	5	4	NA	4	4	3	16	NA	20	16	15
6		Dermal Contact	4	NA	5	4	5	5	NA	5	5	5	20	NA	25	20	25
7	Stream Sediment	Ingestion	4	NA	5	4	5	4	NA	4	4	3	16	NA	20	16	15
8		Dermal Contact	4	NA	5	4	5	5	NA	5	5	5	20	NA	25	20	25
9	Stream Aquatic Food Web Uptake	Ingestion	NA	NA	NA	4	5	NA	NA	NA	4	3	NA	NA	NA	16	15
10	Off-Site Soil	Ingestion	5	NA	NA	5	5	5	NA	NA	5	5	25	NA	NA	25	25
11		Dermal Contact	5	NA	NA	5	5	5	NA	NA	5	5	25	NA	NA	25	25
12	Potentially Lead / Metal Bearing Dust	Inhalation	5	4	NA	5	5	5	5	NA	5	5	25	20	NA	25	25
13		Potential Incident	5	NA	NA	5	5	3	NA	NA	3	4	15	NA	NA	15	20
14		Potential Incident	NA	4	NA	NA	NA	NA	4	NA	NA	NA	NA	16	NA	NA	NA
15		Noise Effects	5	4	NA	4	5	4	4	NA	4	5	20	16	NA	16	25
16	Landfill Material	Ingestion	NA	5	NA	5	5	NA	4	NA	4	5	NA	20	NA	20	25
17		Dermal Contact	NA	5	NA	5	5	NA	4	NA	4	5	NA	20	NA	20	25
18		Chemical Incident	NA	5	NA	NA	NA	NA	5	NA	NA	NA	NA	25	NA	NA	NA

Risk Analysis Matrix

Likelihood	Score	Consequence: Minimal	Minor	Medium	Major	Critical
		5	4	3	2	1
Rare	5	25	20	15	10	5
Unlikely	4	20	16	12	8	4
Possible	3	15	12	9	6	3
Likely	2	10	8	6	4	2
Almost Certain	1	5	4	3	2	1

Risk Rating

Risk Rating	Risk Score
Minimal Risk	19.6 - 25.0
Minor Risk	14.6 - 19.5
Medium Risk	7.6 - 14.5
Major Risk	3.6 - 7.5
Critical Risk	0.0 - 3.5

Potential exposures or hazards potentially are related to remedial activites at the Class 2 landfill

L = Long Term
S = Short Term

CLIENT
EXIDE TECHNOLOGIES

CONSULTANT
Golder Associates

YYYY-MM-DD	2014-08-22
PREPARED	A.PARKIN
DESIGN	D.C.
REVIEW	D.C.
APPROVED	F.S.

PROJECT
LANDFILL EVALUATION PROJECT

TITLE
CONCEPTUAL SITE MODEL FOR THE CLASS II LANDFILL: ALTERNATIVE 1 - CLOSE IN PLACE

PROJECT No. 13-02086

FIGURE
EXAMPLE FIGURE 5

Criterion	Subgroup	Receptors	Indicator Number	Means of Potential Exposure	Location	Indicator Names	Alternative 1: Closure In Place (with cell reference from CSM Figure 5)	Alternative 2: Ex Situ On-Site Re-Treatment (with cell reference from CSM Figure 6)	Alternative 3a: Excavation and Off-Site Re-Treatment and Disposal): FRC Facility and Vicinity Only (with cell reference from CSM Figure 7)	Alternative 3b: Excavation and Off-Site Re-Treatment and Disposal: Off-Site TSD Facility and Vicinity Only (with cell reference from CSM Figure 7)	Scoring Criteria	Indicator Scores 1	Indicator Scores 2	Indicator Scores 3a On-Site	Indicator Scores 3b Off-Site	Indicator Scores 3	Subgroup Scores 1	Subgroup Scores 2	Subgroup Scores 3	Criterion Scores 1	Criterion Scores 2	Criterion Scores 3
		Off-Site Residents	20	Construction Activities	Class 2 Landfill and Vicinity	Off-Site Resident Exposure to Construction Dust (Class 2 Landfill and Vicinity)	A12 Minimal - material will remain undisturbed in situ and the entire landfill will have a multi-layer cap. Construction dust would be from clean materials. Appropriate controls, such as watering, will minimize dust generation.	A12 Medium - landfill material will be excavated, loaded into trucks, and crushed on-site to a fine particle size, creating potential lead/metal-bearing dust which may become airborne and travel off-site. Appropriate controls such as watering can minimize dust generation.	A14 Medium - landfill material will be broken to manageable pieces (to a lesser extent than the crushing activities in Alternative 2), loaded into trucks, and transported off site for disposal, creating lead/metal-bearing dust which may become airborne and travel off-site. Appropriate controls such as watering can minimize dust generation.	NA - this indicator applies to the Class 2 landfill only	Probability minimized 1 High probability 25 Low probability	25	12	12		12						
		Off-Site Residents	21	Construction Activities	Class 2 Landfill and Vicinity	Off-Site Resident Exposure to Increased Truck Traffic (Class 2 Landfill and Vicinity)	A13 Minor - some increased truck traffic in the vicinity of the site when importing cover materials.	A13 Medium - increased operations in the vicinity of the site for excavation, crushing, loading, treatment, and hauling over an approximate 2.5-year period.	A15 Major - very high volume of truck traffic into and out of the site to transport material for a 1.5- to 3-year period.	NA - this indicator applies to the Class 2 landfill only	Truck traffic minimized 1 High traffic 25 Low traffic	15	12	6		6						
		Off-Site Residents	22	Construction Activities	Class 2 Landfill and Vicinity	Off-Site Resident Exposure to Increased Noise (Class 2 Landfill and Vicinity)	A15 Minimal - some increased noise during cover construction from standard earth moving equipment.	A15 Medium - increased noise due to crushing, excavation, loading, and hauling.	A17 Medium - increased noise due to truck traffic, breakage, excavation, loading, and hauling.	NA - this indicator applies to the Class 2 landfill only	Noise levels minimized 1 High noise levels 25 Low noise levels	20	9	12		12						
		Off-Site Residents	23	Transportation	Transportation Route	Off-Site Resident Exposure to Construction Dust (Transportation Route)	No off-site transportation	No off-site transportation	NA - off-site transportation is scored under Alternative 3b	E20 Minor - approximately 15,500 truck loads will haul the landfill material 250 miles one way to move the material to the off-site TSD facility. Lead/metal-bearing dust could potentially be generated from transport of landfill material. Appropriate controls, such as covering truck loads, will minimize dust generation. However, any dust dispersion would likely be spread over a wide area, minimizing localized exposures.	Probability minimized 1 High probability 25 Low probability	25	25		16	16						
	Community Hazard Minimization	Off-Site Residents	24	Transportation	Transportation Route	Off-Site Resident Exposure to Increased Traffic (Transportation Route)	No off-site transportation	No off-site transportation	NA - off-site transportation is scored under Alternative 3b	E21 Medium - approximately 15,500 truck loads will haul the landfill material 250 miles each way for a total of 7,750,000 miles of increased truck traffic to move the material to the off-site TSD facility.	Probability minimized 1 High probability 25 Low probability	25	25		8	8	23.3	20.3	15.6			
Short-Term Risk Minimization		Off-Site Residents	25	Transportation	Transportation Route	Off-Site Resident Effects from Accidental Spill (Transportation Route)	No off-site transportation	No off-site transportation	NA - off-site transportation is scored under Alternative 3b	E22, E23 Minor - approximately 15,500 truck loads will haul the landfill material 250 miles one way to move the material to the off-site TSD facility, with the attendant the risk of spillage or accidents.	Probability minimized 1 High probability 25 Low probability	25	25		16	16				23.0	19.5	14.5
		Off-Site Residents	26	Construction Activities	Off-Site TSD Facility Only	Off-Site Resident Exposure to Construction Dust (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	H24 Minimal - landfill material crushed on-site, creating potential lead/metal-bearing dust which may become airborne and travel off-site. However, the off-site TSD facility is expected to be located in remote area, which minimizes potential exposures.	Probability minimized 1 High probability 25 Low probability	25	25		25	25						
		Off-Site Residents	27	Transportation	Off-Site TSD Facility Only	Off-Site Resident Exposure to Increased Truck Traffic (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	H25 Minor - approximately 15,500 truck loads of landfill material will enter and exit the off-site TSD facility to deliver material. However, the facility is expected to be remote from residential areas.	Truck traffic minimized 1 High traffic 25 Low traffic	25	25		20	20						
		Off-Site Residents	28	Construction Activities	Off-Site TSD Facility Only	Off-Site Resident Exposure to Noise (Off-Site TSD Facility)	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	NA - this indicator applies to the Off-site TSD only	H27 Minimal - an estimated 15,500 truckloads of material from the Class 2 landfill will be received at the off-site facility. However, the facility is expected to be remote, which minimizes noise exposure to residents in the vicinity.	Probability minimized 1 High probability 25 Low probability	25	25		25	25						
		Site Remediation Worker	29	Construction Activities	Class 2 Landfill and Vicinity	Site Remediation Worker Exposure to Construction Dust (Class 2 Landfill and Vicinity)	B12 Minimal - operations will involve moving clean material for cover over a 3 to 4 month period.	B12 Major - increased operations for crushing, excavation, loading, and hauling over an approximate 2.5-year period will result in increased potentailly lead/metal-bearing dust. Appropriate controls, such as watering, will minimize exposure.	B14 Medium - Increased operations for breakage and excavation of landfill material and loading into trucks for off site disposal over a 1.5- to 3-year period will generate potential lead/metal-bearing dust.	NA - this indicator applies to the Class 2 landfill only	Probability minimized 1 High probability 25 Low probability	20	6	9		9						
	Occupational Hazard Minimization	Site Remediation Worker	30	Construction Activities	Class 2 Landfill and Vicinity	Site Remediation Worker Occupational Hazards (Class 2 Landfill and Vicinity)	B14 Minor - operations will involve standard earth moving equipment over a 3 to 4 month period.	B14 Major - landfill materials crushing, excavation, loading, and hauling operations will occur over an approximate 2.5-year period.	B16 Major - significant increased truck traffic; landfill material breakage, excavation, loading, and hauling will occur over a 1.5- to 3-year period.	NA - this indicator applies to the Class 2 landfill only	Probability minimized 1 High probability 25 Low probability	16	6	6		6	21.9	15.2	10.9			

CLIENT

EXIDE TECHNOLOGIES

CONSULTANT

Golder Associates

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PREPARED	A.PARKIN
DESIGN	D.C.
REVIEW	D.C.
APPROVED	F.S.

PROJECT

LANDFILL EVALUATION PROJECT

TITLE

RISK EVALUATION OF REMEDIAL ALTERNATIVES

PROJECT No.
13-02086

FIGURE
EXAMPLE TABLE 1

Established in 1960, Golder Associates is a global, employee-owned organization that helps clients find sustainable solutions to the challenges of finite resources, energy and water supply and management, waste management, urbanization, and climate change. We provide a wide range of independent consulting, design, and construction services in our specialist areas of earth, environment, and energy. By building strong relationships and meeting the needs of clients, our people have created one of the most trusted professional services organizations in the world.

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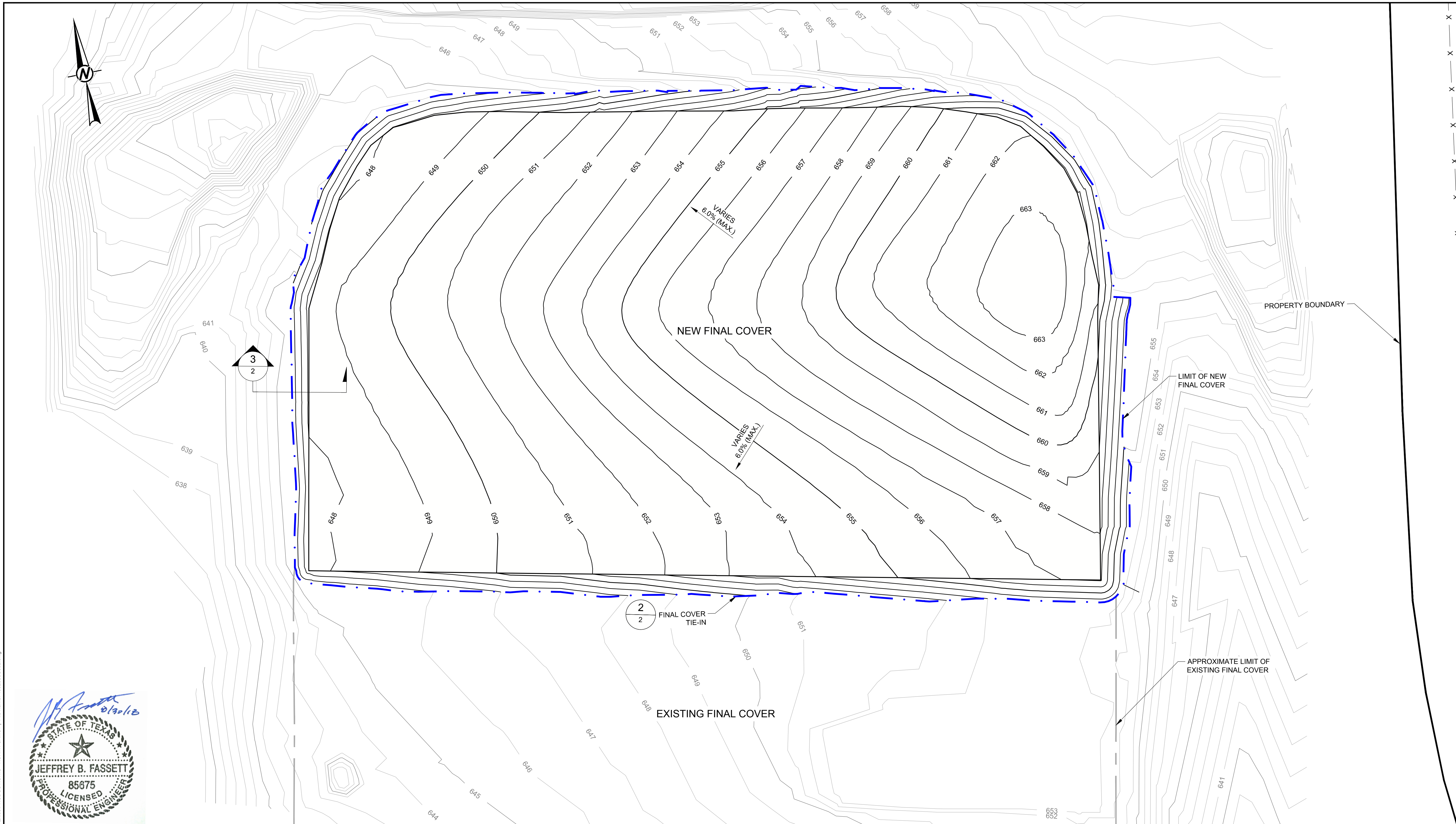
Golder Associates

Engineering Earth's Development, Preserving Earth's Integrity

APPENDIX C

FINAL NORTH CAMU COVER SYSTEM DRAWINGS



LEGEND

— X — X — X —	FENCE
———	PROPERTY BOUNDARY
— · — · —	LIMITS OF NEW FINAL COVER
—650—	EXISTING CONDITIONS CONTOURS
—650—	PROPOSED FINAL COVER CONTOURS
— — —	APPROXIMATE LIMIT OF EXISTING FINAL COVER

NOTES

1. "AS-CONSTRUCTED" INFORMATION INCLUDES INFORMATION PROVIDED BY OTHERS.
2. TOPOGRAPHY COMPILED FROM GROUND SURVEYS CONDUCTED ON DECEMBER 5, 2016 AND AUGUST 7, 2018.

0 30 60 90
SCALE FEET

CLIENT
EXIDE TECHNOLOGIES

CONSULTANT
GOLDER

YYYY-MM-DD	2018-08-29
DESIGNED	JVH
PREPARED	JVH
REVIEWED	JBF
APPROVED	JBF

PROJECT
EXIDE RECYCLING CENTER
ON-SITE INDUSTRIAL CLASS 2 LANDFILL CAMU
FINAL COVER SYSTEM

TITLE
FINAL COVER GRADING PLAN

PROJECT NO.	REV.	FIGURE
1302086	0	1

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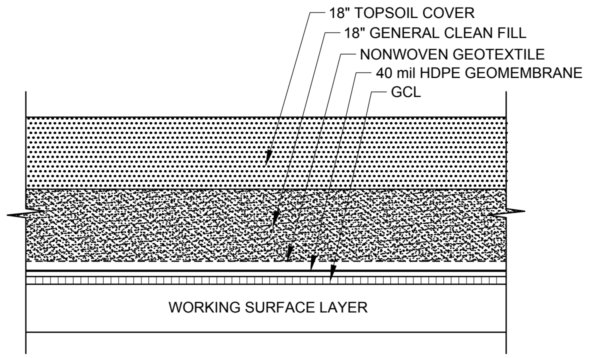
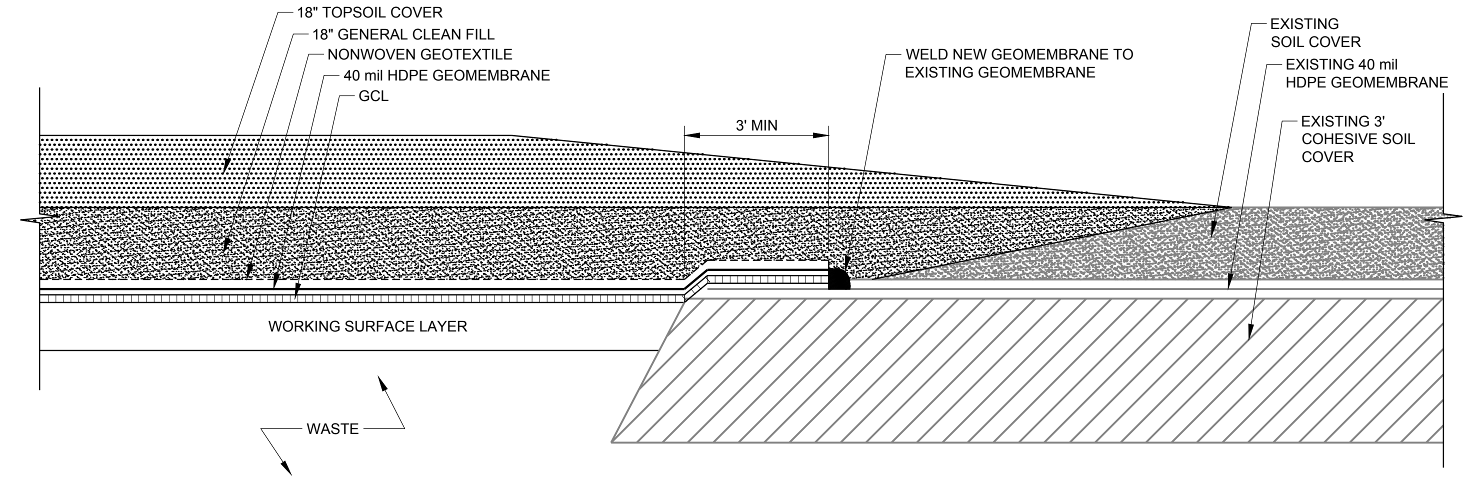
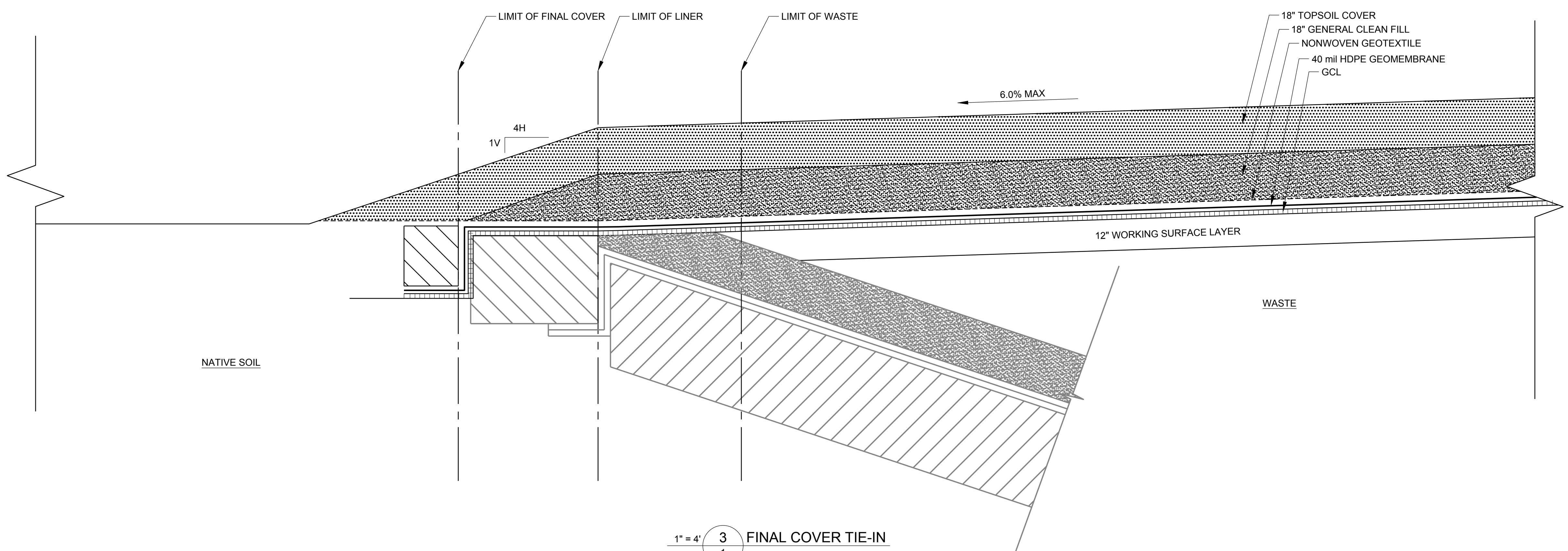


1" = 4' 1/1 FINAL COVER DETAIL



1" = 4' 2/1 FINAL COVER TIE-IN DETAIL



1" = 4' 3/1 FINAL COVER TIE-IN

STATE OF TEXAS
JEFFREY B. FASSETT
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CLIENT
EXIDE TECHNOLOGIES

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DESIGNED	TNB
PREPARED	TNB
REVIEWED	JBF
APPROVED	JBF

PROJECT
EXIDE RECYCLING CENTER
ON-SITE INDUSTRIAL CLASS 2 LANDFILL CAMU
FINAL COVER SYSTEM

TITLE
FINAL COVER DETAILS

PROJECT NO.	REV.	FIGURE
1302086	0	2

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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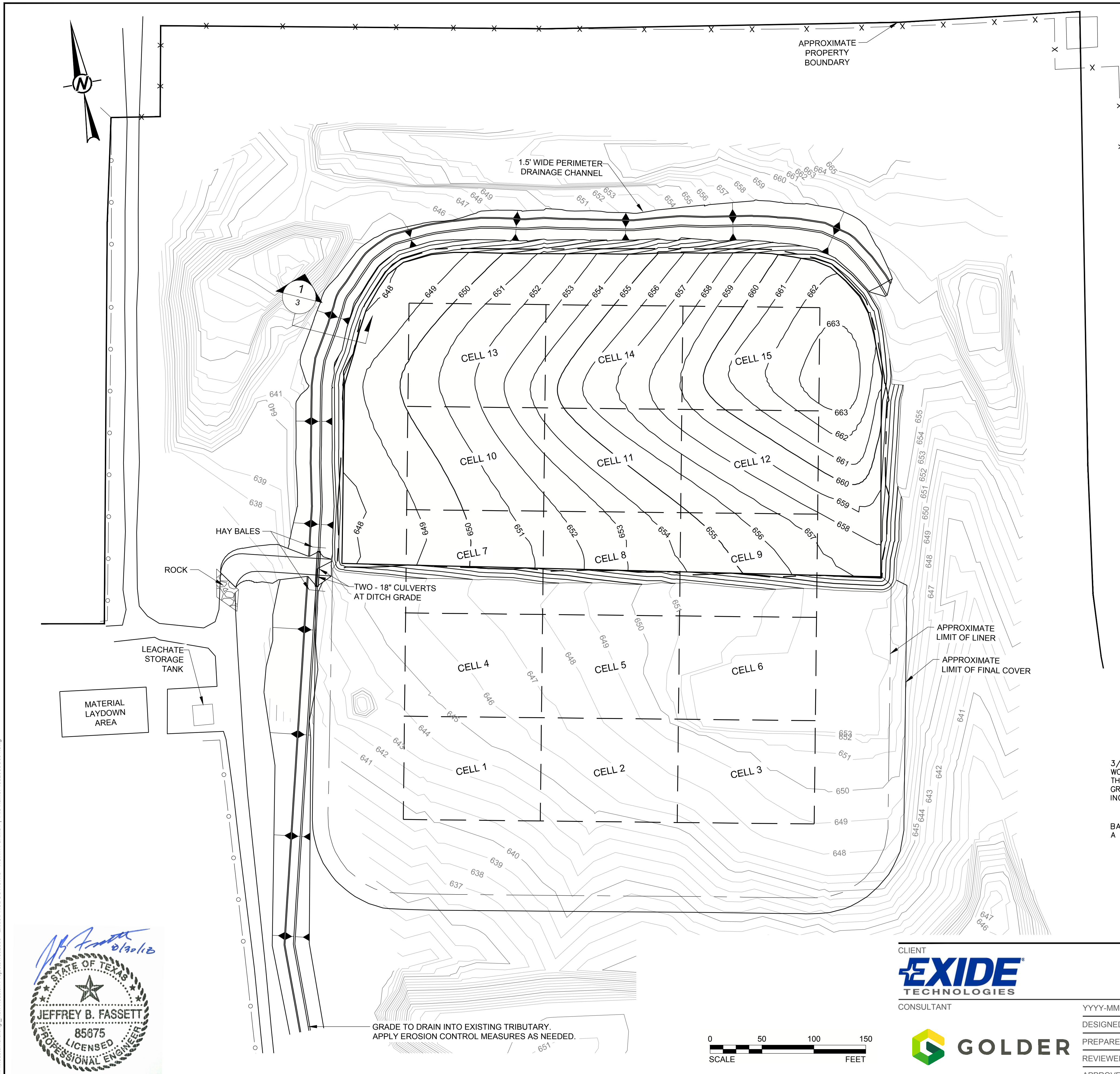
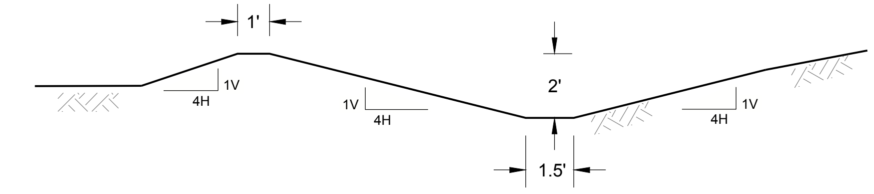


LEGEND

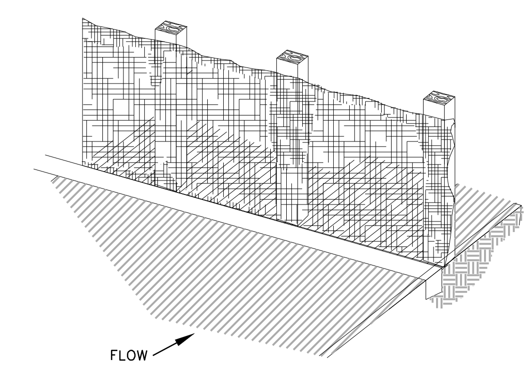
- FENCE (APPROXIMATE PROPERTY LINE)
- FENCE (CHAINLINK)
- CELL BOUNDARY
- PROPOSED FINAL COVER CONTOURS
- EXISTING CONDITIONS CONTOURS
- PROPERTY BOUNDARY
- LIMITS OF FINAL COVER
- LIMITS OF LINER
- LIMITS OF EXISTING FINAL COVER

NOTES

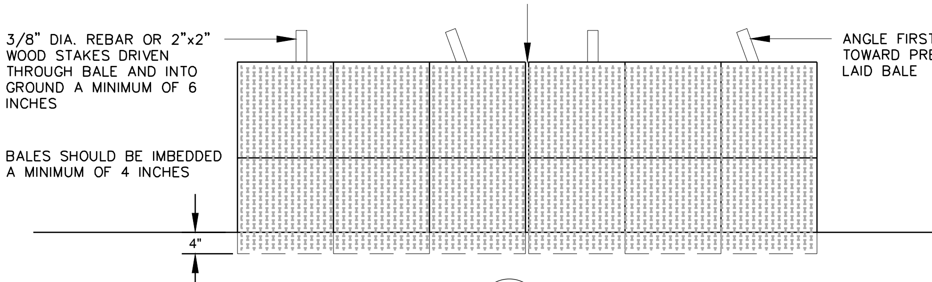
1. LIMITS OF EXISTING FINAL COVER PROVIDED BY OTHERS.
2. TOPOGRAPHY COMPILED FROM GROUND SURVEYS CONDUCTED ON DECEMBER 5, 2016 AND AUGUST 7, 2018.
3. PRIOR TO ESTABLISHMENT OF VEGETATION, SILT FENCING AND HAY BALES MAY BE USED ALONG SLOPE AND WITHIN CHANNELS AS NEEDED TO INTERCEPT AND CAPTURE SEDIMENT.



SCALE 1"=6' 1/3 TYPICAL DITCH SECTION



SCALE: NTS 2/3 SILT FENCE



SCALE: NTS 3/3 HAY BALE

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CLIENT
EXIDE TECHNOLOGIES

CONSULTANT
GOLDER

YYYY-MM-DD	2018-08-29
DESIGNED	JVH
PREPARED	JVH
REVIEWED	JBF
APPROVED	JBF

PROJECT
EXIDE RECYCLING CENTER
ON-SITE INDUSTRIAL CLASS 2 LANDFILL CAMU
FINAL COVER SYSTEM

TITLE
FINAL COVER LAYOUT

PROJECT NO. 1302086
REV. 0
FIGURE 3

APPENDIX D

NORTH CAMU OPERATIONS AND MAINTENANCE PLAN

NORTH CAMU O&M PLAN

NORTH CAMU OPERATION & MAINTENANCE PLAN

Exide Technologies Frisco Recycling Facility
Frisco, Texas

Submitted To: Exide Technologies
Mr. Brad Weaver
P.O. Box 250
7471 Fifth Street
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Submitted By: Golder Associates Inc.
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8/29/18

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August 2018 **130208606**

Golder Associates

Table of Contents

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1.0 INTRODUCTION 1
- 1.1 Background 1
- 1.2 Organization of Report 1

2.0 ACTIVE NORTH CAMU OPERATIONS PROCEDURES 3
- 2.1 General 3
- 2.2 Waste Acceptance Limits and Testing 3
- 2.3 Method of North CAMU Filling 4
  - 2.3.1 Interim Storage 4
  - 2.3.2 Initial Waste Placement 4
  - 2.3.3 Subsequent Waste Lifts 4
  - 2.3.4 Ponded Water 4
- 2.4 Physical Criteria of Waste 5
- 2.5 Daily Cover Operations 5
- 2.6 Equipment Decontamination 5

3.0 FINAL CLOSURE PROCEDURES 7
- 3.1 Working Surface Soil 7
- 3.2 Geosynthetic Clay Liner 7
- 3.3 Geomembrane Barrier 7
- 3.4 Geotextile 7
- 3.5 Clean Fill Material 8
- 3.6 Vegetative Cover Soil 8

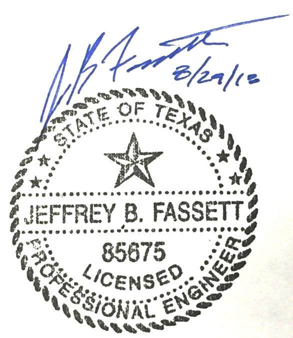
4.0 LEACHATE AND STORM WATER MANAGEMENT PROCEDURES 9
- 4.1 Water Management During Active North CAMU Filling and Closure Operations 9
  - 4.1.1 Interior North CAMU Leachate Management 9
  - 4.1.2 North CAMU Contact Storm Water Management 9
  - 4.1.3 Exterior North CAMU Storm Water Management 9
  - 4.1.4 Decontamination Water 10
- 4.2 Post-Closure Water Management 10
  - 4.2.1 Leachate Management 10
  - 4.2.2 Storm Water Management 10

5.0 SUPPORT OPERATIONS PROCEDURES 11
- 5.1 Waste Hauling Vehicles and Traffic Control 11
- 5.2 Surveying 11
- 5.3 Soil Erosion and Sediment Control 11
- 5.4 Noise Control 11
- 5.5 Odor Control, Air Monitoring and Dust Suppression 11
- 5.6 Site Security 12

5.7 Fire Protection and Emergency Measures 12
6.0 INSPECTIONS AND MONITORING 13
6.1 Active North CAMU Operations Site Inspections and Monitoring 13
6.1.1 General CL2LF CAMU Conditions and Operating Conditions 13
6.1.2 Final Cover 14
6.1.3 Leachate Collection and Conveyance System 14
6.2 Post-Closure Inspections, Maintenance and Monitoring 15
7.0 EQUIPMENT 16
7.1 Heavy Equipment 16
7.2 Support Equipment 16
7.3 Stationary Operating Equipment and Tools 16
7.4 Equipment Maintenance Requirements 17
8.0 PERSONNEL AND TRAINING 18
8.1 Personnel 18
8.1.1 Site Manager 18
8.1.2 Equipment Operators 19
8.1.3 Laborers 19
8.2 Personnel Training 19
8.3 Worker Safety Programs 19

List of Appendices

Appendix A Inspection and Maintenance Forms



1.0 INTRODUCTION

Golder Associates Inc. (Golder) has prepared this operation and maintenance plan (O&M Plan) for the North Corrective Action Management Unit (North CAMU) at the Former Operating Plant (FOP) of the Exide Technologies (Exide) Frisco Recycling Center (FOP) in Frisco, Collin County, Texas (Site). A Site Location Map is provided as Figure 1 of the Final Closure Plan. The layout of the North CAMU is depicted in Figure 3 in Appendix C of the Final Closure Plan. The North CAMU already contains treated slag generated during operations at the FRC (which have now ceased) and metals-impacted soils from the Undeveloped Buffer Property (J-Parcel) surrounding the Site. It also will be used for the disposal of Class 2 wastes generated during the ongoing demolition and remediation activities at the FOP.

1.1 Background

Initial notification for construction of a Class 2 industrial landfill, including engineering plans and a landfill operations plan, was provided to the Texas Natural Resource Conservation Commission (TNRCC) by GNB Technologies, Inc. in August 1995 (1995 Notification). TNRCC acknowledgement of receipt and review of the notification was provided in a September 14, 1995 letter. Landfill construction commenced thereafter and Exide records indicate that the Landfill operations began in 1996. The North CAMU currently consists of fifteen cells, nine of which (Cells 1 through 9) have been closed and capped. The closed cells of the North CAMU consist of treated slag monofills (PBW, 2013). The active cells (Cells 10 through 12) of the North CAMU currently contain treated slag, and they, along with the new cells that are part of a partially constructed expansion (cells 13 through 15) also contain Class 2 wastes generated during the ongoing demolition and remediation activities at the adjacent J-Parcel. (PBW, 2013). Additional Class 2 remediation waste from the FOP will be disposed in cells 13-15.

1.2 Organization of Report

This O&M Plan is being prepared in accordance with the requirements listed in the Agreed Order effective April 27, 2015, Docket No. 2013-2207-IHW-E (Agreed Order). The Agreed Order specifies that the Final Closure Plan for the North CAMU must include detailed operations and maintenance plans. This O&M Plan has been prepared as a supplement to the Landfill Operations Plan included in the 1995 Notification.

This O&M Plan provides general instructions to be followed by Site management and operating personnel for operations at the North CAMU throughout the operating life of the North CAMU in accordance with the Agreed Order. This O&M Plan also includes a description of waste management practices to be followed during implementation of the final closure methods, including removal and decontamination of equipment and devices during North CAMU closure activities. The operations and maintenance items included in this O&M Plan are as follows:

- Section 2.0 presents the North CAMU Filling Procedures;

- Section 3.0 presents the Final Closure Procedures;
- Section 4.0 details the specific Leachate and Storm Water Management Procedures;
- Section 5.0 presents Support Operations Procedures;
- Section 6.0 presents Inspection and Monitoring Procedures;
- Section 7.0 outlines Equipment Descriptions; and
- Section 8.0 discusses Personnel and Training.

Inspections, monitoring and maintenance during the post-closure period are included in the Final Closure Plan text, to which this O&M Plan is an Appendix. Other information previously submitted in existing documents or in the Final Closure Plan is referenced where appropriate.

2.0 ACTIVE NORTH CAMU OPERATIONS PROCEDURES

This section describes the Site-specific procedures for active North CAMU filling operations including management objectives, the waste acceptance criteria, working face practices, and placement of initial and subsequent soil waste lifts. Support functions including leachate and storm water management procedures to be followed during the active period are presented in Section 4.0 of this document.

2.1 General

Class 2 waste will be placed in the existing constructed North CAMU in lifts. The general operational approach dictates that the lifts be placed with the primary objective of protection of the geosynthetic liner system along interior side slopes (subsequent soil waste lifts).

A significant rainfall event (determination to be made by the Construction Manager) would stop all loading and transportation activities in the North CAMU. No waste will be loaded, transported or placed into the North CAMU during such an event. Work will resume as soon as possible after the rain stops and conditions allow. The decision to resume work will be the responsibility of the Construction Manager.

The following subsections provide a narrative of how waste placement requirements will be implemented during the filling operations.

2.2 Waste Acceptance Limits and Testing

Based on the Agreed Order, the following wastes are CAMU-eligible wastes that are authorized to be placed in the CL2LF CAMU:

- The treated slag that currently exists in cells 1 through 12; and
- Class 2 non-hazardous remediation waste associated with clean-up activities for Voluntary Cleanup Program (VCP) No. 2541 (J Parcel) and other Class 2 remediation waste approved in the Final Closure Plan.

Waste characterization for the Class 2 non-hazardous remediation waste associated with clean-up activities for the J-Parcel is being performed in accordance with the Response Action Soil Sampling and Analysis Plan included in the Undeveloped Buffer Property VCP Response Action Plan, prepared by Pastor, Behling & Wheeler, LLC. (PBW).

Other Class 2 remediation waste may also be placed in the North CAMU. These wastes may include soils from surface or subsurface excavation areas, concrete, sediment, or other remediation wastes that are within class 2 standards. These Class 2 remediation waste will be characterized in accordance with the proposed Response Action Plan and corresponding Sampling and Analysis Plan. Any waste characterized as hazardous waste will not be placed in the North CAMU and will be disposed off-Site at an appropriate permitted facility.

2.3 Method of North CAMU Filling

The waste placement technique to be used will incorporate use of the existing footprint of the North CAMU. As shown on the Site Layout (Figure 3 in Appendix C of the Final Closure Plan), waste hauling vehicles will use a partially concrete paved road to access the North CAMU area, then, once in the North CAMU area, use an access road located to the west side of the North CAMU, as directed by the Construction Manager. These waste hauling vehicles will back down the interior North CAMU embankment ramp and will unload in the designated drop area. This drop area will be demarcated by use of temporary barriers. Tracked equipment (excavator and dozer) will be stationed within the North CAMU and will work in tandem to place the waste in lifts as required.

2.3.1 Interim Storage

Interim storage areas are not anticipated to be needed for North CAMU operations.

2.3.2 Initial Waste Placement

Soil waste shall be placed and graded to direct drainage away from the work and minimize ponding. Areas shall be uniformly graded to provide a finished surface that is smooth, compacted, and free of irregularities.

A dozer will be used as the primary spreading machine for the initial lift of soil waste from the remediation activities. The initial lift of waste in a new cell will be free of woody roots and sticks or other angular materials that could pose a hazard to the lining system. The initial lift will consist of soil only and will be a minimum of 24 inches thick. Equipment will be prohibited from operating directly on liner materials or geosynthetics during waste placement.

2.3.3 Subsequent Waste Lifts

After completion of the initial waste layer on the side slopes, a route of travel for subsequent lifts in the North CAMU will be established. Waste filling operations will continue to progress and waste will be placed in loose lifts compacted to a general thickness of approximately 1 foot The waste will be compacted by a combination of the tracked dozer operating on the surface and by the haul trucks traveling over the in place soil waste. Following compaction, the soil waste should have sufficient strength to adequately support construction equipment.

2.3.4 Ponded Water

Ponding of water over waste filled areas will be prevented using the following techniques:

- Proper grading of interim waste slopes to promote positive water surface drainage toward drainage features (Figure 1 of Appendix C of the Final Closure Plan), then collected contact surface water will be handled as described below;

- Proper grading of final waste slopes to the elevations shown in the design plans (Appendix C of the Final Closure Plan), which provide surface water drainage without depressions or low spots; and
- Installation of upgradient temporary diversion berms as required to minimize the amount of water entering the disposal area.

Waste fill areas will be inspected to identify depressions or other potential ponding locations. In the event ponded water on the North CAMU is observed, action will be taken to remedy the problem. If water begins to accumulate in the active portion of the North CAMU, it will be removed with a small portable pump. The area of ponding will be filled with clean soil or waste fill and re-graded within seven days of the occurrence, weather permitting. Water that has been in contact with waste will be removed and treated on-Site as described in Section 4.0.

2.4 Physical Criteria of Waste

Soil, slag, sediment and other approved remediation waste to be placed in the North CAMU shall not contain free water. Putrescible wastes shall not be placed in the North CAMU. Wastes shall be placed in a manner to minimize formation of bridging or voids and to allow adequate compaction to prevent excessive consolidation, piping, or settlement after placement.

2.5 Daily Cover Operations

Daily cover will not be required because the waste will not attract birds or animals and does not contain material susceptible to being windblown. A Dust Control Plan is included as Appendix I to the Final Closure Plan. The exposed face of the North CAMU will be limited to the area actively being filled. Other areas of exposed waste may be covered by a spray applied cover or other temporary cover (as previously used at the North CAMU).

2.6 Equipment Decontamination

An equipment decontamination area within the North CAMU at the northwest and/or northeast corner or within the material laydown area shown in Figure 3 in Appendix C of the Final Closure Plan. Berms will be used. The decontamination area will be large enough to accommodate the largest piece of equipment that will be used during the operation and closure activities. 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) geomembrane will be placed over the graded area extending over the berms. The HDPE geomembrane will be anchored at the bottom of the berms to prevent it from becoming windblown. Timbers will be installed over the HDPE geomembrane 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's on-Site wastewater treatment facility for treatment and disposal in accordance with applicable regulations. To limit the generation of contact storm water, the decontamination pad will be covered with poly sheeting weighted with sandbags during periods of inactivity and during significant storm events.

During the operation and closure activities, decontamination residue will be containerized and transferred to a less than 90-day container for characterization, storage and disposal in accordance with local, state and federal requirements. If the decontamination residue meets Class 2 Non-Hazardous waste criteria, it will be placed in the North CAMU provided capacity is available for this waste. The geomembrane and timbers 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 disposal in accordance with applicable regulations. Once decontamination is complete, the liner and timbers will be transferred to a less than 90-day container for characterization, storage and disposal in accordance with local, state and federal requirements. If the liner and timbers meet Class 2 Non-Hazardous waste criteria, it will be placed in the North CAMU provided capacity is available for this waste.

Following completion of decontamination activities and removal of the decontamination pad, three grab samples will be collected from beneath the decontamination area.

If the decontamination pad is within the North CAMU, the samples will be analyzed for TCLP lead, cadmium, arsenic and selenium. Should any of the results exceed Class 2 Standards for any of these four metals, a minimum of six (6) inches of material underlying the decontamination area will be removed and sent to RCA, if applicable, or placed into a temporary less than 90-day container meeting applicable standards for waste characterization and analysis. This process will be repeated as required until the grab samples exhibits TCLP results that meet the Class 2 Standards for these four metals. Material that does not meet the Class 2 Standards will be transported to the RCA or off-Site for disposal in accordance with local, state and federal requirements.

If the decontamination pad is outside the North CAMU, the samples will be analyzed for total lead, cadmium, arsenic and selenium. Should any of the results exceed applicable Protective Concentration Limits (PCLs) for any of these four metals, a minimum of six (6) inches of material underlying the decontamination area will be removed and placed into a temporary less than 90-day container meeting applicable standards for waste characterization and analysis. This process will be repeated as required until the grab samples exhibits results that meet the PCLs for these four metals. Material will be transported to the RCA or off-Site for disposal in accordance with local, state and federal requirements.

3.0 FINAL CLOSURE PROCEDURES

This section describes the Site-specific procedures for Final Closure activities, including placement of final cover. Final closure procedures and specifications are included in the Final Closure Plan and QA/QC Plan and included here for reference. Should the specifications listed within this document differ from the Final Cover System Drawings (Appendix C of the Final Closure Plan) or the QA/QC Plan (Appendix E of the Final Closure Plan), the Engineering Drawings take precedence, followed by the QA/QC Plan and then the Final Closure Plan.

Support functions, including leachate and storm water management procedures during final closure, will be the same as those identified during active operations and summarized in Sections 2.0 and 4.0 of this O&M Plan.

3.1 Working Surface Soil

The final surface of waste will be covered with a minimum 12-inch thick working surface soil layer (see the QA/QC Plan for the North CAMU which is included as Appendix E to the Final Closure Plan for more detail). The surface will be drum rolled to a smooth condition and surveyed at 100-foot intervals to establish the elevations of the surface prior to placement of a geosynthetic clay liner (GCL). The working surface soil material will be obtained from an on- or off-site source, delivered using haul trucks, and spread with a dozer to prepare a smooth surface for the GCL. The 12-inch working surface soil layer may be composed of waste placed, given the top four inches of the working surface is smooth and free of all sharp, angular objects as described above. The surface should provide a firm, unyielding foundation for the GCL with no sudden sharp or abrupt changes or break in grade.

3.2 Geosynthetic Clay Liner

Following the grading and smoothing of the working surface soil, a GCL will be placed directly above the working surface soil as shown on Figure 2 in Appendix C of the Final Closure Plan. The new GCL shall tie in to the existing compacted clay liner of the cells that have already been closed and extend beyond the liner system as shown on Figure 2 in Appendix C of the Final Closure Plan.

3.3 Geomembrane Barrier

Following the installation of the geosynthetic clay liner, a 40-mil high density polyethylene (HDPE) geomembrane will be installed over the North CAMU. The geomembrane will be anchored in a trench outside the North CAMU perimeter, as shown on Figure 2 in Appendix C of the Final Closure Plan.

3.4 Geotextile

A nonwoven geotextile layer shall be placed over the 40-mil textured HDPE geomembrane. The nonwoven geotextile shall be an 8-ounce per square yard (oz/sy), nonwoven and needle-punched.

3.5 Clean Fill Material

An 18-inch thick layer of general clean fill material will be placed on top of the geotextile layer. The clean fill soil layer will consist of suitable soil obtained from an approved borrow source.

3.6 Vegetative Cover Soil

An 18-inch thick layer of topsoil will then be placed above the general clean fill layer. The uppermost 6-inch layer of the vegetative cover soil will be placed in a loose condition and will be amended as necessary to establish a dense growth of vegetation. Once placement of the vegetative growth layer is completed, the area will be hydroseeded.

4.0 LEACHATE AND STORM WATER MANAGEMENT PROCEDURES

There are two distinct leachate and storm water management procedures to be used at the North CAMU. During the active waste placement period, the North CAMU will receive direct rainfall. Therefore, comprehensive storm water and leachate management procedures will need to be used. After the North CAMU is filled and the cover system installed, the leachate generation is expected to fall significantly and the associated management procedures are simplified. This section presents the details of the procedures to be used during the active operations and closure of the North CAMU as well as during the post-closure period. Inspection and monitoring requirements are presented in Section 6.0.

4.1 Water Management During Active North CAMU Filling and Closure Operations

4.1.1 Interior North CAMU Leachate Management

As described in the Final Closure Plan, the North CAMU was constructed with a leachate collection system (LCS). The LCS will be pumped using submersible pump, which will be water-level activated. During active North CAMU filling operations, water collected in the LCS will be pumped to a storage tank adjacent to the North CAMU and will subsequently disposed offsite in accordance with applicable regulations. A detailed description of the operations for the LCS is included in Section 2.2.2 of the Final Closure Plan.

4.1.2 North CAMU Contact Storm Water Management

The existing final cover slopes toward the southwest, away from the active North CAMU area. The remainder of the active area is surrounded by a perimeter berm with an elevation higher than the surrounding ground surface. Therefore, there is no mechanism for storm water run-on to occur and no additional measures are required to control storm water run-on.

Storm water from minor rain events falling on the working face will either evaporate, or will infiltrate through the waste and be removed through the leachate collection system. In the event that there is a significant amount of rainfall and water removal is needed, contact storm water (defined as storm water that contacts the waste during active placement in the North CAMU) will be directed toward a sump in the North CAMU and either directed to the solar evaporation pond for offsite disposal or treatment and discharge (if authorized) or to the stormwater pond for treatment and discharge (if authorized) or pumped to frac tanks for storage until this water can be disposed of in accordance with applicable regulations.

4.1.3 Exterior North CAMU Storm Water Management

Run-on control is not an issue for the majority of the North CAMU due to the height of the perimeter berm above existing grade. Run-on from along the northern portion of the unit will be diverted to the west. Run-off from capped areas will be controlled using mulch and erosion control netting on exposed slopes, placement of lining materials on concentrated flow paths, and installation of culverts for road crossings over channels (see Figure 3 in Appendix C of the Final Closure Plan).

4.1.4 Decontamination Water

Decontamination procedures and protocols to be used at this Site are discussed in Section 2.6 above. Decontamination waters will be handled as described in Section 2.6.

4.2 Post-Closure Water Management

During the post-closure period, only interior North CAMU leachate and non-contact storm water will be generated.

4.2.1 Leachate Management

As described above and in the Final Closure Plan, the North CAMU was constructed with a leachate collection system (LCS). The LCS uses a submersible pump, which will be water-level activated. During the post-closure care period, leachate collected in the LCS will be pumped to a storage tank adjacent to the North CAMU and subsequently disposed off-Site. A detailed description of the operations for the LCS is included in Section 2.1.2.2 of the Final Closure Plan.

4.2.2 Storm Water Management

Following final closure, storm water run-off from the North CAMU will flow primarily off the final cover to the southwest with a small amount of flow off of the final cover toward the northwest. Storm water run-off will be directed to a channel along the northern and western perimeter of the North CAMU, where it will be conveyed to an existing tributary to Stewart Creek located south of the North CAMU. Calculations for channel and culvert sizing are included in Appendix G of the Final Closure Plan. Two 12-inch culverts will convey water under the access road on the west side of the North CAMU. Storm water management details are also included in Figure 3 of Appendix C of the Final Closure Plan.

Storm water drainage facilities will be inspected regularly as described in the Final Closure Plan. Fill material, siltation and excessive plant growth will be removed from drainage waterways to prevent obstruction of flow. Erosion on the sides or bottoms of the drainage waterways will be repaired and reconstructed.

5.0 SUPPORT OPERATIONS PROCEDURES

This section describes the Site-specific support operations procedures for hauling and handling Class 2 waste.

5.1 Waste Hauling Vehicles and Traffic Control

Vehicles for hauling Class 2 waste must be suitable for transporting this material from the FOP areas to the North CAMU. Waste haulers will be responsible for observing the speed limits, traffic and safety requirements. Waste hauling vehicles shall be covered to minimize dust migration during transportation. Waste hauling vehicles will follow only those routes designated by the Construction Manager.

Waste hauling vehicles will track each load, documenting the quantity and time loaded. The Construction Manager designee at the entry to the North CAMU will stop each truck and log its arrival in the North CAMU records. An inventory number will be assigned to each load by the Construction Manager designee. These logs will become part of the final recordkeeping as described in the Final Closure Plan.

5.2 Surveying

As described in the QA/QC Plan, the working surface layer and the soil cover layers will be surveyed by a surveyor licensed in the state of Texas.

5.3 Soil Erosion and Sediment Control

Erosion and sedimentation will be reduced and controlled using best management practices. Erosion control measures at the North CAMU will include hydroseeding as specified in the Agreed Order. Erosion calculations, included in Appendix G of the Final Closure Plan, indicate that, once the final cover is installed and vegetation is established, the potential for erosion and sedimentation will be minor.

5.4 Noise Control

North CAMU operations are expected to occur during daytime hours and will be contained within the Site boundary; therefore, no special noise controls are needed. However, noise levels for equipment used at the Facility will comply with applicable Occupational Safety and Health Administration (OSHA) requirements as described in each contractor's Health and Safety Plan (to be prepared prior to the start of work at the Site).

5.5 Odor Control, Air Monitoring and Dust Suppression

Odorous constituents are not expected to be an issue based upon the types of Class 2 wastes that are approved for acceptance at the North CAMU. Ambient air monitoring will be performed as described in the Air Monitoring Plan (included as Appendix H to the Final Closure Plan) and each contractor's health and safety plan, which will be prepared prior to the start of work at the Site. A Dust Control Plan has also been prepared for the North CAMU is included as Appendix I to the Final Closure Plan.

5.6 Site Security

Unauthorized personnel will not be permitted in or near the North CAMU. The North CAMU will not be open to the public at any time. Site security will be provided by the existing fencing around the FOP. A security guard is currently contracted for the FOP when the FOP is not staffed [during the closure process].

To minimize the possibility that wildlife or unauthorized individuals will enter the North CAMU, a six-foot high fence, with a lockable entrance gate, will be installed around the North CAMU or entire FOP perimeter following final closure activities. The fence will reduce the possibility for large wildlife or unauthorized individuals to enter the North CAMU area and potentially damage liners, interfere with operations, come in contact with waste materials, or track waste materials outside of the North CAMU area.

During active operations, the Construction Manager designee the entrance to the Site or the North CAMU will stop each vehicle or person to determine whether they are permitted in the North CAMU area. At other times the gate to the FOP will be locked.

All Site security elements are included in the periodic inspections discussed in Section 6.0 and the Final Closure Plan.

5.7 Fire Protection and Emergency Measures

Only Class 2 Non-Hazardous waste which are non-flammable and non-combustible will be placed in the North CAMU and as such fire hazards are believed to be minimal. A Contingency Plan for the North CAMU has been prepared and is included as Appendix J to the Final Closure Plan.

6.0 INSPECTIONS AND MONITORING

6.1 Active North CAMU Operations Site Inspections and Monitoring

During active operations, the North CAMU will be inspected a minimum of weekly and after each significant storm event to detect evidence of the following:

- Deterioration, malfunction, or improper operation of surface water control features;
- Erosion of North CAMU cap or berms;
- The presence of leachate in and proper functioning of leachate collection and removal systems;
- Procedures followed by operations and maintenance staff; and
- The condition of the operating equipment, including earth moving equipment, alarms and pumps.

An inspection check form with explanations of observations made will document each of these weekly inspections and become part of the North CAMU records. In addition, inspections of the security system (existing fences, gates, locks, etc.), emergency equipment, communications equipment, and alarm system for the LCS will be conducted weekly during active operations. These areas are described in the following subsections and documented on the North CAMU Inspection Form (Inspection Form), which is included in Attachment A of this O&M Plan. If, during a periodic inspection, damage, deterioration, or malfunction of any of the systems, components, or facilities is observed, steps shall be initiated to rectify the situation. Site personnel, or their designated contractor, will perform minor maintenance activities as described in this O&M Plan. Maintenance and repair actions will be documented on the Repair Report From included in Attachment A of this O&M Plan.

6.1.1 General CL2LF CAMU Conditions and Operating Conditions

The following will be inspected weekly and noted on the Inspection Form:

- Signs of erosion, obstructions or ponding on the exterior berm slopes and on temporary water control systems, including ditches and culverts;
- Condition of heavy and support equipment, including signs of leaks or other items requiring maintenance;
- Access road conditions (potholes, washouts, ponding, or other deterioration);
- Inventory and condition of emergency and communications equipment (all should be available, stocked, and functioning);
- Conditions of any tanks used on-Site for fuel or other material storage; and
- Conditions of existing fences, locks, gates, and signs (i.e. note any missing items, damage, or signs of tampering).

The on-Site access road will be inspected and maintained so that routine inspections can be performed. Any potholes or washouts, or excessive “washboarding” of the road will be repaired and the road will be graded, as needed.

6.1.2 Final Cover

The existing final cover and any temporary cover will be inspected by walking the North CAMU to confirm positive drainage from the cover to the perimeter drainage features and assess the condition of the cover. Any subsidence that significantly alters drainage from the cover will be corrected. Any areas that allow water to pond on the cover will be backfilled and revegetated. The inspector will look for evidence of erosion, subsidence, ponded water, animal burrows, cracks along the cover, and loss of soil. Any excessive erosion will be identified and corrected. Erosion over large areas will be backfilled and revegetated. The following should be noted on the inspection form:

- Rills, gullies and crevices 6 inches or deeper in the vegetative soil layer;
- Cover settling or subsidence that affects surface water runoff;
- Reworked surfaces and areas with sparse or eroded vegetation in excess of 100 square feet cumulatively;
- Brush, trees or similar invasive vegetation with tap roots growing in areas not designated for this type of vegetation;
- Evidence of burrowing or other cover disturbance by burrowing animals; and
- Effectiveness of storm water drainage features.

The vegetative surface will be mowed after initial establishment of the planted species. Mowing is assumed to occur twice a year. Any areas with rills and gullies greater than 6 inches in depth will be filled with soil and the vegetation re-established. Settlement, subsidence, or displacement of the North CAMU will be corrected. Temporary erosion and sediment control measures will be employed on steep slopes to enhance restoration of the restored surfaces.

6.1.3 Leachate Collection and Conveyance System

The following should be inspected and noted on the inspection form for the LCS and conveyance system:

- Leachate levels in the enclosed collection sumps;
- All exposed piping, conduit, and other facilities for apparent wear, damage or leakage;
- Alarm and auto-dialer system receiving power;
- Alarm system in working order; and
- Auto-dialer system in working order.

6.2 Post-Closure Inspections, Maintenance and Monitoring

Post-closure inspections, maintenance and monitoring are included in the Final Closure Plan, to which this document is an appendix.

7.0 EQUIPMENT

The following section describes the general types of equipment to be used at the North CAMU, the functions this equipment performs and equipment maintenance requirements. All equipment and tools used in the performance of the work are subject to the approval of the Construction Manager before work is started.

7.1 Heavy Equipment

Heavy equipment available for day-to-day operations of the disposal area may consist of bulldozer, earth moving equipment, waste or soil compactors (as needed), drum rollers, and a water truck, as well as other equipment as needed. When major repairs to heavy equipment are needed, the North CAMU operator or contractors will make additional equipment of similar size and function available. All heavy equipment shall be fitted with fully enclosed cabs.

7.2 Support Equipment

In addition to the required heavy equipment, miscellaneous pickups, and/or other light utility vehicles, as well as various portable water pumps, instruments, and safety and training equipment will be on-Site as necessary. Pickup trucks shall be used to haul North CAMU personnel within the Site to conduct Site duties. A portable pump shall be used for pumping stormwater from excavations and from ponded areas, if needed.

North CAMU support equipment includes mobile and portable equipment used in operating and maintaining the North CAMU. The support equipment may include:

- Trucks (dump, pickup, etc.);
- Portable pumps;
- Portable generator;
- Portable air compressor;
- Temporary light fixtures;
- Roll off containers;
- Tankers;
- Fuel storage tank;
- CQA/testing equipment; and
- Health and safety equipment.

7.3 Stationary Operating Equipment and Tools

Stationary operating equipment will include the equipment installed at the North CAMU during construction, such as:

- Leachate pumps and controls;
- Electrical equipment;
- Contact storm water storage and treatment tanks (if needed);
- Emergency power generating equipment;
- Piping; and
- Water hoses.

7.4 Equipment Maintenance Requirements

Maintenance is necessary to keep equipment in a condition that assures continuous proper operation of the assigned functions. Maintenance can be divided into three basic categories:

- Preventive Maintenance – routine work that can be accomplished with minimal or no downtime of equipment. These tasks include routine inspections, lubrication and adjustments.
- Corrective Maintenance – the non-routine repair work that may require some equipment downtime. These tasks include changing belts and replacing work bearings and brushes, etc.
- Major Overhauls – large jobs that usually require extensive downtime. These tasks can involve considerable expenditures of money and may require additional labor.

The heavy equipment maintenance program can be divided into two major categories:

- Equipment maintenance and repair to be performed by the heavy equipment suppliers; and
- Maintenance activities to be performed by North CAMU operator and/or maintenance personnel.

Maintenance must also be performed on the support and stationary equipment. The frequency and extent of maintenance will be as recommended by the manufacturer.

Each piece of mechanical equipment on the Site, from personal exposure meters to heavy equipment, will be inspected routinely. All emergency equipment will be regularly inspected to assure that it is present, functional and decontaminated. Whenever a problem is discovered with equipment necessary for safe North CAMU operations, operations will be curtailed until a satisfactory repair or replacement can be put in place.

8.0 PERSONNEL AND TRAINING

The Site personnel will include, at a minimum, a Site manager and/or supervisor (Exide representative or designated Contractor Construction Manager), equipment operators, and laborers.

8.1 Personnel

8.1.1 Site Manager

The Site manager (SM) will be responsible for all activities at the FOP and will be the designated contact person for regulatory compliance matters. The SM or his designated alternate will provide on-Site management of the facility operations and will be responsible for day to day operations with applicable regulatory requirements and this O&M Plan. The SM or designated alternate will provide adequate staffing to operate the facility in accordance with applicable regulatory requirements and this O&M Plan. The SM or his designated alternate will be responsible for inspection and/or maintenance of all equipment and operating systems required for the North CAMU operations and closure activities.

The SM or designated alternate must be an experienced personnel manager, who is familiar with and has the aptitude to implement operational aspects of waste disposal operations including knowledge of relevant regulations and permit requirements, and safe management practices.

Direct operation and maintenance activities, as described throughout this report, are the responsibility of the SM. The major responsibilities of the SM during operation of the North CAMU include the following:

- Operate and coordinate all disposal of waste into the North CAMU;
- Ensure that all applicable health and safety protocols are followed in accordance with the approved plan;
- Ensure that all personnel are properly trained for North CAMU operations;
- Maintain records of methods of placement within the North CAMU;
- Ensure waste is placed in accordance with procedures described in this O&M Plan;
- Divert storm water away from waste material within the North CAMU to the extent practical, and appropriately manage contact stormwater;
- Maintain records of applicable inspections outlined in this O&M Plan;
- Perform any corrective measures required as a result of these inspections;
- Perform routine maintenance on equipment;
- Attain all required record survey information;
- Control potential traffic congestion at the North CAMU; and
- Maintain Site dust and erosion control throughout the duration of North CAMU operations.

8.1.2 Equipment Operators

Equipment operators will operate vehicles and heavy equipment associated with North CAMU operations and closure in a safe manner to achieve functions necessary for operation and closure of the FOP. Duties may include spreading waste and final cover materials, maintaining access roads, establishing and maintaining stormwater drainage, and placement of soils.

8.1.3 Laborers

Site laborers will have responsibilities as directed by the SM or the designated alternate. These duties may include dust control, inspection and maintenance of gates, perimeter fencing, and other duties as necessary.

8.2 Personnel Training

The SM will be responsible for training operators and laborers on the requirements of this North CAMU O&M Plan, the Contingency Plan, and other items as needed. Documentation of on-Site training will be maintained.

Personnel are trained on

- Procedures for using, inspecting, repairing, and replacing facility emergency and monitoring equipment,
- Key parameters for waste feed (i.e., waste hauling vehicles) cut-off systems,
- Communications or alarm systems,
- Response to fires or explosions,
- Response to groundwater contamination incidents, and
- Shutdown of operations procedures.

Personnel are fully trained on all relevant O&M and safety procedures within six months after the date of their employment or appointment to a new position. Personnel who have not yet been fully trained do not work in unsupervised positions until they have received all necessary training. Exide maintains records at the facility which include each employee’s name, job description, the amount of both introductory and continuing training necessary for the position, and the current status of the employee’s training.

The training program covering the North CAMU’s O&M and safety procedures is reviewed annually. All North CAMU personnel are required to participate in the review. Documentation of on-site training will be maintained at the Site.

8.3 Worker Safety Programs

Operations at the North CAMU will comply with the health and safety procedures established by the contractor’s Site-specific Health and Safety Plan. Each contractor will be responsible for developing a

Site-specific health and safety plan in accordance with Exide internal requirements as well as applicable regulatory requirements. Exide will use appropriately trained personnel to operate and maintain the North CAMU. Each contractor will be responsible for providing required health and safety training to their personnel and providing appropriate documentation to Exide. All contractors working at the Site will also attend a health and safety orientation provided by an Exide representative prior to beginning work at the Site.

APPENDIX A
INSPECTION AND MAINTENANCE FORMS

INSPECTION FORM
EXIDE FRISCO NORTH CAMU

Date:_________ Type of Inspection (Storm, Monthly, Quarterly or Semi-Annual):______________________

Inspector(s):____

Signature(s):____

Instructions: For any items that require maintenance, submit this form and notify the Exide representative of any recommended actions. Schedule remedial actions complete the **REPAIR REPORT FORM** when complete.

Facility Component	Inspection Item	Inspection Frequency				Condition		Notes or Recommended Repairs
		Storm	Monthly	Quarterly	Semi-Annually	Acceptable	Maintenance Needed	
General Conditions	Exterior Berm Slopes and Surface Water Control Systems including Ditches and Culverts							
	Access Road on Berm							
	Signs, Security Fence and Gates							
	Benchmarks							
Final Cover	Surface erosion, rills, gullies, and crevasses; minor cover settling or subsidence							

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Facility Component	Inspection Item	Inspection Frequency				Condition		Notes or Recommended Repairs
		Storm	Monthly	Quarterly	Semi-Annually	Acceptable	Maintenance Needed	
	Major Cover Settlement							
	Water on landfill surface							
	Sparse or Eroded Vegetation							
	Invasive Vegetation							
	Cover Disturbance by Burrowing Animals							
	Grass							
Surface Water Management	Ditches							
	Erosion and Sediment Control Devices							
	Culverts and Conveyance Pipes							
	Grass							
	Surface Water Drainage							
Leachate Collection Conveyance	Pumps and Pump House							

Facility Component	Inspection Item	Inspection Frequency				Condition		Notes or Recommended Repairs
		Storm	Monthly	Quarterly	Semi-Annually	Acceptable	Maintenance Needed	
System	Collection Sumps							
	Exposed Piping, Conduit, and Appurtenances							
	Riser Cracked							
	Alarm system and auto-dialer system							
Groundwater Monitoring System	Protective Casing							
	Locks							
	Ground Surface Seal							
	Accumulation of Surface Water							
	Concrete Pad and Bollards							

REPAIR REPORT FORM
EXIDE TECHNOLOGIES FRISCO RECYCLING CENTER

Inspector(s):____

Signature(s):____

Instructions: Note the problem(s) identified during the inspection, date the problem(s) was identified, actions performed to address the problem(s), date the problem(s) was addressed, and date the problem(s) was fully addressed.

Deficiency	Date Identified	Action Taken	Date Addressed	Date Completed

Golder Associates

Established in 1960, Golder Associates is a global, employee-owned organization that helps clients find sustainable solutions to the challenges of finite resources, energy and water supply and management, waste management, urbanization, and climate change. We provide a wide range of independent consulting, design, and construction services in our specialist areas of earth, environment, and energy. By building strong relationships and meeting the needs of clients, our people have created one of the most trusted professional services organizations in the world.

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Golder Associates

Engineering Earth's Development, Preserving Earth's Integrity

APPENDIX E

NORTH CAMU QUALITY ASSURANCE / QUALITY CONTROL PLAN

NORTH CAMU QA/QC PLAN

NORTH CORRECTIVE ACTION MANAGEMENT UNIT

QUALITY ASSURANCE / QUALITY CONTROL PLAN

Exide Technologies Frisco Recycling Center
7471 Old Fifth Street, Frisco, Texas 75034

Submitted To: Exide Technologies
7471 Old Fifth Street
Frisco, TX 75034

Submitted By: Golder Associates Inc.
14950 Heathrow Forest Parkway, Suite 280
Houston, TX 77032

STATE OF TEXAS
5/23/19
JEFFREY B. FASSETT
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LICENSED
PROFESSIONAL ENGINEER

GOLDER ASSOCIATES INC.
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Registration Number F-2578

May 2019 **Project No. 130208606**

Golder Associates

Table of Contents

1.0 INTRODUCTION AND PURPOSE 1
1.1 Introduction 1
1.2 Purpose 1
2.0 GEOSYNTHETIC CLAY LINER EVALUATION 2
2.1 Pre-Installation Material Evaluation 2
2.1.1 Manufacturer's Quality Control Certificates 2
2.2 Installation Procedures 4
2.2.1 GCL Subgrade Preparation 4
2.2.2 Anchor Trench Construction 4
2.2.3 GCL Deployment 4
2.2.4 GCL Repairs 5
2.2.5 GCL Protection 5
3.0 GEOMEMBRANE EVALUATION 6
3.1 Pre-Installation Material Evaluation 6
3.1.1 Manufacturer's Quality Control Certificates 6
3.2 Installation Procedures 9
3.2.1 GCL Preparation for Geomembrane Installation 9
3.2.2 Geomembrane Deployment 9
3.3 Installation Monitoring and Testing 10
3.3.1 Trial Seam 10
3.3.2 Non-Destructive Testing 11
3.3.3 Destructive Seam Testing 12
3.3.4 Seam Failure Delineation 13
3.3.5 Seam Failure Repairs and Retesting 13
4.0 GEOTEXTILE LAYER 15
5.0 SOIL COVER LAYER EVALUATION 16
6.0 QA/QC FOR AIR MONITORING 17
7.0 QA/QC FOR WASTE SAMPLING AND ANALYSIS 18
8.0 GROUNDWATER MONITORING 19
9.0 OTHER QA/QC PROCEDURES 20

STATE OF TEXAS
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List of Tables

Table 1 GCL QC Submittal Frequency & Material Specifications
Table 2 HDPE Resin QC Test Frequency and Specifications
Table 3 HDPE Geomembrane (Smooth) Material Specifications
Table 4 Geomembrane Conformance Test Schedule
Table 5 Seam Strength 40-mil HDPE Geomembrane
Table 6 Geotextile QC Submittal Frequency & Material Specifications

List of Figures

Figure 1 Fusion Weld Seam Break Classifications
Figure 2 Extrusion Weld Seam Break Classifications

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1.0 INTRODUCTION AND PURPOSE

1.1 Introduction

Golder Associates Inc. (Golder) has prepared this Quality Assurance/Quality Control (QA/QC) Plan for the North Corrective Action Management Unit (North CAMU) at the Former Operating Plant (FOP) at the Exide Technologies (Exide) Frisco Recycling Center (FRC) in Frisco, Collin County, Texas (Site). The North CAMU will be used for the disposal of Class 2 wastes generated during the ongoing demolition and remediation activities at the FRC, including metals-impacted soils from the Undeveloped Buffer Property (J-Parcel) surrounding the Site, and then will be capped.

1.2 Purpose

This QA/QC Plan has been prepared in order to document the quality assurance and quality control procedures that will be followed during operation and closure of the North CAMU. This QA/QC Plan includes a description of the following or references to locations where information is included in other documents:

- Geosynthetic Clay Liner (GCL) Evaluation
- Geomembrane Evaluation
- Soil Cover Layer Evaluation
- QA/QC for Air Monitoring and Dust Suppression
- QA/QC for Waste Sampling and Analysis
- QA/QC for Groundwater Sampling
- Other QA/QC Procedures

Exide shall be responsible for contracting a qualified QA/QC Professional prior to the time when cell final cover construction operations are initiated. Each phase of the final cover construction shall be conducted under the supervision of the QA/QC Professional. The QA/QC Professional shall be an independent third-party professional engineer (PE) licensed in the State of Texas with experience in civil or geotechnical engineering and soils testing. A qualified construction quality assurance (CQA) monitor performing daily QA/QC observation and testing shall be under the direct supervision of the QA/QC Professional. The QA/QC Professional or his/her qualified representative(s) shall provide fulltime monitoring.

2.0 GEOSYNTHETIC CLAY LINER EVALUATION

This section presents quality assurance and quality control testing requirements, and installation procedures for the geosynthetic clay liner (GCL) construction. The GCL shall consist of sodium bentonite encapsulated between two geotextile layers, needle-punched or stitched-bonded together.

2.1 Pre-Installation Material Evaluation

2.1.1 Manufacturer's Quality Control Certificates

Prior to the installation of the GCL, the manufacturer or installer shall provide the QA/QC Professional with quality control certificates signed by a responsible party employed by the manufacturer. Each quality control certificate shall include roll identification numbers, testing procedures, and results of quality control tests. The quality control tests shall be performed in accordance with project-specific testing methods and subject to the minimum testing frequency shown in Table 1. Exide Technologies (Exide) may require more frequent testing at its discretion.

The quality control testing may be performed in the manufacturing plant. The QA/QC Professional shall review the test results prior to acceptance of the GCL to ensure that the certified minimum properties meet the values presented in Table 1.

In addition to the manufacturer's quality control certificates, samples of rolls of GCL will be obtained for conformance testing. The samples shall be tested by an independent third-party laboratory in accordance with Table 1(B). The QA/QC Professional shall review the test results to ensure that they meet the values presented in Table 1(A).

In order to prevent premature hydration, the GCL rolls shall be shipped in plastic wrapping that shall remain intact until material installation. Upon delivery of the GCL, storage and handling procedures shall be documented. The rolls will be stacked, stored and handled in accordance with ASTM D5888.

TABLE 1 – GCL Pre-Installation Testing

(A) QC Submittal Frequency & Material Specifications

Bentonite					
Property	**Qualifier**	**Unit**	**Value**	**Test Method(1)**	**Frequency**
Fluid Loss	max.	ml	18	ASTM D5891	1 per 50 tons or every truck or railcar
Free Swell	min.	ml	24	ASTM D5890	
Geotextile					
Property	**Qualifier**	**Unit**	**Value**	**Test Method(1)**	**Frequency**
Mass per Unit Area	min.	oz/yd^2	5.9 (nonwoven) 3.0 (woven)	ASTM D5261	1 per 200,000 ft^2
Tensile Properties:	--	lb	--	ASTM D4632	
GCL Product					
Property	**Qualifier**	**Unit**	**Value**	**Test Method(1)**	**Frequency**
Bentonite Mass	min.	lb/ft^2	0.8	ASTM D5993	1 per 40,000 ft^2
Bentonite Moisture Content	--	%	--	ASTM D5993	
Grab Tensile Strength	--	lb/in	23	ASTM D6768	1 per 200,000 ft^2
Hydraulic Flux	max.	m^3/m^2-s	1×10^{-8}	ASTM D5887	1 per 250,000 ft^2

Notes:
1. Updated ASTM methods may be implemented based on a review by the QA/QC Professional. Alternate test methods may not be used without first revising the quality assurance plan with TCEQ approval.
2. GCLs that include nonwoven needle-punched geotextiles must be verified to have been continuously inspected for the presence of broken needles using metal detectors and found to be needle-free.
3. For those properties that do not indicate a value, the GCL material must meet the manufacturer's minimum specification

(B) GCL Conformance Test Schedule

TEST	**METHOD(1)**	**FREQUENCY**
Bentonite Mass/Unit Area	ASTM D5993	Not less than 1 test per 100,000 ft^2
Hydraulic Flux	ASTM D5887	

Notes:
1. Updated methods may be implemented based on a review by the QA/QC Professional.

2.2 Installation Procedures

2.2.1 GCL Subgrade Preparation

The final surface of waste will be covered with a minimum 12-inch thick working surface layer placed and graded according to the design plans. The surface will be drum rolled to a smooth condition and surveyed at 100-foot intervals to establish the elevations of the surface prior to placement of the GCL. The working surface soil material will be obtained from an on- or off-site source, delivered using haul trucks, and spread with a dozer to prepare a smooth surface for the GCL. The working surface soil layer may be composed of waste soil provided it meets the requirements listed below.

- The upper 4 inches of the working surface layer must be compacted, smooth, and free of all rocks greater than 0.75-inch diameter, sharp/angular objects, sticks, roots, or debris of any kind. The surface should provide a firm, unyielding foundation for the GCL with no sudden, sharp or abrupt changes or break in grade. Loose rocks and/or dry soil particles that could damage the GCL shall be removed. Excessive voids or dimples shall be filled with soil.
- The lower 8 inches must be compacted and free of rocks greater than 1.5-inch diameter.

Standing water or excessive moisture on the subgrade will not be allowed. The subgrade shall be maintained in a smooth, uniform, and drained condition.

2.2.2 Anchor Trench Construction

The anchor trench shall be constructed according to Figure 2 of the Final Cover System Drawings provided in Appendix C of the Closure Plan, and the excavation and backfilling operations shall be documented. The inside edge of the trench shall be rounded so as to avoid stresses from sharp bends in the GCL. The GCL will not be placed into the anchor trench on top of any rocks greater than 0.75-inch diameter, sharp/angular objects, sticks, roots, or debris of any kind. The anchor trench shall be adequately drained to prevent ponding or hydration of the GCL while the trench is open. The anchor trench shall be backfilled and compacted, with compaction equipment as deemed suitable by the QA/QC representative.

2.2.3 GCL Deployment

Equipment used to deploy GCL must not cause excessive rutting of the subgrade. Deployed GCL panels should contain no folds or excessive slack. Installation personnel must not smoke or wear damaging shoes on GCL; and GCL should not be placed during excessive winds. Vehicle traffic other than low contact pressure vehicles such as smooth-tired ATVs or golf carts must not be allowed on the deployed GCL. Generators, gasoline or solvent cans, tools, or supplies must not be stored directly on the GCL.

Panels shall be overlapped and seamed as recommended by the manufacturer. End-to-end seams on sideslopes shall be kept to a minimum. If end-to-end seams are necessary (i.e., if the GCL roll lengths are insufficient to cover the entire slope length), a minimum overlap of 3 feet will be required.

Alternatively, seams may be glued as recommended by the manufacturer. In addition, end-to-end seams may be placed only in the lower half of the slope and must be staggered.

To limit the potential for pre-mature hydration, the GCL deployment shall be limited to the amount that can be covered with the overlying geomembrane liner the same day. GCL deployment shall not be undertaken during precipitation or when there is an impending threat of precipitation.

Following deployment, the CQA monitor shall visually examine the entire surface of the GCL for even bentonite distribution, thin spots, or other panel defects. All defects will be recorded and repaired. The QA/QC representative shall also verify and document the following:

- Proper overlap during deployment
- Seams between GCL panels are constructed per manufacturer's recommendations
- Defects are patched and overlapped properly
- The bentonite has not become excessively hydrated

Excessively hydrated GCL shall be removed and replaced with new GCL in accordance with the specifications.

2.2.4 GCL Repairs

Torn or otherwise damaged geosynthetic facing must be patched with the same type of geosynthetic. The geosynthetic patch must extend at least 12 inches beyond the damaged area and must be adhesive or heat bonded or otherwise attached to the main GCL to avoid shifting during backfilling or placement of overlying geosynthetics. If the GCL damage includes loss of bentonite, the patch must consist of full GCL extending at least 12 inches beyond the damaged area. Lapping procedures must be the same as specified for original laps of GCL panels.

2.2.5 GCL Protection

The overlying geosynthetics and soil layers shall be deployed in such a manner as to ensure that the GCL is not damaged. To avoid local bentonite displacement, and the possible impact on the hydraulic performance of a GCL, the soil cover layer shall be placed over a GCL as soon as practicable following installation of the geomembrane and geotextile.

3.0 GEOMEMBRANE EVALUATION

This section presents QA and QC testing requirements and construction specifications for geomembrane installation. The composite final cover liner system will generally include the following components above GCL cover, from bottom to top:

- 40-mil high density polyethylene (HDPE) geomembrane;
- 8-oz/sy nonwoven geotextile;
- 18-inch thick layer of general clean fill; and
- 18-inch thick layer of vegetative soil layer. The upper six inches is an erosion control layer and must be capable of sustaining native plant growth.

3.1 Pre-Installation Material Evaluation

3.1.1 Manufacturer's Quality Control Certificates

Prior to installation of any geomembrane, the manufacturer or installer shall provide the QA/QC Professional with quality control certificates signed by the responsible party employed by the manufacturer. Each quality control certificate shall include roll identification numbers, testing procedures, and results of quality control tests. The quality control tests shall be performed in the manufacturing plant using the test methods and frequencies listed in the most recent version of the Geosynthetic Research Institute (GRI) test method GM13.

The HDPE resin supplier shall provide the QA/QC Professional with quality control certificates signed by a responsible party employed by the supplier using the test methods and frequency listed in Table 2.

Table 2 - HDPE Resin QC Test Frequency and Specifications

Test	Method	Frequency	Required Value
Density	ASTM D1505 or D792	Per manufacturer's specifications	≤ 0.932
Melt Index	ASTM D1238 (190/2.16)		< 1.0 g/10 min.

The QA/QC Professional shall review the test results prior to acceptance of the geosynthetics to assure that the certified minimum properties of the resin meet specified values listed in Table 2, and that the geomembrane meets the specified values as determined by the most recent GRI test method GM13 as shown on Table 3.

The geomembrane must be manufactured from virgin raw materials. Reground, reworked, or trim materials from the same lot may be acceptable but recycled or reclaimed materials must not be used in the manufacturing process. HDPE material and required welding rods must contain between two and three percent carbon black. All sheets must be free from pinholes, surface blemishes, scratches, or other defects (e.g., non-uniform color, streaking, roughness, agglomerates of carbon black or other undesirable additives or fillers, visibly discernable regrind or rework, etc.).

The rolls delivered to the site shall be inspected and inventoried, recording the manufacturer's name and product identification, and the roll thickness, number and dimensions. Manufacturer's certificates should be cross-referenced to rolls delivered to the site.

Table 3 - HDPE Geomembrane (Smooth) Material Specifications

Properties	**Test Method**	**Test Value**	**Minimum Testing Frequency**
Thickness (min. ave.)	D 5199	40 mils	per roll
lowest individual for any of the 10 values		36 mils	
Density g/cc (max.)	D 1505/D 792	0.940	200,000 lb
Tensile Properties (1) (min. ave.) • yield strength – lb/in • yield elongation - % • break strength – lb/in • break elongation - %	D 6693 Type IV	 84 12 152 700	20,000 lb
Tear Resistance – lb (min. ave.)	D 1004	28	45,000 lb
Puncture Resistance – lb (min. ave.)	D 4833	72	45,000 lb
Stress Crack Resistance (2)	D 5397 (App.)	500 hr.	Per GRI GM10
Carbon Black Content - %	D 4218 (3)	2.0 - 3.0	20,000 lb
Carbon Black Dispersion	D 5596	(4)	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) (5) (a) Standard OIT - or- (b) High Pressure OIT	D 3895 D 5885	100 min. 400 min	200,000 lb
Oven Aging at 85°C (6) (a) Standard OIT (min. ave.) - % retained after 90 days - or – (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 3895 D 5885	 55 80	Per formulation
UV Resistance (7) (a) Standard OIT (min. ave.) - or – (b) High Pressure OIT (min. ave)-% retained after 1600 hr (9)	D 3895 D 5885	N.R. (8) 35	Per formulation

Notes:

1. Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
   - Yield elongation is calculated using a gage length of 1.3 in.
   - Break elongation is calculated using a gage length of 2.0 in.
2. The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing
3. Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (tube furnace) can be established.
4. Carbon black dispersion (only near spherical agglomerates) for 10 different views:
   - 9 in Categories 1 or 2 and 1 in Category 3
5. The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
6. It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 days response.
7. The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
8. Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
9. UV resistance is based on percent retained value regardless of the original HP-OIT value.

Resumes of the installer's supervisor(s) or Master Seamer(s) shall be obtained to verify that adequate seaming experience will be utilized on the project. The installer's supervisor or Master Seamer should have had experience totaling a minimum of 2,000,000 square feet of geomembrane installation.

Upon delivery of geosynthetic material, storage and handling procedures shall also be documented. Rolls of geosynthetic materials shall be handled and stored in such a way as not to damage the material. As a general rule, rolls of geosynthetic materials should not be stacked more than four rolls high.

In addition to the manufacturer's quality control certificates, samples of the geomembrane will be obtained for conformance testing. Either at the manufacturing facility or upon delivery of the rolls of geomembrane, the test samples shall be obtained for conformance testing at an independent third party laboratory in accordance with the testing schedule shown in Table 4.

Table 4. Geomembrane Conformance Test Schedule

Test	Method(1)	Minimum Frequency
Thickness (laboratory)	ASTM D5199, (2)	1 per 100,000 ft^2 (not less than 1 per resin lot)
Density	ASTM D1505 or D792	Minimum 1 per 100,000 ft^2 (not less than one per resin lot)
Carbon black content	ASTM D4218	
Carbon black dispersion	ASTM D5596	
Tensile properties (3)	ASTM D6693	

Notes:

1. Test values must meet the values as determined by the most recent GRI test method GM13.
2. No single measurement shall be less than ten percent below the required nominal thickness in order for the panel to be acceptable. A minimum of 5 measurements shall be made per panel.
3. 2-inch initial gauge length assumed for elongation at break.

3.2 Installation Procedures

3.2.1 GCL Preparation for Geomembrane Installation

Preparation of the soil underlying the GCL will be as discussed in Section 2. A final inspection of the GCL surface will be conducted prior to deployment of the geomembrane to insure all defects have been properly repaired, no folds are present, and no tools, debris, etc. have been left on the GCL surface.

3.2.2 Geomembrane Deployment

The geomembrane shall be installed in direct and uniform contact with the GCL. Wrinkles shall be walked-out or removed as much as possible prior to field seaming. The geomembrane shall not be placed during inclement weather such as high winds or rain. Seaming should generally not take place when ambient temperatures are below 32 degrees Fahrenheit (°F), unless preheating is used. For fusion welding, preheating may be waived if the installer demonstrates that quality welds may be obtained without preheating. Seaming shall not be permitted at ambient temperatures above 104°F, unless the installer can demonstrate that seam quality is not compromised.

The geomembrane shall be installed over the GCL the same day that the GCL is deployed to prevent damage to the GCL, as described in Section 2.

No vehicular traffic shall be allowed on the geomembrane prior to the placement of the soil cover layer. Only low-ground pressure supporting equipment (e.g., golf carts, ATVs or other small rubber tired equipment with a ground pressure less than 5 pounds per square inch and a total weight less than 750 pounds) may be allowed to traverse the surface of the geomembrane. Personnel working on the geomembrane shall not smoke, wear damaging shoes, or engage in any other activity likely to damage the geomembrane. Only those sections that are to be placed and seamed in one day should be unrolled. Panels left unseamed shall be anchored with sandbags or other suitable weights. In general, seams shall be oriented parallel to the line of maximum slope, i.e., oriented up and down, not across the slope. In corners and odd-shaped geometric locations, the number of field seams should be minimized.

Panels shall be overlapped as recommended by the manufacturer as appropriate for the type of seam welding to be performed; however, overlapping shall be no less than 2 inches. Field seaming shall be performed by the method or methods approved by the manufacturer only, either by extrusion welding or double-tracked fusion welding. All foreign matter (dirt, water, oil, etc.) should be removed from the area to be seamed. No seaming shall take place without the installer’s supervisor or Master Seamer and QA/QC representative being present. Fishmouths or large wrinkles at the seam overlap shall be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut shall be seamed and/or patched. Seams made to correct fishmouths or large wrinkles shall extend to the outside edge of panels placed in the anchor trench.

Panel layout and field seams shall be given an identification code, mapped, and logged to record relevant installation information. Inspection and testing records shall be logged as well as repair and retest data. Section 5.0 includes a thorough listing of items to be documented during geomembrane construction and testing.

3.3 Installation Monitoring and Testing

Field seaming will be performed in strict accordance with methods approved by the manufacturer. This is usually fusion welding or extrusion welding for high density polyethylene (HDPE). Tack welds (if used) with HDPE geomembrane will use heat only. No double-sided tape, glue, or other method will be permitted when extrusion or fusion welding is used for bonding.

3.3.1 Trial Seam

Each day prior to commencing field seaming, trial seams shall be made on pieces of geomembrane material to verify that conditions are adequate for production seaming. Trial seams shall be made at the beginning of each seaming period and shift (generally, at least twice each day) for each combination of production seaming machine and operator to be used that day. The trial test seam shall be at least 3 feet long by 1 foot wide (after seaming) with the seam centered lengthwise. Four (6 when possible using dual track fusion welding) 1-inch wide specimens shall be die-cut from the trial seam sample. Two specimens shall be tested in the field for shear and 2 for peel (4 when possible if testing both inner and outer welds for dual track fusion welding) and shall be compared to the minimum seam strength requirements specified in Table 5 and discussed below.

If any of the trial seam specimens fail, the entire trial seam operation shall be repeated. If an additional specimen fails from the second trial seam, the seaming machine and seamer shall not be used for seaming until the deficiencies are corrected and two consecutive successful trial seams are achieved. Additional trial seams shall be performed if frequent field seaming problems are experienced or if power to the seaming machines is interrupted sufficiently long to require rewarming.

Weld Acceptance Criteria: For HDPE seams, the strength of four out of five 1.0-inch wide strip specimens in shear should meet or exceed the values given in Table 5. The fifth must meet or exceed 80% of the given values.

The shear percent elongation shall be calculated as described in GRI Test Method GM19.

The strength of 4 out of 5 of the 1.0-in. wide strip specimens tested in peel should meet or exceed the values given in Table 5. The fifth must meet or exceed 80% of the given values.

In addition, the peel separation (or incursion) should not exceed the values given in Table 5. The value shall be calculated as described in GRI Test Method GM19.

Regarding the locus-of-break patterns of the different seaming methods in shear and peel, the following are unacceptable break codes per their description in ASTM D6392 (SIP is an acceptable break code);

- Hot Wedge:
  - AD and AD-Brk > 25%
- Extrusion Fillet:
  - AD1, AD2
  - AD-WLD (unless strength is achieved).
- The break codes are illustrated on Figures 1 and 2.

Table 5. Seam Strength 40-mil HDPE Geomembrane

Property	Unit	Specified Value	Test Method
Hot Wedge Seams			ASTM D6392
shear strength(1)	lb/in.	80	
shear elongation at break(2)	%	50	
peel strength(1)	lb/in.	60	
peel separation	%	25	
Extrusion Fillet Seams			ASTM D6392
shear strength(1)	lb/in.	80	
shear elongation at break(2)	%	50	
peel strength(1)	lb/in.	52	
peel separation	%	25	

Notes:
1. Value listed for shear and peel strengths are for 4 out of 5 test specimens; the 5th specimen can be as low as 80% of the listed values.
2. Elongation measurements should be omitted for field testing.

3.3.2 Non-Destructive Testing

Continuous, non-destructive testing shall be performed on all seams by the installer. Air pressure testing on dual-track fusion welds and vacuum-box testing for extrusion welds are the only acceptable methods for HDPE geomembrane seams. All leaks must be isolated and repaired by following the procedures described in this QA/QC Plan.

Air-Pressure Testing- The ends of the air channel of the dual-track fusion weld must be sealed and pressured to approximately 30 psi, if possible. The air pump must then be shut off and the air pressure observed after 5 minutes. A loss of less than 4 psi is acceptable if it is determined that the air channel is not blocked between the sealed ends. A loss of 4 psi or more indicates the presence of a seam leak that must then be isolated and repaired by following the procedures described in this QA/QC Plan. Test results, initial and final pressure readings, and start and stop times will be recorded for all pressure tests. The QA/QC Professional or his/her qualified representatives must observe and record all pressure gauge readings.

Vacuum-Box Testing- A suction value of approximately 3 to 5 inches of gauge vacuum must be applied to all extrusion welded seams that can be tested in this manner. Examples of extrusion welded seams that do not easily lend themselves to vacuum testing would be around boots, some sump areas, appurtenances, etc. The seam must be observed for leaks at least 10 seconds while subjected to this vacuum. The QA/QC Professional or his/her qualified representative must observe and document 100 percent of this testing.

Other Testing- Other non-destructive testing must have prior written approval from the Engineer.

3.3.3 Destructive Seam Testing

Destructive samples shall be taken at a minimum frequency of one test location, selected randomly, within each 500 linear feet of seam length, inclusive of both primary longitudinal and cross seams, cap strips and repairs or 20 ft^2 or larger. Each test sample should be about 44 to 56 inches long and 12 inches wide with the seam located in the middle. Test specimens, approximately 1 inch wide, shall be cut from both ends of the sample for field testing (peel and shear). The remaining sample should be cut into three parts (one for quality assurance laboratory testing, one for installer quality control laboratory testing, and one for archive storage to be maintained at a location selected by the owner).

The field tests shall be conducted on a certified calibrated tensiometer capable of maintaining a constant extension rate of 2 inches per minute. If one of the field test specimens from the ends of the destructive sample fail, then the seam will be considered to have failed, and repairs shall be initiated as described below. If both specimens pass, then a sample for laboratory testing will be sent to the quality assurance laboratory for testing in both peel and shear. Seam strengths for HDPE geomembranes shall meet the minimum values specified in Table 5 and as discussed above for weld acceptance criteria.

Destructive test results for both field and laboratory tests shall include qualitative data including the location of the failure and locus-of-break code as described on Figures 1 and 2. Peel tests on double-tracked fusion welds shall be performed on both inside and outside tracks of the weld.

At a minimum, a destructive test must be done for each welding machine used for seaming or repairs. A sufficient amount of the seam must be removed in order to conduct field testing, independent laboratory testing, and archiving of enough material in order to retest the seam when necessary. Field testing shall include at least two peel test specimens (four when testing both tracks on dual-track fusion welded seams) and at least two shear specimens. Destructive seam-testing locations shall be cap-stripped and the cap completely seamed by extrusion welding to the geomembrane. Capped sections shall be non-destructively tested. Additional destructive test samples may be taken if deemed necessary by the QA/QC professional or his\her qualified representative.

3.3.4 Seam Failure Delineation

When a sample fails a destructive test, the installer shall follow the welding path to an intermediate location at least 10 feet in each direction, or a distance determined by the QA/QC Professional, from the point of the failed test in each direction and take 1-inch wide specimens for an additional set of field tests. If these additional samples pass the tests, then two laboratory destructive samples shall be taken adjacent to the intermediate locations or at locations determined by the QA/QC Professional or his/her representative. If these laboratory samples pass the tests, then the seam shall be repaired between these locations. If either sample fails, then the process shall be repeated to establish the zone where the seam should be repaired. All acceptable repaired seams shall be bounded by two locations from which samples passing laboratory destructive tests have been taken.

3.3.5 Seam Failure Repairs and Retesting

Any portion of the geomembrane exhibiting a flaw or failing a destructive or nondestructive test shall be repaired. Repair methods may include spot welding (extrusion) for minor flaws and punctures; patches for larger holes and tears; capping for large lengths of failed seams or panel damage; and extrusion welding of the outer flap for repair on an inadequate fusion seam (less than 100-ft cumulative length) which has an exposed edge. All seam leaks and destructive test locations shall be repaired for a distance of at least six inches on each side of the faulty spot or area detected. At a minimum, those repairs shall be non-destructively retested and possibly destructively tested (refer to destructive testing criteria for repaired seams as described above in Destructive Seam Testing).

For any repair method, the following provisions shall be satisfied:

- Surfaces of the geomembrane which are to be repaired using extrusion methods shall be ground no more than one hour prior to the repair;
- All surface shall be clean and dry at the time of repair;
- Patches or caps shall extend at least six inches beyond the edge of the defect, and all corners of patches shall be rounded with a radius of approximately three inches or more;
- All repairs shall be nondestructively tested as previously described; and
- All seaming equipment, personnel, and operation procedures used in repair work shall meet the same requirements as for new seaming operations.

The QA/QC Professional or his/her qualified representative shall observe and document all destructive and nondestructive testing of repairs and shall record the number of each repair, type, date and test outcome. Repairs that pass the nondestructive tests shall be taken as an indication of an adequate repair. Repairs more than 150 ft long shall also be required to have a destructive test performed.

Repairs that fail the initial retest shall be redone and retested until a passing test results. All work and testing of repairs shall be fully documented in a repair log.

When placing overlying material on the geomembrane, every effort must be made to minimize wrinkle development. If possible, cover should be placed during the coolest weather available. Small wrinkles should be isolated and covered as quickly as possible to prevent their growth. In no case shall the geomembrane be allowed to fold over on itself.

4.0 GEOTEXTILE LAYER

A nonwoven geotextile layer shall be placed over the 40-mil HDPE geomembrane. The nonwoven geotextile shall be an 8-oz/sy, nonwoven, needle-punched made from staple fiber. The geotextile shall meet the following material properties.

Table 6. Geotextile QC Submittal Frequency & Material Specifications

Property	Test Method	Frequency	Min. Ave. Roll Value
Mass per unit area, oz/yd^2	ASTM D5261	90,000 ft^2	8
Grab Tensile Strength, lb	ASTM D4632	90,000 ft^2	220
Grab Elongation, %	ASTM D4632	90,000 ft^2	50
Trapezoidal Tear, lb	ASTM D4533	90,000 ft^2	90

The geotextile shall be deployed in a manner meeting the restrictions described in Section 3.2.2.

Geotextile panels will be overlapped and seamed as recommended by the manufacturer.

5.0 SOIL COVER LAYER EVALUATION

The soil cover layer will consist of an 18-inch thick layer of general clean fill and an 18-inch thick layer of topsoil.

Soil cover does not require compaction control; however, it should be stable for construction traffic. Care shall be exercised in placement so as not to shift, wrinkle or damage any underlying geosynthetic layers, and the placement methods shall be documented. Soil cover placement shall be monitored by the QA/QC Professional or his representative on a full-time basis.

Light equipment such as low ground pressure dozers (less than 5 pounds per square inch contact pressure) shall be used to place the soil cover and a minimum of 12 inches of material shall be maintained between the dozer and the underlying geosynthetics. If possible, cover should be placed during the coolest weather available. Soil cover material shall be deployed in “fingers” along the geosynthetics to control the amount of slack, and minimize wrinkles and prevent folds.

The final thickness of the soil cover layer shall be a minimum of 36 inches directly above the geomembrane layer. The required thickness of the layer shall be verified by survey techniques on an established grid system with not less than one verification point per 10,000 square feet of surface area. A minimum of two verification points is required.

The soil used as the topsoil layer will be capable of sustaining native plant growth and must be hydroseeded immediately after completion of the final cover (weather permitting). Temporary or permanent erosion control materials (i.e., mulches, containment meshes, geomatting systems, etc.) may be used to minimize erosion and aid establishment of vegetation. An alternative erosion layer may also be constructed (subject of the approval of the Engineer and TCEQ) consisting of cobbles, riprap, or other hard armor systems for areas in which the establishment of vegetation cover has proven difficult.

Other quality assurance for the soil cover layer should consist of continuous observation by the QA/QC Professional or his representative during construction, including verification that the soil is free of deleterious materials; and performing any additional test believed necessary by the QA/QC Professional to verify that the layer has been constructed in accordance with the closure plan.

6.0 QA/QC FOR AIR MONITORING

QA/QC Procedures for Air Monitoring activities conducted during closure activities are included in Section 6.0 of the North CAMU Air Monitoring Plan, included as Appendix H to the Closure Plan.

7.0 QA/QC FOR WASTE SAMPLING AND ANALYSIS

Waste characterization for the Class 2 non-hazardous remediation waste associated with clean-up activities for the J-Parcel will be performed in accordance with the Response Action Soil Sampling and Analysis Plan included in the Undeveloped Buffer Property VCP Investigation Response Action Plan, prepared by Pastor, Behling & Wheeler, LLC (PBW). QA/QC procedures applicable to this sampling program are included in that plan.

Other Class 2 remediation waste may also be disposed of at the Site. These wastes may include soils from surface or subsurface excavation areas, concrete, sediment, or other appropriate wastes. QA/QC procedures related to sampling and analysis for waste are included in the Waste Analysis Plan, which is included as Attachment Q to the August 2018 supplement to the industrial and hazardous waste permit renewal application.

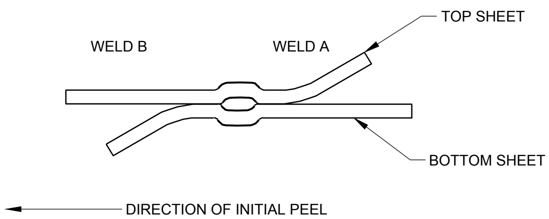
8.0 GROUNDWATER MONITORING

QA/QC procedures for groundwater monitoring are included in various sections, including Section 4.3 of the Final Closure Plan.

9.0 OTHER QA/QC PROCEDURES

In the event that additional sampling related to closure activities is required, the sampling activities will be performed in general accordance with the procedures outlines in the Sampling and Analysis Work Plan dated November 2011 prepared by Conestoga-Rovers & Associates, which includes a Quality Assurance Project Plan.

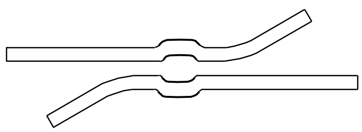
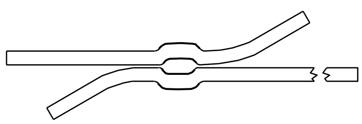
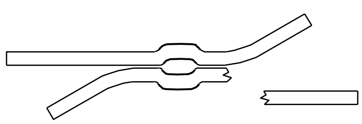
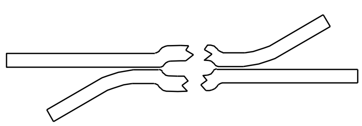
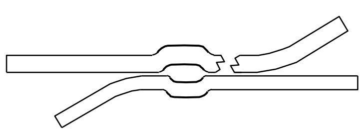
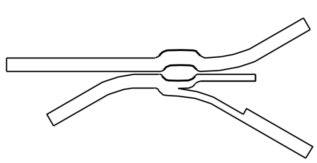
FIGURES



SCHEMATIC OF UNTESTED SPECIMEN

STATE OF TEXAS
JEFFREY B. FASSETT
85675
LICENSED
PROFESSIONAL ENGINEER

GOLDER ASSOCIATES INC.
Professional Engineering Firm
Registration Number F-2578

TYPES OF FAILURE	LOCUS-OF-BREAK CODE	BREAK
	AD	ADHESION FAILURE
	BRK	BREAK IN SHEETING. BREAK CAN BE IN EITHER TOP OR BOTTOM SHEET.
	SE1	BREAK AT OUTER EDGE OF SEAM. BREAK CAN BE IN EITHER TOP OR BOTTOM SHEET.
	SE2	BREAK AT INNER EDGE OF SEAM THROUGH BOTH SHEETS.
	AD-BRK	BREAK IN FIRST SEAM AFTER SOME ADHESION FAILURE BREAK CAN BE IN EITHER THE TOP OF BOTTOM SHEET
	SIP	SEPARATION IN THE PLANE OF THE SHEET. BREAK CAN BE IN EITHER TOP OF BOTTOM SHEET.

CLIENT
EXIDE TECHNOLOGIES

PROJECT
EXIDE TECHNOLOGIES FRISCO RECYCLING CENTER
ON-SITE INDUSTRIAL NORTH CAMU FINAL COVER SYSTEM

CONSULTANT

Golder Associates

YYYY-MM-DD	2015-08-20
PREPARED	TGM
DESIGN	TGM
REVIEW	JBF
APPROVED	MRS

TITLE
FUSION WELD SEAM BREAK CLASSIFICATIONS

PROJECT No.	Rev.	FIGURE
130208602		1

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1 in

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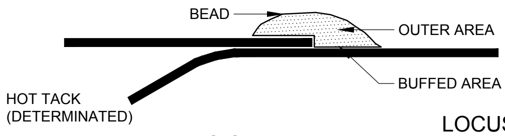
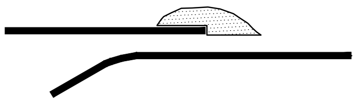
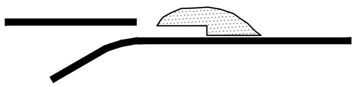
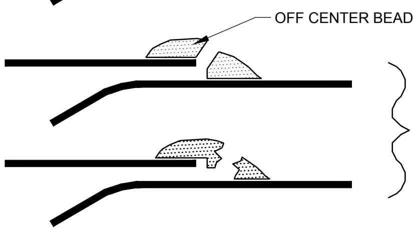
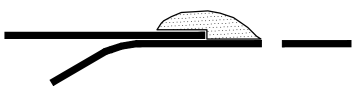
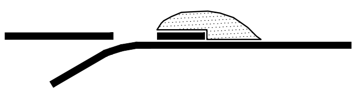
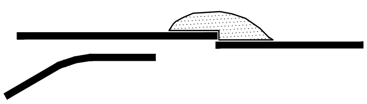
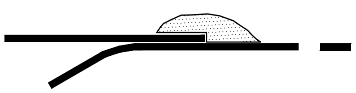
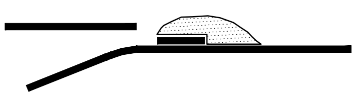
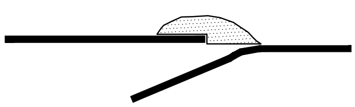
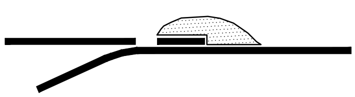
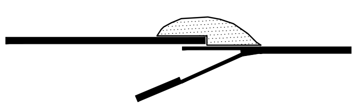


UNTESTED SPECIMEN
EXTRUSION WELD WITH LEISTER HEAT SEAM

STATE OF TEXAS
JEFFREY B. FASSETT
85675
LICENSED
PROFESSIONAL ENGINEER
5/21/19

GOLDER ASSOCIATES INC.
Professional Engineering Firm
Registration Number F-2578

TYPES OF BREAK	LOCUS-OF-BREAK CODE	BREAK DESCRIPTION
	AD1	FAILURE IN ADHESION. SPECIMENS MAY ALSO DELAMINATE UNDER THE BEAD AND BREAK THROUGH THE THIN EXTRUDED MATERIAL IN THE OUTER AREA.
	AD2	FAILURE IN ADHESION
	AD-WLD	BREAKS THOUGH THE FILLET. BREAKS THOUGH THE FILLET RANGE FROM BREAKS STARTING AT THE EDGE OF THE TOP SHEET TO BREAKS THOUGH THE FILLET AFTER SOME ADHESION FAILURE BETWEEN THE FILLET AND THE BOTTOM SHEET.
	SE1	BREAK AT SEAM EDGE IN THE BOTTOM SHEET. SPECIMENS MAY BREAK ANYWHERE FROM THE BEAD/OUTER AREA EDGE TO THE OUTER AREA/BUFF AREA. (APPLICABLE TO SHEAR ONLY).
	SE2	BREAK AT SEAM EDGE IN THE TOP SHEET. SPECIMENS MAY BREAK ANYWHERE FROM THE BEAD/OUTER AREA EDGE TO THE OUTER AREA/BUFF AREA. (APPLICABLE TO SHEAR ONLY).
	SE3	BREAK AT SEAM EDGE IN THE BOTTOM SHEET. (APPLICABLE TO PEEL ONLY).
	BRK1	BREAK IN THE BOTTOM SHEETING. A "B" IN PARENTHESIS FOLLOWING THE CODE MEANS THE SPECIMEN BREAK IN THE BUFFED AREA. (APPLICABLE TO SHEAR ONLY).
	BRK2	BREAK IN THE TOP SHEETING. A "B" IN PARENTHESIS FOLLOWING THE CODE MEANS THE SPECIMEN BREAK IN THE BUFFED AREA. (APPLICABLE TO SHEAR ONLY).
	AD-BRK	BREAK IN THE BOTTOM SHEETING AFTER SOME ADHESION FAILURE BETWEEN THE FILLET AND THE BOTTOM SHEET. (APPLICABLE TO PEEL ONLY).
	HT	BREAK AT THE EDGE OF THE HOT TACK FOR SPECIMENS WHICH COULD NOT BE DELAMINATED IN THE HOT TACK.
	SIP	SEPARATION IN THE PLANE OF THE SHEET.

CLIENT	PROJECT
EXIDE TECHNOLOGIES	EXIDE TECHNOLOGIES FRISCO RECYCLING CENTER ON-SITE INDUSTRIAL NORTH CAMU FINAL COVER SYSTEM

CONSULTANT			TITLE
Golder Associates	YYYY-MM-DD	2015-08-20	**EXTRUSION WELD SEAM BREAK CLASSIFICATIONS**
	PREPARED	TGM	
	DESIGN	TGM	
	REVIEW	JBF	PROJECT No. 130208602 / Rev. / FIGURE 2
	APPROVED	MRS	

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0 1 in

Established in 1960, Golder Associates is a global, employee-owned organization that helps clients find sustainable solutions to the challenges of finite resources, energy and water supply and management, waste management, urbanization, and climate change. We provide a wide range of independent consulting, design, and construction services in our specialist areas of earth, environment, and energy. By building strong relationships and meeting the needs of clients, our people have created one of the most trusted professional services organizations in the world.

Africa	+ 27 11 254 4800
Asia	+ 852 2562 3658
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 56 2 2616 2000

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Golder Associates

Engineering Earth's Development, Preserving Earth's Integrity

APPENDIX F

NORTH CAMU STABILITY CALCULATIONS

FINAL COVER STABILITY

Made By: VK
Checked by: JBF
Reviewed by:

1.0 OBJECTIVE

To investigate the stability of the final cover lining system.

STATE OF TEXAS
JEFFREY B. FASSETT
85675
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2.0 GIVEN

Maximum slope of the geomembrane within the final cover is approximately 6%.
Length of maximum slope is conservatively assumed to be 100 ft.

3.0 ASSUMPTIONS

Proposed final cover liner system consists of (from top to bottom):

36-inch Soil Cover
Non-Woven Geotextile
60-mil HDPE smooth geomembrane
GCL

The soil cover is assumed to be saturated.

Based on a review of available data, the following parameters were assigned to the materials.

Material	Strength Parameters		Unit Weight (pcf)		Reference
	ϕ	c	Moist	Saturated	
Soil cover	28	0	115	132	Estimate-conservative
Soil cover/Nonwoven Geotextile	29	0	N/A	N/A	Golder*
Nonwoven Geotextile/Smooth Geomembrane	11	0	N/A	N/A	Koerner and Narejo, 2005**
Smooth Geomembrane/GCL	14	0	N/A	N/A	Golder*

* Based on unpublished testing data for similar materials presented later in Figure 1 and Figure 3.

** The data indicates an average peak friction angle of 11 degrees - see Figure 2.

Based on the shear strength parameters, the critical interface occurs along the nonwoven geotextile/smooth geomembrane interface; this interface has a friction angle of 11 degrees.

4.0 METHOD

A model was created representing the final cover slopes. A limit equilibrium analysis was performed to determine the minimum factor of safety against a sliding block failure along the critical interface.

Infinite Slope Analysis

$$\boxed{FS = \frac{c + (\gamma b \cos\beta - \gamma_w d \cos\beta)\tan\phi}{\gamma b \sin\beta}}$$

based on Soong and Koerner 1996.

Sliding at Nonwoven Geotextile/Smooth Geomembrane Interface

ϕ =	11	interface friction angle	
β =	6%	slope angle - max	
	3.4	slope angle - max (degrees)	0.05992816
c =	0	cohesion of soil (psf)	
γ =	125	saturated unit weight of soil (pcf)	
b =	3.0	soil thickness (ft)	
d =	3	water depth in cover (ft)	
γ_w =	62.4	unit weight of water (pcf)	

FS = 1.64

5.0 RESULTS

Using the Golder Associates and GRI interface friction angle data, the critical angle of internal friction was conservatively assumed to be 11 degrees. The resulting minimum factor of safety was calculated to be 1.64.

6.0 CONCLUSION

Through analysis of the lining system, the final cover slope is found to be stable.

7.0 REFERENCE

Te-Yang Soong and Robert M. Koerner, "Cover Soil Slope Stability Involving Geosynthetic Interfaces," GRI Report #18, Geosynthetic Research Institute, Drexel University, Philadelphia, PA, December 1996.

Rombert M. Koerner and Dhani Narejo, "Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces," GRI Report #30, Geosynthetic Research Institute, Drexel University, Philadelphia, PA, June 2005.

FIGURE 1 Peak shear strength based on testing performed by Golder Associates Inc.

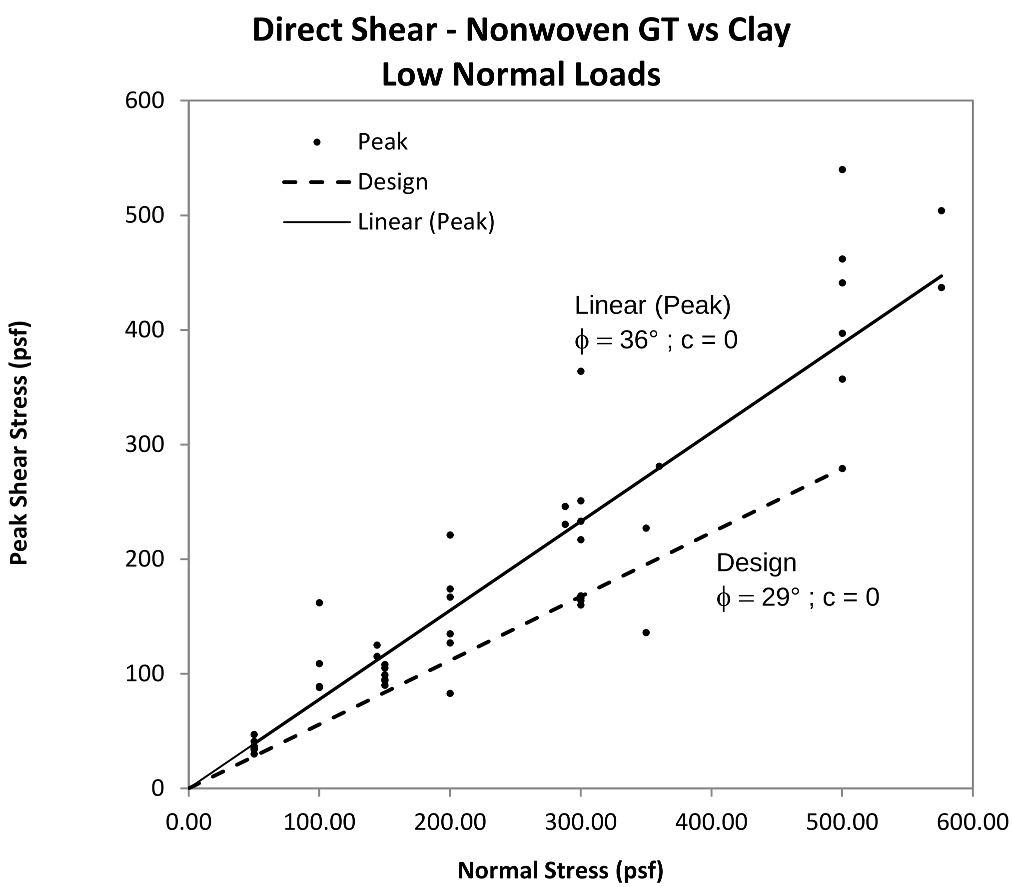


FIGURE 2

Peak Shear Strength; Smooth HDPE against NW-NP Geotextile (Figure from Koerner and Narejo 2005)

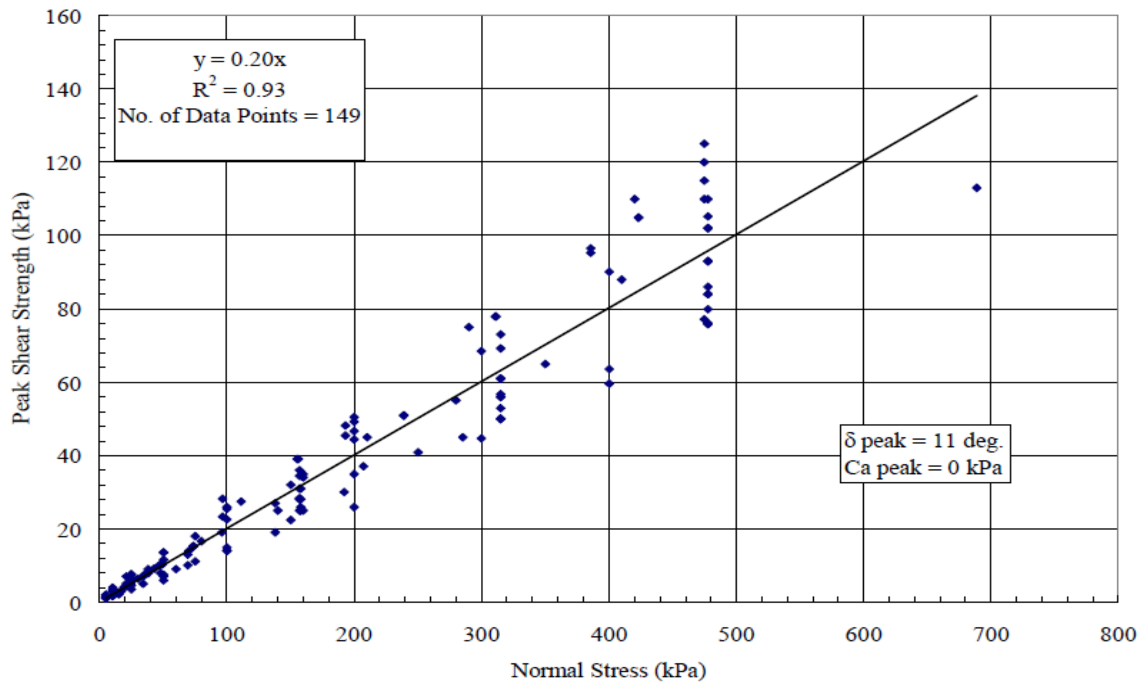
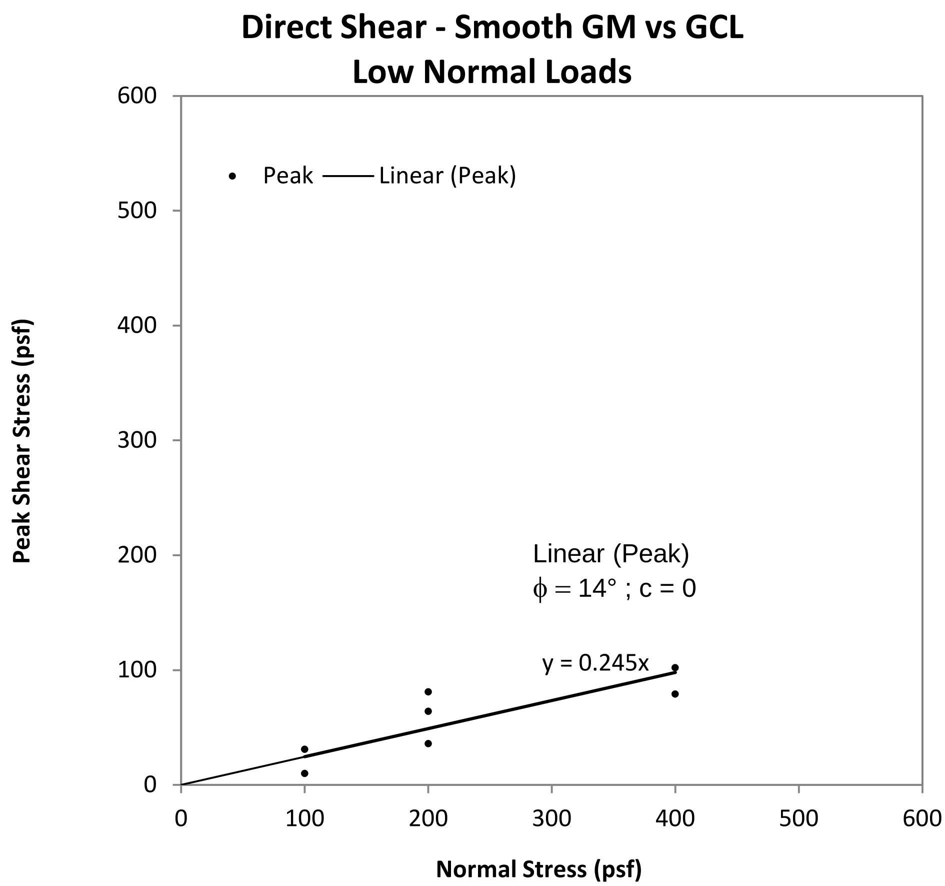


FIGURE 3 Peak shear strength based on testing performed by Golder Associates Inc.



APPENDIX G

NORTH CAMU DRAINAGE AND EROSION CALCULATIONS

DETAIL DRAINAGE CALCULATION

Made By: HH
Checked by: JBF
Reviewed by: JBF

1.0 OBJECTIVE

Golder has designed the final cover system for Cells 10 through 15 of the North CAMU at the closed Exide Frisco Recycling Center in Frisco, Texas. With this proposed design there is a need for drainage features. A perimeter drainage channel on the north that drains to the west and on the west that drains to the south have been proposed. This drainage channel will extend 436 feet to the south and discharge into an existing tributary that leads to Stewart Creek. A culvert at the proposed access road crossing is required. This culvert will allow flow to pass under the landfill access road and continue to the tributary.

2.0 METHOD

The rational method is used to calculate discharge flows in small areas. The estimated flows are used to size the drainage channel using the Manning's equation. The road crossing culvert(s) are sized with HY8 using the esimated flows.

3.0 CALCULATION

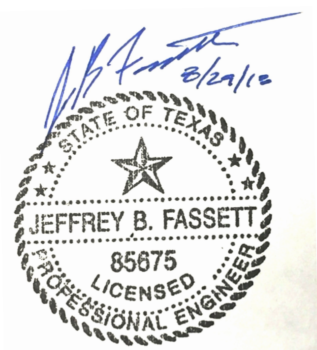
3.1 Discharge Flows

The rational method equation is used to calculate the peak discharge for facilities serving a drainage area less than 200 acres.

$$Q=ciA$$

c = Rational runoff coefficient
i = rainfall intensity (in/hour)
A = drainage area (acres)
Q = Peak discharge (cfs)

The runoff coefficient for a non-developed land is 0.30. The rainfall intensity is 7.6 in/hr. The runoff coefficient and time of concentration were taken from the Engineering Standards, The City of Frisco, Texas. The Tc is put into the TxDOT spreadsheet for calculating Rainfall Intensity-Duration-Frequency Coefficients for Texas Counties. The 25-year, 24-hour storm event is used to analyze the peak discharge. The drainage area is based on the final site conditions.



Pre Culvert			Post Culvert		
c =	0.3		c =	0.3	
i =	6.2	in/hr	i =	5.6	in/hr
A =	5.27	ac	A =	4.86	ac
Q =	**10**	**cfs**	**Q =**	**8**	**cfs**

3.2 Channel Sizing

The Mannings equation is used to size the perimeter channel. Table 3, Channel Hydraulic Calculation, show the channel design geometry, velocity, and freeboard calculation.

3.3 Culvert Sizing

Using Hy-8 (version 7.3) from the Federal Highway Administration and the site data (discharge, tailwater, roadway, etc.) the culvert was sized to pass the peak flows without overtopping the roadway.

4.0 CONCLUSION

The ditch is designed to be grassed lined with a geometry of 2 feet deep and 1.5 feet wide with 4H:1V sideslopes.

The culvert size is 2-18" CMP culverts at 26 feet long. A 5 ft by 5 ft by 12 in deep riprap inlet and outlet pad is required.

5.0 REFERENCES

1) Engineering Standards, The City of Frisco, Texas. Version August 2017
2) Hy-8 Program (version 7.5) Build date: July 28, 2016
3) Rainfall Intensity Duration Frequency Coefficients for Texas Counties, Texas Department of Transprotation.
4) Atlas of Depth-Duration Frequency of Precipitation Annual Maxima for Texas-U.S. Geological Survey, TxDOT Implementation Report 5–1301–01–1

TABLE 1A
COMPOSITE CURVE NUMBER CALCULATIONS

EXIDE RECYCLING CENTER
EXIDE TECHNOLOGIES
Project Number: 1302086-02

Date:	8/28/18
By:	HH
Chkd:	JBF
Apprvd:	JBF

Design Storm 25 **-Year Reoccurance Interval**

Storm Duration (hours)	2-Year Depth (inches)	25 -Year Depth (inches)	Storm Distribution
24	4.1	7.6	II

Subbasin ID	Subbasin Area (ft^2)	Subbasin Area (acres)	Subbasin Area (sq mile)	CN = 98 CONCRETE - PAVED AREAS OR POND AREAS (acres)	CN = 92 DIRT ROADS - UNPAVED AREAS -- HERBACEOUS GRASS/BRUSH (acres)	CN = 85 LANDFILL FINAL COVER AREAS (acres)	Composite SCS Curve No.	S = $\frac{1000}{CN}$ - 10	Unit Runoff Q (in)	Runoff Volume (ac-ft)	Runoff Volume (ft^3)
LANDFILL AREA											
1	229,561	5.27	0.0082			5.27	CN = 85	1.76	5.84	2.56	111,673
2	211,702	4.86	0.0076			4.86	CN = 85	1.76	5.84	2.36	102,985
Total:	441,263	10.13	0.02							4.93	214,657

TABLE 1B
BASIN TIME OF CONCENTRATION CALCULATIONS

EXIDE RECYCLING CENTER
EXCIDE TECHNOLOGIES
Project Number: 14 1302086.0

Date:	8/28/18
By:	HH
Chkd:	JBF
Apprvd:	JBF

				Flow Segment 1							Flow Segment 2							Flow Segment 3						
Subbasin ID	Composite Curve Number	Total Lag (0.6*Tc) (min)	Total Travel Time (min)	Type of Flow	Length (ft)	Slope (ft/ft)	Roughness Condition(1)		Typical Hydraulic Radius (Channel Only) (ft)	Travel Time (min)	Type of Flow	Length (ft)	Slope (ft/ft)	Roughness Condition(1)		Typical Hydraulic Radius (Channel Only) (ft)	Travel Time (min)	Type of Flow	Length (ft)	Slope (ft/ft)	Roughness Condition(1)		Typical Hydraulic Radius (Channel Only) (ft)	Travel Time (min)
LANDFILL AREA																								
1	85	13.8	22.9	Sheet	221	0.032	F	Dense Grass		19.6	Shallow	10.5	0.250	U	Unpaved		0.0	Channel	736	0.016	G	Grass-lined	0.58	3.3
2	85	16.7	27.8	Sheet	300	0.034	F	Dense Grass		24.5	Shallow	274.0	0.034	U	Unpaved		1.5	Channel	436	0.017	G	Grass-lined	0.60	1.8

Notes:
1. Refer to Table 3 for Roughness Condition descriptions and Tc Coefficients.

Table 2
Time of Concentration and Mannings Flow Coefficients

TR-55 (1986)

Sheet Flow Travel time (SCS Upland Method)

$$T_t = \frac{0.007\,(n' L)^{0.8}}{(P_2)^{0.5}\, s^{0.4}}$$

Where: T_t = travel time (hr); n' = roughness coefficient; L = flow length (ft);

P_2 = 2-yr storm depth (inches); s = slope (ft/ft)

flow velocity = L/(60T_t)

Flow Type	Surface Type	roughness n	Surface Description	Short Description
Sheet/Overland Flow	A	0.011	Smooth surfaces (concrete, asphalt, gravel, bare soil)	Smooth
	B	0.05	Fallow (no residue)	Fallow
	C	0.06	Cultivated soils: Residue cover <= 20%	Cover<20%
	D	0.17	Cultivated soils: Residue cover > 20%	Cover>20%
	E	0.15	Grass: Short grass prairie	Short Grass
	F	0.24	Grass: Dense grasses	Dense Grass
	G	0.41	Grass: Bermuda grass	Bermuda Grass
	H	0.13	Range (natural)	Range
	I	0.40	Woods: Light underbrush	Light woods
	J	0.80	Woods: Heavy underbrush	Heavy Woods

Shallow Concentrated Flow Velocity (SCS Upland Method)

$v = mS^{0.5}$

Where: v = velocity (fps); m = roughness coeffient; S = slope (ft/ft)

Flow Type	Surface Type	Roughness m	Surface Description	Short Description
Shallow Conc. Flow	P	20.3282	Paved Surfaces	Paved
	U	16.1345	Unpaved Surfaces	Unpaved

Channel Flow Velocity (Mannings Velocity)

$v = 1.49/n\ Rh^{2/3} S^{1/2}$

Where: v = velocity (fps); n = roughness coeffient; Rh = Hydraulic Radius (ft), S = slope (ft/ft)

Lining Type	Mannings n for Depth	Mannings n for Velocity	Material	Maximum Velocity	Maximum Shear Stress
A	0.026	0.026	ACB	25	
C	0.024	0.020	CSP	50	
E	0.025	0.022	Earth-lined	3	
G	0.035	0.030	Grass-lined	5	
I	0.017	0.013	Ductile Iron	50	
P	0.012	0.009	Plastic	25	
R	0.040	0.035	Riprap	15	
T	0.035	0.030	Turf Reinf.	10	1.5
Z	0.060	0.005	Other	25	

Table 3
Channel Hydraulic Calculations

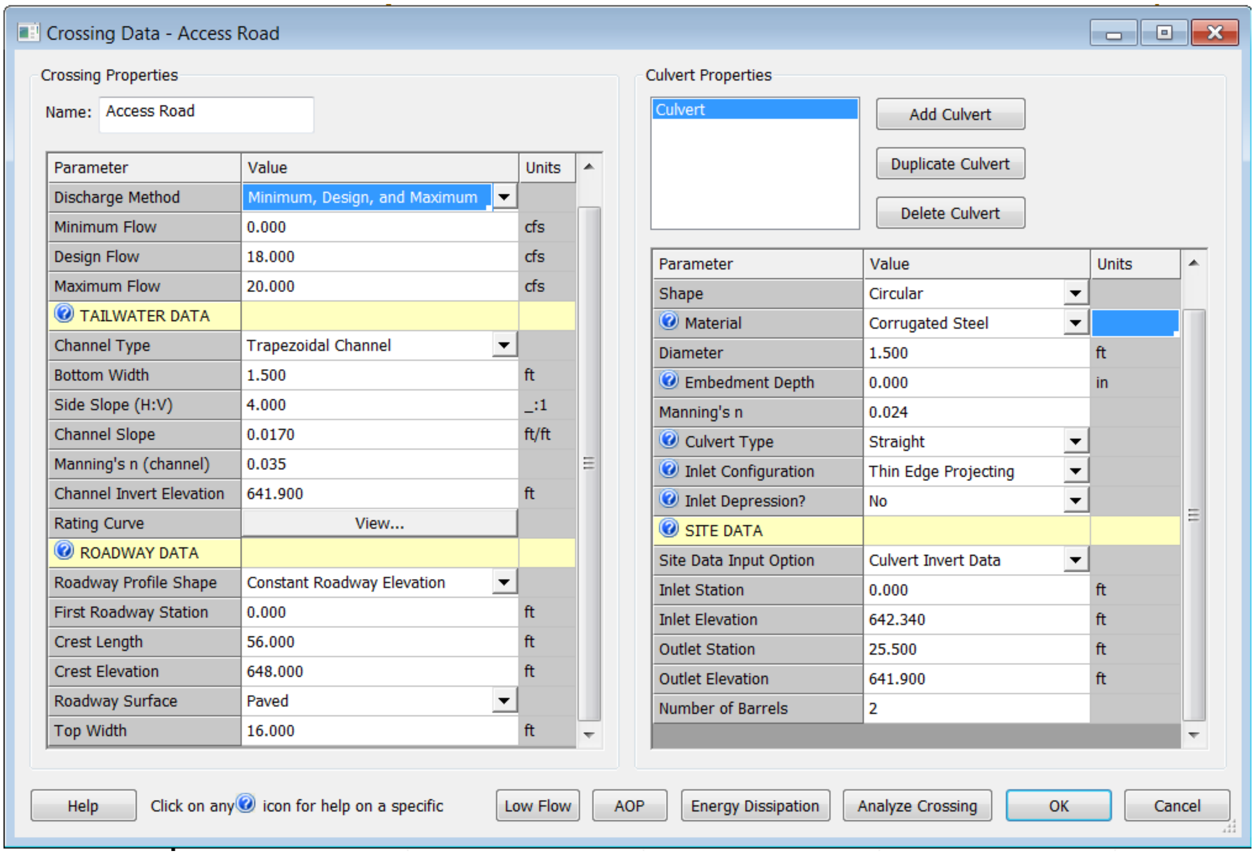
Exide Technologies
Exide Recycling Center
Collin County, Texas
PROJECT NO.: 1302086-02

Date:	8/29/18
By:	HH
Chkd:	JBF
Apprvd:	JBF

			Channel Design Geometry						Channel Roughness Parameters				Hydraulic Calculations							Channel Evaluations	
Reach Designation	Q (cfs)	Storm Event	Approximate Channel Length (ft)	Bed Slope (ft/ft)	Left Side Slope (H:1V)	Right Side Slope (H:1V)	Bottom Width (ft)	Minimum Channel Depth (ft)		Design Channel Lining	Mannings 'n' for Capacity (Depth Calculation)	Mannings 'n' for Stability (Velocity Calculation)	Maximum Velocity (ft/sec)	Maximum Normal Flow Depth (ft)	Froude Number	Normal Depth Shear Stress (lb/ft^2)	Stream Power (W/m^2)	Top Width of Flow (ft)	Top Width of Channel (ft)	Available Freeboard (ft)	
Perimeter Channels																					
Channel Pre Culvert	10.0	25-year	776	0.0163	4.0	4.0	1.5	2.0	GL	Grass-lined	0.035	0.030	3.5	0.73	0.95	0.74	37.38	7.4	17.5	1.27	
Channel Post Culvert	8.0	25-year	436	0.0100	4.0	4.0	1.5	2.0	GL	Grass-lined	0.035	0.030	2.7	0.74	0.74	0.46	18.23	7.4	17.5	1.26	

(1) Note: Comments and Warnings:
< 1.0 ft indicates freeboard is less than 1 foot.
< 1/2 Vel. Head indicates that the remaining freeboard is less than 1/2 the velocity head ($V^2/2g$) suggesting water may splash out.
Warning: VxD>9 indicates that the velocity times the depth is greater than 9 ft^2/sec, which is undesirable and may be unsafe.
Unstable V indicates that calculated velocity exceeds the recommended maximum for the lining material.
Unstable T indicates that calculated shear stress exceeds the recommended maximum for the lining material.

EXIDE RECYCLING CENTER
HY-8 INFORMATION



Crossing Data - Access Road

Crossing Properties

Name: Access Road

Parameter	Value	Units
Discharge Method	Minimum, Design, and Maximum	
Minimum Flow	0.000	cfs
Design Flow	18.000	cfs
Maximum Flow	20.000	cfs
TAILWATER DATA		
Channel Type	Trapezoidal Channel	
Bottom Width	1.500	ft
Side Slope (H:V)	4.000	_:1
Channel Slope	0.0170	ft/ft
Manning's n (channel)	0.035	
Channel Invert Elevation	641.900	ft
Rating Curve	View...	
ROADWAY DATA		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	0.000	ft
Crest Length	56.000	ft
Crest Elevation	648.000	ft
Roadway Surface	Paved	
Top Width	16.000	ft

Culvert Properties

Culvert

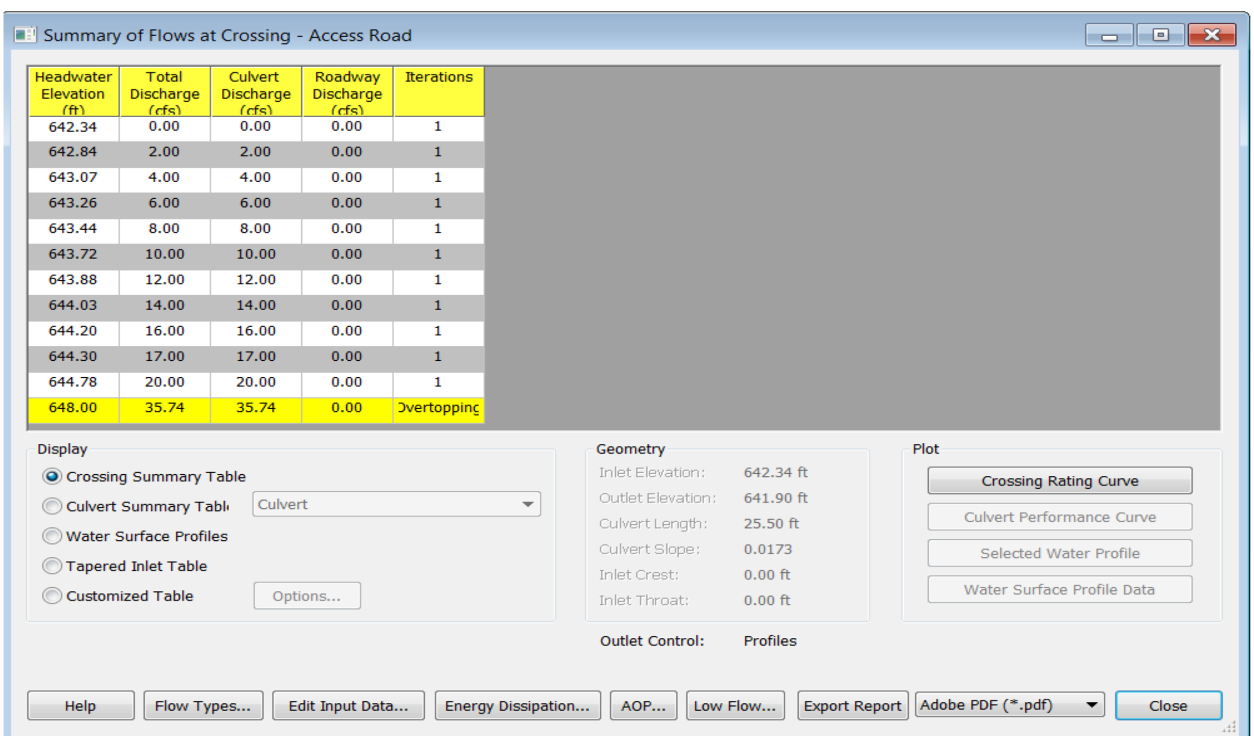
Add Culvert

Duplicate Culvert

Delete Culvert

Parameter	Value	Units
Shape	Circular	
Material	Corrugated Steel	
Diameter	1.500	ft
Embedment Depth	0.000	in
Manning's n	0.024	
Culvert Type	Straight	
Inlet Configuration	Thin Edge Projecting	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.000	ft
Inlet Elevation	642.340	ft
Outlet Station	25.500	ft
Outlet Elevation	641.900	ft
Number of Barrels	2	

Help | Click on any icon for help on a specific | Low Flow | AOP | Energy Dissipation | Analyze Crossing | OK | Cancel



Summary of Flows at Crossing - Access Road

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert Discharge (cfs)	Roadway Discharge (cfs)	Iterations
642.34	0.00	0.00	0.00	1
642.84	2.00	2.00	0.00	1
643.07	4.00	4.00	0.00	1
643.26	6.00	6.00	0.00	1
643.44	8.00	8.00	0.00	1
643.72	10.00	10.00	0.00	1
643.88	12.00	12.00	0.00	1
644.03	14.00	14.00	0.00	1
644.20	16.00	16.00	0.00	1
644.30	17.00	17.00	0.00	1
644.78	20.00	20.00	0.00	1
648.00	35.74	35.74	0.00	Overtopping

Display

- Crossing Summary Table
- Culvert Summary Table — Culvert
- Water Surface Profiles
- Tapered Inlet Table
- Customized Table — Options...

Geometry

Inlet Elevation: 642.34 ft
Outlet Elevation: 641.90 ft
Culvert Length: 25.50 ft
Culvert Slope: 0.0173
Inlet Crest: 0.00 ft
Inlet Throat: 0.00 ft

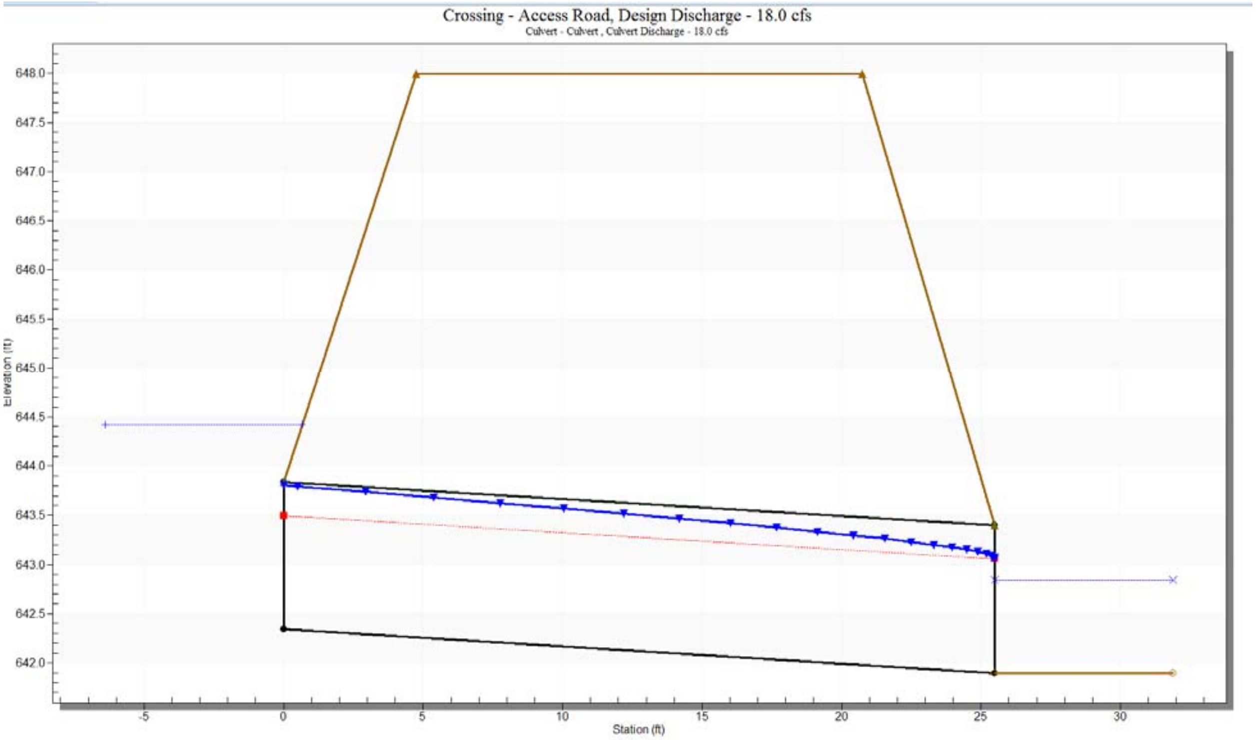
Outlet Control: Profiles

Plot

Crossing Rating Curve
Culvert Performance Curve
Selected Water Profile
Water Surface Profile Data

Help | Flow Types... | Edit Input Data... | Energy Dissipation... | AOP... | Low Flow... | Export Report | Adobe PDF (*.pdf) | Close

EXIDE RECYCLING CENTER
HY-8 INFORMATION



Rainfall Intensity-Duration-Frequency Coefficients for Texas Counties

1. Select your county. 2. Enter the time of concentration

County	Coefficient	2-year	5-year	10-year	25-year	50-year	100-year
Collin	e (in)	0.790	0.781	0.778	0.779	0.776	0.764
	b	54	67	79	92	102	106
	d (mins)	8.2	8.8	8.8	8.8	8.8	8.2
	Intensity (in/hr)*	3.6	4.5	5.4	6.2	7.0	7.7

Clay
Cochran
Coke
Coleman
Collin
Collingsworth
Colorado
Comal
Comanche

Coefficient	2-year	5-year	10-year	25-year	50-year	100-year
e (mm)	0.790	0.781	0.778	0.779	0.776	0.764
b	1372	1702	2007	2337	2591	2692
d (mins)	8.2	8.8	8.8	8.8	8.8	8.2
Intensity (mm/hr)*	90.8	114.4	136.3	158.2	177.3	194.8

* for time of Concentration = **22.9** mins

Rainfall Intensity-Duration-Frequency Coefficients for Texas Counties

1. Select your county. 2. Enter the time of concentration

County	Coefficient	2-year	5-year	10-year	25-year	50-year	100-year
Collin	e (in)	0.790	0.781	0.778	0.779	0.776	0.764
	b	54	67	79	92	102	106
	d (mins)	8.2	8.8	8.8	8.8	8.8	8.2
	Intensity (in/hr)*	3.2	4.0	4.8	5.6	6.2	6.8

Clay
Cochran
Coke
Coleman
Collin
Collingsworth
Colorado
Comal
Comanche

Coefficient	2-year	5-year	10-year	25-year	50-year	100-year
e (mm)	0.790	0.781	0.778	0.779	0.776	0.764
b	1372	1702	2007	2337	2591	2692
d (mins)	8.2	8.8	8.8	8.8	8.8	8.2
Intensity (mm/hr)*	80.7	102.1	121.7	141.2	158.2	173.9

* for time of Concentration = **27.9** mins

FINAL COVER EROSION SOIL LOSS CALCULATION - North CAMU

Made By: CMF
Checked by: JBF
Reviewed by:
Date: 5/30/2019

1.0 OBJECTIVE:

Estimate erosion soil loss under final closure conditions for the Class 2 Landfill (CL2LF) CAMU at the closed Exide Recycling Canter in Frisco, Texas.

2.0 METHOD:

Erosion loss was determined using the Revised Universal Soil Loss Equation (RUSLE), (UDSA,1997).

I) Use revised universal soil loss equation.

A = R K L S C P Variables described below

Rainfall and erosivity index (R)

From Fig. 1, Ref.1, the average annual rainfall erosion index for the site is approx. **295**

Soil Erodibility Factor (K)

Assume a silty clay loam with an organic matter content of 4% and use Table 1, Ref. 1, to determine the K factor.

Use K = 0.26

Cover and Management Factor [C]

Assume 80% ground cover and interpolate C from values shown on Table 2, Ref. 1

C = 0.013

Support Practice Factor (P)

Surface tracked with dozer -- rough surface

Use P = 1

Length Slope Factor (LS) (Ref. 2)

For regular slopes > 15 ft long, the **Slope Steepness Factor, S** =

$S = 10.8 \sin \Theta + 0.03$; $\sin \Theta < 0.09$ Eqn. 8.39

or $16.8 \sin \Theta - 0.50$; $\sin \Theta \geq 0.09$ Eqn. 8.40

Where: Θ = slope angle

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Length Factor, L

$L = [\lambda/72.6]^m$ Eqn. 8.43

λ = slope length (measured as the horizontal projection of plot length)

m is an exponent dependent upon slope given by

$$m = \frac{\beta}{1+\beta} \quad \text{Eqn. 8.44}$$

β for soils moderately susceptible to erosion is given by:

$$\beta_{mod} = \frac{11.16 \sin\Theta}{3.0(\sin\Theta)^{0.8} + 0.56} \quad \text{Eqn. 8.45}$$

β is modified as follows for soils of low and high susceptibility to erosion:

$\beta_{low} = (1/2)\beta_{mod}$

$\beta_{high} = 2\beta_{mod}$

3.0 ASSUMPTIONS:

Facility slopes are 4H:1V on the sides, 3.2% on top,

R was taken from Figure 1, Average Annual Values of the Rainfall Erosion Index,

K was taken from the USDA soil Interpretation Records, Soil Conservation Services,

S = slope steepness factor (Haan, 1994),

There are three equations available to determine S. If the length of the applicable slope is less than 15 feet, then equation 8.41 which is $S = 3.0 (\sin \Theta)^{0.8}+0.56$. If the applicable slope is greater than 15 feet then equation 8.39 or 8.40 would apply, depending on the angle of the slope. These two equations are:

If $\sin \Theta < 0.09$, then $S = 10.8 \sin \Theta + 0.03$

If $\sin \Theta \geq 0.09$, then $S = 16.8 \sin \Theta - 0.50$

In our specific calculation, the slope angles are as follows:

For the 4 (H): 1(V) slope, $\Theta = 14.04°$

$\sin 14.04° = 0.24 \geq 0.09$, Use eq. 8.40

For the 3.2% slope, $\Theta = 2.29°$

$\sin 2.29° = 0.03 < 0.09$, Use eq. 8.39

L = slope length factor

$$L = \frac{\lambda}{72.6}^{m}$$

where λ = horizontal projection of plot length

$$m = \frac{\beta}{1+\beta}$$

$$\beta = rill\ erosion$$

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$$\beta_{mod} = \frac{11.16 \sin \Theta}{3.0(sin\Theta)^{0.8} + 0.56}$$

The equation for rill erosion applies to moderately erodible soils.

C represents 80% ground cover without appreciable canopy - Table 2, USDA-SCS TR 52,

P was assumed to be 1.0 for long-range prediction & no maintenance.

4.0 CALCULATIONS

A RUSLE calculation was performed for a compound slopes.

A Summary of the RUSLE calculation is presented in Table 1.

5.0 CONCLUSION/RESULTS

RUSLE calculation for a compound slope is found in Tables 1. Annual erosion is calculated to be 0.7 ton/ac/year.

6.0 REFERENCES:

1) Use of the Universal Soil Loss Equation in Final Cover/Configuration Design, Procedural Handbook," TNRCC, Permits Section, October 1993.
2) Haan C.T., B. J. Barfield, and J.C. Hayes. 1994. Design hydrology and sedimentology for small catchments. San Diego CA : Academic Press Inc.
3) TCEQ Regulatory Guidance, "Guidelines for Preparing a Surface Water Drainage Report for a Municipal Solid Waste Facility.", August 2006

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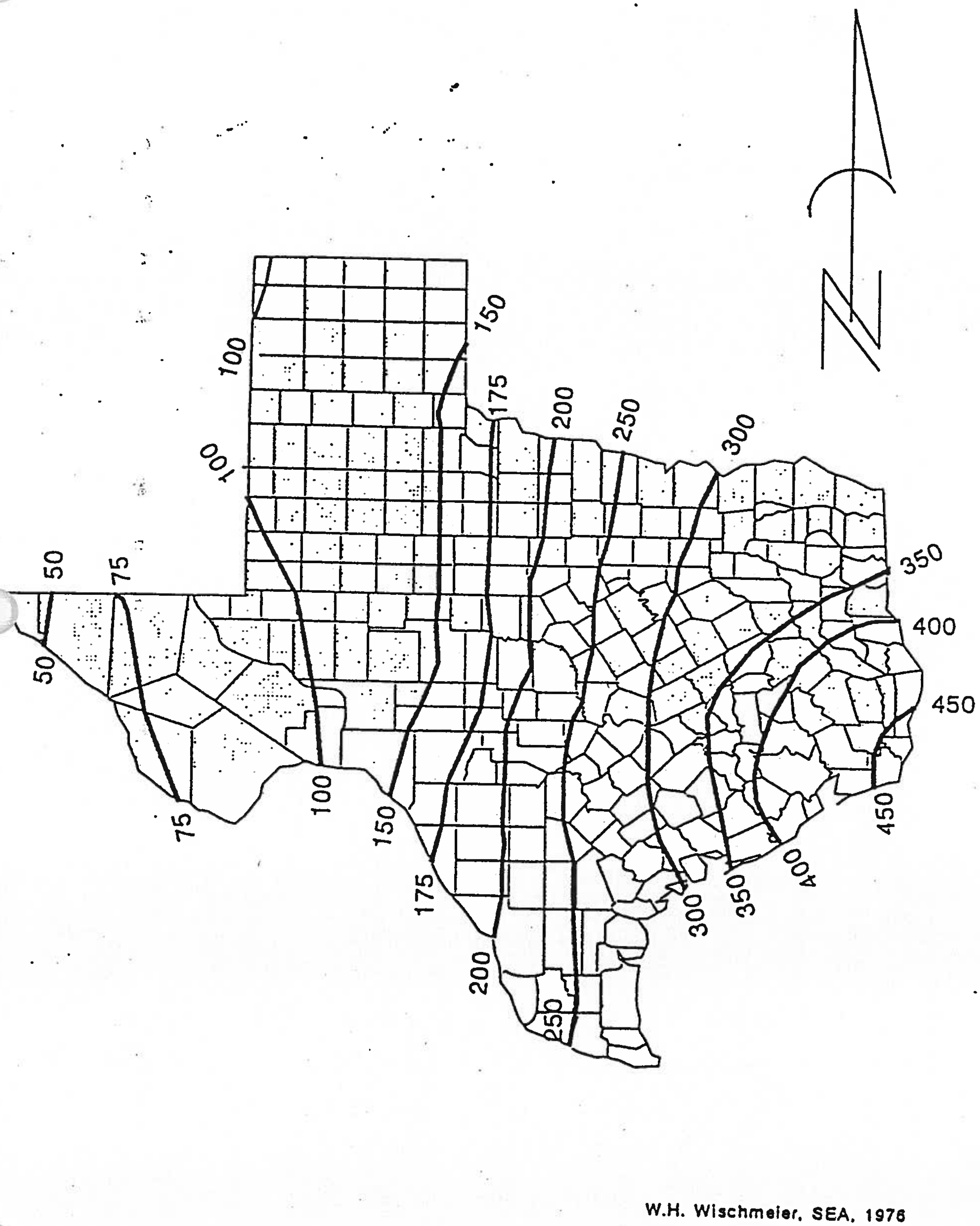
TABLE 1. EXIDE RECYCLING CENTER - ESTIMATED AVERAGE ANNUAL EROSION
MAXIMUM EROSION LOSS

R ft tonsf in/acre hr year	Slope Segment	K ton*ac-hr/hundredths ac-ft*tonf*in	Slope (ft/ft)	Length (l) (ft)	rill susceptability low, mod, high	beta eq. 8.45	m eq.8.44 or .5 (Foster & Wischmeier, 1978)	LS	C	P	A_i ton/ac/yr
Final Cover - Top (80% cover)											
295	1	0.26	0.03	221	mod	0.475	0.3222	0.513	0.013	1.00	0.5
295	2	0.26	0.25	10.5	mod	1.774	0.6395	0.235	0.013	1.00	0.2
								Eff. LS: 0.75			**0.7**

NOTES: **R** was taken from Figure 1, Average Annual Values of the Rainfall Erosion Index
M was calculated from Eq. 8.37 (p. 256) - *Design Hydrology and Sedimentology for Small Catchments* 1
K was based on soil survey descriptions obtained from the USDA, Soil Interpretation Records, Soil Conservation Services
LS was calculated from Eqs. 8.39-41 and 43 (p. 261) - *Design Hydrology and Sedimentology for Small Catchments*
C represents 80% ground cover without appreciable canopy - *USDA-SCS TR 51*
P was assumed to be 1.0 for long-range prediction & no maintenance

A = R * K * LS * C * P

where:
A = soil loss, tons/(acre - year)
R = rainfall erosion index
K = soil erodibility factor
LS = slope length and steepness factor
C = vegetative cover factor
P = erosion control practice factor



…GURE 1. - AVERAGE ANNUAL VALUES OF THE RAINFALL EROSION INDEX

Table 1 Approximate Values of Factor K for USDA Textural Classes

TABLE 1

Texture Class	Organic Matter Content <0.5% K	2% K	4% K
Sand	0.05	0.03	0.02
Fine Sand	0.16	0.14	0.10
Very Fine Sand	0.42	0.36	0.28
Loamy Sand	0.12	0.10	0.08
Loamy Fine Sand	0.24	0.20	0.16
Loamy Very Fine Sand	0.44	0.38	0.30
Sandy Loam	0.27	0.24	0.19
Fine Sandy Loam	0.35	0.30	0.24
Very Fine Sandy Loam	0.47	0.41	0.33
Loam	0.38	0.32	0.29
Silt Loam	0.48	0.42	0.33
Silt	0.60	0.52	0.42
Sandy Clay Loam	0.27	0.25	0.21
Clay Loam	0.28	0.25	0.21
Silty Clay Loam	0.37	0.32	0.26
Sandy Clay	0.14	0.13	0.12
Silty Clay	0.25	0.23	0.19
Clay	0.13 - 0.29		

The values shown are estimated averages of broad ranges of specific-soil values. When a texture is near the borderline of two texture classes, use the average of the two K values.

Table 2 Factor C for permanent pasture, range, and idle land[1]

Vegetative Canopy		Cover that contacts the soil surface						
Type and height[2]	Percent cover[3]	Percent ground cover						
		0	20	40	60	70	80	90
No Appreciable Canopy		0.45	0.20	0.10	0.042	.028	0.013	0.006
Tall weeds or short brush with average drop fall height of 20 in.	50	0.26	0.13	0.07	0.035	.023	0.012	0.006
	75	0.17	0.10	0.06	0.032	.022	0.011	0.005

Extracted from:
United States Department of Agriculture, AGRICULTURE HANDBOOK NUMBER 537

1 The listed C values assume that the vegetation and mulch are randomly distributed over the entire area.

2 Canopy height is measured as the average fall height of water drops falling from the canopy to the ground. Canopy effect is inversely proportional to drop fall height and is negligible if fall height exceeds 33 ft.

3 Portions of total-area surface that would be hidden from view by canopy in a vertical projection (a bird's-eye view).

The impact of changes in saturated hydraulic conductivity on the K factor must be accounted for by the nomograph in Fig. 8.9. To accomplish this correction using Eq. (8.38), relationships between hydraulic conductivity and permeability classes used in Fig. 8.9 must be known. Rawls *et al.* (1982) proposed the relationship shown in Table 8.3.

Example Problem 8.4. Effects of rock fragments on K

A silty clay loam soil is classified as permeability class 5. Based on textural information, soil structure, and a permeability class of 5, K is estimated as 0.21 in English units. What would be the value for K as corrected for rock fragments if the percentage of rock fragments greater than 2 mm occupies 40% of the soil mass by weight?

Solution:

1. Impact of rock fragment on hydraulic conductivity. From Table 8.3, k_f for a silty clay loam soil is between 0.04 and 0.08 in./hr. Assume a value of 0.06 in./hr. From Eq. (8.38)

$$k_b = k_f(1 - R_w) = 0.06(1 - 0.40) = 0.036 \text{ in./hr.}$$

2. Estimating the revised permeability class. From Table 8.3, the permeability class for $k_b = 0.036$ in./hr is 6.

3. Estimating the new erodibility. Entering Fig. 8.9 with an estimated K of 0.21 for a permeability class of 5, the K value for a class 6 permeability is estimated as 0.22 (English units).

It is again important to note that this procedure corrects only for the effects of rock fragments on infiltration. Impacts on the C factor must be based on percentage ground cover, as discussed in a subsequent section.

Rough Estimates of K from Textural Information and Experimental Values for Construction and Mined Sites

The USDA–SCS has developed estimates of K based on textural classification for topsoil, subsoil, and residual materials as shown in Table 8.4. These values are first estimates only and do not include the influence of soil structure or infiltration characteristics.

A limited number of data sets have been developed for drastically disturbed lands and for reconstructed soils. A summary of the data is given in Table 8.5 along with a comparison to values from the Wischmeier *et al.* (1971) nomograph shown in Fig. 8.9. The comparison is sufficiently favorable to warrant the use of the nomograph for a first estimate of K on disturbed topsoil or A-horizon material. The comparison is not favorable for subsoil materials.

Length and Slope Factors L and S

The effects of topography on soil erosion are determined by dimensionless L and S factors, which account for both rill and interrill erosion impacts.

Slope Steepness Factor S

The slope steepness factor S is used to predict the effect of slope gradient on soil loss. For slope lengths

Table 8.3 Soil Water Data for the Major USDA Soil Textural Classes (after Rawls *et al.*, 1982)

Texture	Permeability class[a]	Saturated hydraulic conductivity		Hydrologic soil group[b]
		in./hr	mm/hr	
Silty clay, clay	6	< 0.04	<1	D
Silty clay loam, sandy clay	5	0.04–0.08	1–2	C–D
Sandy clay loam, clay loam	4	0.08–0.20	2–5	C
Loam, silt loam	3	0.20–0.80	5–20	B
Loamy sand, sandy loam	2	0.80–2.40	20–60	A
Sand	1	> 2.40	>60	A+

[a]See Soil Conservation Service National Soils Handbook (SCS, 1983).
[b]See Soil Conservation Service National Engineering Handbook (SCS, 1972, 1984).
[c]Note: Although the silt texture is missing from the NEH because of inadequate data, it undoubtedly should be in permeability class 3.

greater than 15 ft, the S factor from the USLE was modified significantly by McCool *et al.* (1987, 1993) after extensive evaluation of the original USLE data base. The modified version is

$$S = 10.8 \sin\theta + 0.03; \qquad \sin\theta < 0.09 \qquad (8.39)$$

$$S = 16.8 \sin\theta - 0.50; \qquad \sin\theta \geq 0.09, \qquad (8.40)$$

where θ is the slope angle. Based on an evaluation of data from disturbed lands with slopes up to 84%, McIssac *et al.* (1987) developed an equation similar to (8.39) and (8.40) with exponents in the same range; thus McCool *et al.* (1993) recommend that Eqs. (8.39) and (8.40) also be used for disturbed lands.

For slope lengths less than 15 ft, the S factor is not as strongly related to slope (slope exponent less than 1.0) since rilling would not have been initiated. The recommended factor is

$$S = 3.0(\sin\theta)^{0.8} + 0.56. \qquad (8.41)$$

Under conditions where thawing of recently tilled soils is occurring and surface runoff is the primary factor causing erosion (typical of the Pacific Northwest in the spring), the S factor should be (McCool *et al.*, 1987, 1993)

$$S = 4.25(\sin\theta)^{0.6}, \qquad \sin\theta \geq 0.09. \qquad (8.42)$$

For thawing soils with slopes less than 9%, Eq. (8.39) should be used.

The S factor in the RUSLE is significantly modified from the original USLE as a result of an extensive reevaluation of the original data base, addition of the factors for short slope lengths, and new values for thawing soils (McCool *et al.*, 1987). The original data base did not include values beyond 20%. When using the quadratic form of the equation for S developed for the original USLE, projections beyond 20% yielded unreasonably high values for erosion. The RUSLE equation with the linear function corrects this problem.

Table 8.4 K Value Estimates based on Textural Information (English Units) (Soil Conservation Service, 1978)

Texture	Estimated K value[a]
Topsoil	
Clay, clay loam, loam, silty clay	0.32[b]
Fine sandy loam, loamy very fine sand, sandy loam	0.24
Loamy fine sand, loamy sand	0.17
Sand	0.15
Silt loam, silty clay loam, very fine sandy loam	0.37
Subsoil and Residual Material	
Outwash Soils	
Sand	0.17
Loamy sand	0.24
Sandy loam	0.43
Gravel, fine to moderate fine	0.24
Gravel, medium to moderate coarse	0.49
Lacrustrine Soils	
Silt loam and very fine sandy loam	0.37
Silty clay loam	0.28
Clay and silty clay	0.28
Glacial Till	
Loam, fine to moderate fine subsoil	0.32
Loam, medium subsoil	0.37
Clay loam	0.32
Clay and silty clay	0.28
Loess	0.37
Residual	
Sandstone	0.49
Siltstone, nonchannery	0.43
Siltstone, channery	0.32
Acid clay shale	0.28
Calcareous clay shale or limestone residuum	0.24

[a]These values are typical based only on textural information. Values for an actual soil can be considerably different due to different structure and infiltration.

[b]Units on K in this table are English units (tons•acre•hr/hundreds•acre•ft•tonsf•in.). To convert to metric units (t•ha•h/ha•MJ•mm), multiply K values by 0.1317.

Slope Length Factor

The slope length factor was developed by McCool *et al.* (1989, 1993) from the original USLE data base augmented with theoretical considerations. The L factor retains its original form

$$L = \left[\frac{\lambda}{72.6}\right]^m, \qquad (8.43)$$

where λ is the slope length in feet, 72.6 ft is the length of a standard erosion plot, and m is a variable slope length exponent. Slope length, λ, is the horizontal projection of plot length, not the length measured along the slope. The difference in horizontal projections and slope lengths becomes important on steeper slopes.

The slope length exponent is related to the ratio of rill to interrill erosion, β (Foster *et al.*, 1977b; McCool *et al.*, 1989, 1993), by

$$m = \frac{\beta}{1+\beta}. \qquad (8.44)$$

Table 8.5 Experimental K Value Estimates for Disturbed Lands (English Units)

Reclaimed soil or residual material	Location of experimental site	K Exp[a]/Nomo[b]	Reference
Hosmer silt loam	Indiana	0.387/0.485[c]	Stein *et al.* (1983)
Alfred silt loam	Southern Indiana	0.812/0.485	
Ava silt loam	Southern Indiana	0.842/0.478	
Graded overburden	Southern Indiana	0.197–0.835/ 0.250–0.478	
Clinton silt loam[d]	Western Illinois	0.370/0.360	Mitchell *et al.* (1983)
Tama silty clay loam[d]	Western Illinois	0.210/0.310	
Hosmer silt loam[d]	Southern Indiana	0.450–0.650/ 0.470	
Sadler silt loam (A horizon)	Western Kentucky	0.415/0.385	Barfield *et al.* (1988)
Sadler silt loam (B horizon)	Western Kentucky	0.380/0.640	
Shale spoil material	Western Kentucky	0.140/0.180	

[a]Values measured experimentally with rainfall simulators.
[b]Values calculated from Wischmeier *et al.* (1971) nomograph shown in Fig. 8.9.
[c]Values in English units of tons•acre•hr/hundreds•acre•ft•tonsf•in. To convert to metric units of t•a•h/ha•MJ•mm, multiply by 0.1317.
[d]The dominant soil series. Some mixing occurred with other series.

For soils that are classed as being moderately susceptible to erosion, McCool *et al.* (1989) proposed that

$$\beta_{\text{mod}} = \frac{11.16 \sin \theta}{3.0(\sin \theta)^{0.8} + 0.56}, \tag{8.45}$$

where θ is the slope angle. Thus, the slope exponent is a function of the slope angle θ.

Soils in the RUSLE are classed as having low, moderate, or high susceptibility to rill erosion. Equation (8.45) is for soils that are moderately susceptible to erosion. Conversions for soils that have low or high susceptibility to erosion are given in Table 8.6. Values in Table 8.6 are based on the assumption that moderately erodible soils have a β defined by Eq. (8.45), soils highly susceptible to rilling have a β that is twice that given by Eq. (8.45), and soils with low susceptibility to rilling have a β that is defined by half that given by Eq. (8.45).

For soils in the Pacific Northwest, or other soils that are exposed to runoff during thawing without sufficient rainfall energy to cause interrill erosion, the values in Table 8.6 should not be used. Instead, McCool *et al.* (1989) recommend that a slope length exponent of 0.5 be used for all slopes. When runoff on thawing soils is exposed to rainfall sufficient to cause significant interrill erosion, the slope length exponent for the low rill to interrill erosion ratio should be used (column 1 in Table 8.6). For rangeland soils, the use of a low rill to interrill erosion ratio is proposed. Selection of the appropriate column to use in Table 8.6 requires professional judgement. The assistance of a soil scientist may be helpful.

Combined Length and Slope Factors

Combined slope length and slope steepness factors were calculated using the factors from Eqs. (8.39) to (8.43). These combination factors are given in Fig. 8.13 for all susceptibilities and for thawing soils.

Irregular and Segmented Slopes

Soil loss is strongly impacted by slope shape (Foster and Huggins, 1979). A convex shape will have greater erosion than a uniform slope by as much as 30%. A concave slope will have less erosion than a uniform slope. Foster and Wischmeier (1974) developed a procedure for evaluating the impact of irregular slopes by dividing the slope into segments. The soil loss per unit area from the ith segment is

$$A_i = RK_iC_iP_iS_i\left[\frac{\lambda_i^{m+1} - \lambda_{i-1}^{m+1}}{(\lambda_i - \lambda_{i-1})72.6^m}\right], \tag{8.46}$$

where λ_i and λ_{i-1} are the slope lengths at the start and end of segment i, and K_i, C_i, P_i, and S_i are USLE factors for segment i. Equation (8.46) can be used for each segment i. The total erosion from each segment

Table 8.6 Slope Length Exponent m in Eq. (8.43) (after McCool *et al.*, 1993)[a]

Percentage slope	Rill/interrill ratio		
	Low[b]	Moderate[c]	High[d]
0.2	0.02	0.04	0.07
0.5	0.04	0.08	0.16
1.0	0.08	0.15	0.26
2.0	0.14	0.24	0.39
3.0	0.18	0.31	0.47
4.0	0.22	0.36	0.53
5.0	0.25	0.40	0.57
6.0	0.28	0.43	0.60
8.0	0.32	0.48	0.65
10.0	0.35	0.52	0.68
12.0	0.37	0.55	0.71
14.0	0.40	0.57	0.72
16.0	0.41	0.59	0.74
20.0	0.44	0.61	0.76
25.0	0.47	0.64	0.78
30.0	0.49	0.66	0.79
40.0	0.52	0.68	0.81
50.0	0.54	0.70	0.82
60.0	0.55	0.71	0.83

[a]Values in table are not applicable to thawing soils. See text for explanation.
[b]$\beta = 1/2$ value from Eq. (8.45) in Eq. (8.44).
[c]$\beta = 1 \times$ value from Eq. (8.45) in Eq. (8.44).
[d]$\beta = 2 \times$ value from Eq. (8.45) in Eq. (8.44).

would be $A_i(\lambda_i - \lambda_{i-1})$, and the average erosion per unit area over the entire slope length would be

$$A = R\sum_{i=1}^{n} K_iC_iP_iS_i\frac{\left[\lambda_i^{m+1} - \lambda_{i-1}^{m+1}\right]}{\lambda_e 72.6^m}, \qquad (8.47)$$

where λ_e is the total slope length. Equation (8.47) can also be used to evaluate the effects of variation in K, C, and P over the slope length.

An alternate method for evaluating irregular slopes is the use of a slope length adjustment factor (SAF). If the slope is divided into n increments of equal length ΔX, then

$$A = R\sum_{i=1}^{n} K_iC_iP_iS_i\frac{\left[(i\,\Delta X)^{m+1} - ([i-1]\,\Delta X)^{m+1}\right]}{n\,\Delta X 72.6^m}. \qquad (8.48)$$

Dividing by n times the soil loss from a uniform slope of equal length and assuming constant values of K_i C_i P_i along the slope, a slope adjustment factor can be developed for each segment, or

$$\mathrm{SAF}_i = \frac{A_i}{A} = \frac{i^{m+1} - (i-1)^{m+1}}{n^m}, \qquad (8.49)$$

where n is the number of segments and SAF is the slope adjustment factor. The sum of the SAF_i for a given slope is equal to the number of segments n; thus the average erosion over the slope is

$$A = \frac{R}{n}\sum_{i=1}^{n} K_iC_iP_iS_iL_i(\mathrm{SAF})_i. \qquad (8.50a)$$

where L_i is the slope length factor calculated from Eq. (8.43) using the m value corresponding to the segment steepness. In the development of a SAF relationship, R, K, C, and P remain constant over all segments; thus Eq. (8.50a) can be solved for an equivalent LS factor

$$LS = \frac{1}{n}\sum_{i=1}^{n} S_iL_i(\mathrm{SAF})_i. \qquad (8.50b)$$

Factors calculated from Eq. (8.50b) are given in Table 8.7. An example of its use is given in Example Problem 8.5.

Example Problem 8.5. Estimating *LS* factors

A soil that is very susceptible to rilling has a slope length of 210 ft and an average slope of 15%. Estimate the LS factor if:

(1) the slope is uniform
(2) the slope is convex with slopes of 10, 15, and 20% on segments 1, 2, and 3
(3) the slope is concave with slopes of 20, 15, and 10% on segments 1, 2, and 3.

Assume that the soil is not freezing and thawing.

Solution:

1. *Uniform slope.* The slope angle is

$$\theta = \tan^{-1} 0.15 = 8.53^\circ.$$

From Eq. (8.45) for soils moderately susceptible to rilling,

$$\beta = \frac{11.16 \sin 8.53}{3.0(\sin 8.53)^{0.8} + 0.56} = 1.37.$$

APPENDIX H

NORTH CAMU AIR MONITORING PLAN

APPENDIX H
AIR MONITORING PLAN

for

Class 2 Landfill CAMU Final Operation and Closure Activities

at

Class 2 Landfill CAMU
Exide Technologies, Inc.
Frisco, Texas

Prepared by:

Remediation Services, Inc.

&

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January 31, 2013
Updated January 14, 2016

Rev. 2

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Table of Contents

1.0 INTRODUCTION **2**

2.0 ORGANIZATION OF PLAN **2**

3.0 PARTICULATE MONITORING **2**

3.1 Equipment 2

3.2 Monitoring Locations 3

3.3 Take Action and Stop Work Levels Using Particulates as a Surrogate for Lead and Cadmium 3

3.3.1 Establishing Particulate Take Action and Stop Action Levels for Lead 3

3.3.2 Establishing Particulate Take Action and Stop Work Levels for Cadmium 4

3.3.3 Take Action and Stop Work Levels for PM_{10} as Surrogate 4

3.4 Stop Work Level for Wind 4

3.5 Particulate Monitors and Wind Data Monitoring and Notifications 5

3.5.1 Particulate Monitors 5

3.5.2 Wind Speed and Direction Data Monitoring 5

3.5.3 Notifications 5

3.5.4 Stop Work Criteria for Monitors 5

3.6 Dust Suppression Measures 5

3.6.1 Particulate Take Action Levels 5

3.6.2 Particulate Stop Work Levels 6

3.6.3 Visible Dust 6

4.0 AIR SAMPLES COLLECTED FOR LABORATORY ANALYSES **7**

4.1 Metals Analyses 7

4.2 Metals Concentrations Take Action Levels 7

4.3 Metals Concentrations Stop Work Levels 8

5.0 REPORTS **9**

5.1 Daily Dust Concentration and Wind Speed and Direction Summary Reports 9

6.0 QUALITY ASSURANCE / QUALITY CONTROL **10**

6.1 Particulate Monitors 11

6.1.1 Quality Control 11

6.2 Air Samplers 12

6.2.1 Quality Control 12

6.2.2 Quality Assurance 12

6.3 Laboratory Validation 13

6.4 Dust Concentration, Wind Speed and Direction Report Validation 13

6.5 Sample Information Management 13

7.0 POINTS OF CONTACT **14**

ATTACHMENTS

1. Descriptive Literature on E-BAM Particulate Monitors
2. NIOSH Method 7303

1.0 INTRODUCTION

The purpose of the air monitoring and dust control plans is to identify the measures that will be taken to monitor and minimize emissions associated with operation and closure activities at Exide Technologies' Class 2 Landfill (CL2LF) Corrective Action Management Unit (CAMU). The CL2LF CAMU (also referred to as the Landfill) is located at the Former Frisco Recycling Center (FRC) near Frisco, Collin County, Texas (Site). Specifically, this *Air Monitoring Plan* specifies the requirements and methods for monitoring ambient air quality for particulate matter (dust), lead and cadmium during landfill operation and closure activities. This plan works in conjunction with the *Dust Control Plan,* which describes operational controls to reduce dust emissions during landfill operations and closure activities. Landfill closure activities are described in detail in other components of the Final Landfill Closure Plan, to which this Perimeter Air Monitoring Plan is an Appendix.

Air quality monitoring during operation and closure activities will consist of ambient air monitoring to measure in the work area, as addressed in this Plan. Air quality will be monitored by Remediation Services, Inc. (RSI).

The primary objectives of the 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 Air 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 operation and closure activities in accordance with this Air Monitoring Plan.

2.0 ORGANIZATION OF PLAN

This Air Monitoring 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, it 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 in the work area during operation and closure activities that could generate dust. Real-time data from the downwind particulate monitors will be evaluated in 30-minute and 60-minute averaged blocks to provide immediate comparison to Take Action and Stop Work Level criteria. The data collection and reporting system which utilizes data generated by this equipment is described further in Section 3.5. Attachment 1 provides specific information regarding the E-BAM Particulate Monitors that will be utilized at the Site.

3.2 Monitoring Locations

Three downwind monitoring locations will be established each day and monitors placed in the work area to ensure adequate coverage to minimize the potential for impacts outside the Landfill. If Take Action or Stop Work criteria are exceeded, dust mitigation procedures outlined in the *Air Monitoring Plan* and *Dust Control Plan* applicable to each activity will be implemented. 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 on-site personnel as described in Section 3.5. If there is a 90 degree change in the prevailing wind direction averaged over a 30-minute period during the work day, the downwind monitors will be appropriately relocated and Landfill operation and closure 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 impacts outside the Landfill associated with site operation and closure 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-based PM_{10} surrogate levels will be calculated based upon correlations derived from project monitoring data and the more stringent of the two surrogate levels will be used to establish the ongoing Take Action and Stop Work Levels for PM_{10}.

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 a 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 (TAL^{PM-30}). The particulate Stop Work Level will be set on 30-minute (SWL^{PM-30}) and 60-minute (SWL^{PM-60}) 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. Until the AL^{Pb} is established as described below, the default TAL^{PM-30} will be 0.1 mg/m^3, and the SWL^{PM-30} will be 0.2 mg/m^3 (two times the default TAL^{PM-30}). The default SWL^{PM-60} will be 0.1 mg/m^3.

The AL^{Pb} will be calculated by the following method:

The lead content fraction (FPb), taking into account downwind air sampling stations, will be determined from project-collected particulate and lead concentration data based upon the following relationship in the measured downwind particulate 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 monitor and air sampler pairs.

$$\frac{\text{Pb mg/m}^3}{\text{PM}_{10}\text{ mg/m}^3} = \text{FPb (unitless)}$$

The highest of the calculated values from the three downwind particulate monitor and air sampler pairs will be the FPb. The AL^{Pb} for the particulate monitors for the action levels described above will then be calculated as follows:

$$\frac{\text{TPb mg/m}^3}{\text{FPb (unitless)}} = \text{AL}^{Pb}\ \text{mg/m}^3 \text{ (as particulates, PM}_{10}\text{)}$$

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. Until the AL^{Cd} is established as described below, the default TAL^{PM-30} will be 0.1 mg/m^3, and the default SWL^{PM-30} will be 0.2 mg/m^3 (two times the default TAL^{PM-30}). The default SWL^{PM-60} will be 0.1 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 monitor and air sampler pairs.

$$\frac{\text{Cd mg /m}^3}{\text{PM}_{10}\ \text{mg/m}^3} = \text{FCd (unitless)}$$

The highest of the calculated values from the three downwind particulate monitor and air sampler pairs will be the FCd. The AL^{Cd} for the dust monitors for the action levels described above will then be calculated as follows:

$$\frac{\text{(ESL Cd 0.0001) mg/m}^3}{\text{FCd (unitless)}} = \text{AL}^{Cd}\ \text{mg/m}^3 \text{ (as particulates, PM}_{10}\text{)}$$

3.3.3 Take Action and Stop Work Levels for PM_{10} as Surrogate

The TAL^{PM-30} (i.e., 30-minute block average Take Action Level) and SWL^{PM-60} (i.e., 60-minute block average Stop Work Level) for PM_{10} be the LOWER of the calculated AL^{Pb} and AL^{Cd}. In no event will the TAL^{PM-30} and the SWL^{PM-60} be greater than 0.15 mg/m^3. The SWL^{PM-30} (i.e., 30-minute block average Stop Work Level) will be two times the TAL^{PM-30}.

3.4 Stop Work Level for Wind

A wind speed Stop Work Level notification will be set on a ten-minute block average using data from a temporary meteorological station set near the Landfill. If the sustained wind speed (the wind speed obtained by averaging the measured values over a ten minute period) exceeds 20 miles per hour, all Landfill operation and closure activities must cease until the sustained wind speed declines to 20 miles per hour or lower for at least 20 consecutive minutes. Non-dust producing activities (equipment maintenance, etc.) may still be conducted during these periods.

3.5 Particulate Monitors and Wind Data Monitoring and Notifications

3.5.1 Particulate Monitors

The data obtained from 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. Cellular communication gateways will be installed at the Site to act as central communication hubs.

3.5.2 Wind Speed and Direction Data Monitoring

Wind speed and direction will be monitored using a temporary meteorological station set near the Landfill. The data will be transmitted to FDS directly via telemetry. This data will be integrated with the FDS monitoring 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 direction.

3.5.3 Notifications

Notifications of exceedances of the particulate or wind speed Take Action or Stop Work Levels at the downwind monitors will be sent via text message to field personnel. Notifications to the field office (RSI) will be sent via email. The notifications will be sent to RSI's site onsite Project Manager, Dust Control Technician, and the Golder Associates, Inc. On-site 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 temporary meteorological station set near the Landfill is lost for five minutes or more, all waste-disturbing activities will be suspended until the downwind particulate monitors and the temporary meteorological station set near the Landfill 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 at a downwind monitor exceeds the Take Action Levels presented in Table 1 ($TAL^{PM\text{-}30}$), RSI 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
- 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

3.6.2 Particulate Stop Work Levels

If the one-hour (60-minute) average or thirty-minute (30-minute) average PM_{10} concentration at a downwind monitor exceeds the applicable Stop Work Level (SWL^{PM-60} or SWL^{PM-30}) presented in Table 1, RSI will immediately stop all Landfill operation and closure work. During the work stoppage period (minimum 15 minutes), RSI must make dust suppression adjustments to reduce airborne particulate matter concentrations below the Take Action Level concentration for particulates. 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
- 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 dust suppression adjustments have been implemented (minimum 15-minute period), the work may resume. 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 on-site 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 at a downwind particulate monitor twice in one work day, RSI 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, equipment maintenance and other non-dust-producing activities may be performed.

3.6.3 Visible Dust

If visible dust is present in the active work zone, increased wetting of the area using water trucks or spray misters will be implemented. If visible dust is observed leaving the active work zone, work will stop until additional dust control measures are implemented. These additional dust control measures may include:

- Increased wetting/misting of work area
- Adding surfactant to the water used for dust control
- Adjusting the rate/speed and/or quantity of equipment in the work area
- Applying temporary cover (paper mulch with tackifier) to areas not being actively worked
- 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

4.0 AIR SAMPLES COLLECTED FOR LABORATORY ANALYSES

4.1 Metals Analyses

Air samples will be collected downwind in the vicinity of the Landfill for laboratory analyses of both lead and cadmium during Landfill operation and closure activities using a high volume (10 liters per minute) particulate air sampler. The samples will be collected approximately 2-3 feet away from the E-BAMs, to mitigate any air-flow disturbances that may be caused by the E-BAM enclosure. This analytical data will be correlated with the real-time particulate concentration data collected by the E-BAM monitors on a weekly basis, provided validated sampling results are received in a timely manner, and at a minimum every two weeks. Two weeks of analytical data will be correlated with the corresponding real-time particulate concentration data collected by the E-BAM monitors to establish a two-week rolling average. The lowest correlated particulate Take Action Levels for cadmium and lead calculated from the averaged data from each of the three downwind particulate monitor and air sampler pairs will be utilized for the dust monitors AL^{PM} until the next correlation is performed.

Air samples for these metals analyses will be collected by RSI on the first work day of every week and every other day through the week during Landfill operation and closure activities. Samples will not be collected on days when Landfill operation and closure activities are not occurring.

Air samples for metals analyses will be collected over a full working shift (typically eight – ten hours) using a Sensidyne Aircon 2 sampling pump capable of operating at 10 liters per minute. The intakes of the filter cassettes will be positioned adjacent to the inlet of the collocated E-BAM air inlet. The inlet port of the filter will be in a downward position. 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 will be located near the work area downwind. When the downwind air samplers are relocated with the E-BAM monitors due to a 90 degree change in the prevailing wind direction, averaged over a 30-minute period, the air 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 ten liters per minute, thereby resulting in an air sample volume of approximately 4,800 – 6,000 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 ALS Laboratory Group, in Salt Lake City, Utah for analysis of lead and cadmium. ALS is accredited by the TCEQ for analysis of environmental samples and is accredited by the American Industrial Hygiene Association (AIHA) for analysis of air samples and lead in soil, dust, paint and air. 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. This method is specifically accredited by the AIHA.

Laboratory data will be validated by Exide's consultant (Golder Associates Inc.) 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 are 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 from the downwind air samplers will be compared to the lead and cadmium Take Action Levels shown on Table 1. If either concentration in the downwind samples exceeds the relevant Take Action Level, RSI 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
- 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 from the downwind air samplers 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 µg/m^3 is divided by 0.14, yielding 1.07 µg/m^3 average concentration as the lead Stop Work Level. For cadmium, the TCEQ short term ESL of 0.1 µg/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, RSI will immediately stop all Landfill operation and closure 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
- 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 default action levels and responses for particulates, lead and cadmium. When sufficient site data has been collected following the start of the Landfill operation and closure activities, the action and stop work levels for particulates 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 Take Action and Stop Work levels will be updated weekly, provided timely sampling results are received, and at least every two weeks based upon the relationship between dust and measured metals concentrations.

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} Downwind Particulate Monitors	30-minute block average	PM_{10} > $TAL^{PM\text{-}30}$ Default $TAL^{PM\text{-}30}$ - 0.1 mg/m^3 average 30-minute concentration – Implement additional dust control measures.	PM_{10} > $SWL^{PM\text{-}30}$ Default $SWL^{PM\text{-}30}$ (two times $TAL^{PM\text{-}30}$) - 0.2 mg/m^3 average 30-minute concentration Stop Work. Implement additional dust control measures.
	PM_{10} Downwind Particulate Monitors	60-minute block average		PM_{10} > $SWL^{PM\text{-}60}$ Default $SWL^{PM\text{-}60}$- 0.1 mg/m^3 average hourly concentration Stop Work. Implement additional dust control measures.
Lead	High Volume Particulate Samplers	Three days per week	0.78 µg/m^3 – Implement additional dust control measures.	1.05 µg/m^3 average concentration.
Cadmium	High Volume Particulate Samplers	Three days per week	0.075 µg/m^3 – Implement additional dust control measures.	0.1 µg/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 (PM_{10}) and Wind Speed and Direction summary reports will be prepared by FDS. These summary reports will include the average 30-minute net block average PM_{10} results for each downwind 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 Golder Associates, Inc. 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 are received that are 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 Golder Associates, Inc. followed by validation. The summary report with validated data will then be submitted to TCEQ as described above. Concurrent with submittal to the TCEQ, the summary reports will be posted to the publicly accessible website established for the Exide Frisco Facility at http://www.exidefriscoclosure.com/.

6.0 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 subsections describe the QC, calibration, and auditing procedures to be used during this project.

Table 2 Schedule of Audits, Calibrations, and Quality Control Checks		
Frequency	**Activity**	**Acceptable Limits**
Prior to Delivery, Prior to Start of the Project	Calibration of E-BAM Monitors	
Prior to the Start of Work Each Week	Routine Checks of E-BAM Monitors (Tape Checks, Zero Checks, Leak Check, and clean size selective inlets), Verify Clock Settings, Housekeeping) and Air Samplers	Leak Check >1.0 lpm requires nozzle and vane cleaning Leak Check > 1.5 lpm invalidates data to previous leak check
Every Three Weeks	Flow Rate Calibration (Perform Barometric Pressure Sensor Audit, Temperature Sensor Audit Prior to Flow Test), Membrane Test and Pump Test of E-BAM Monitors	Flow Rate ±0.1 lpm of Traceable Reference Standard Audit Device Barometric Pressure Audit – Calibrate E-Bam Temperature Audit– Calibrate E-Bam Membrane Test – Pass/Fail Pump test – Pass/Fail Membrane Check Pass/Fail
Every Tape Change and At Least Monthly	Cleaning Nozzle and Vane of E-BAM Monitors (A Leak Check is required anytime detector tape is removed or a new tape is installed)	Leak Check >1.0 lpm requires nozzle and vane cleaning Leak Check > 1.5 lpm invalidates data to previous leak check.
Weekly	Field Blanks Collected for Air Samplers	See 7.3 below
Monthly	Trip Blanks Collected for Air Samplers	See 7.3 below
Yearly	Calibration of Met Station	Zero check wind speed

6.1 Particulate Monitors

6.1.1 Quality Control

The E-BAM particulate monitor beta detectors are calibrated at the factory. The beta detector 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 manually performed prior to the start of the project and at least every three weeks (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 project, and prior to the start of work each week.

QC flow checks will be performed by RSI personnel every three weeks to ensure that the correct sample flow rate is being maintained to provide proper particle size separation. The flow rate calibration is performed using a traceable reference standard flow audit device (BGI deltaCal® or equivalent). The barometric pressure and ambient temperature must be audited and calibrated, if necessary, prior to the flow check. The ambient temperature and barometric pressure indicated on the traceable reference standard flow audit device is compared to the ambient temperature and barometric pressure indicated on the E-BAM. If necessary, the ambient temperature and barometric pressure indicated on the traceable standard flow audit device is entered into the E-BAM to correct the E-BAM internal ambient temperature and/or barometric pressure sensor reading. The flow rate calibration can then be performed. The E-BAM internal flow rate is audited based upon the flow rate indicated by the traceable reference standard flow audit device. If necessary the E-BAM flow rate indicated on the traceable standard flow audit device is entered into the E-BAM to correct the E-BAM internal flow sensor reading. A pump test will be performed as well every three weeks.

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. Cleaning of the size selective inlets on the particulate monitors will be conducted prior to the start of each work week. 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 weekly and when the tape is removed or a new tape is installed. 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.

6.2 Air Samplers

6.2.1 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 air 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.

6.2.2 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 air 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.

Preventive maintenance will be part of the air 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 air samplers includes inspection and cleaning of the inlets.

6.3 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, Golder Associates, 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.

6.4 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, Golder Associates, 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.

6.5 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-LFOC-YYMMDD-LOC-XXX[-QQ], where

EX-LFOC	=	Project (Exide-Landfill Operations and Closure)
YYMMDD	=	Sampling date (e.g., 11/01/2012 = 121101)
LOC	=	Sample Location (e.g. 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 2015 would be identified as EX-LFOC-151101-DW-123.

7.0 POINTS OF CONTACT

Concerns regarding activities conducted at the Exide Technologies Frisco Recycling Center should be addressed to the following points of contact:

Exide:
Eduardo Salazar
P.O. Box 250
Frisco, Texas 75034
Ph: 972-335-2121
Cell: 972-786-5404
Fax: 972-377-2707
Eduardo.Salazar@exide.com

Texas Commission on Environmental Quality:
Margaret Ligarde
Office of Legal Services
MC-173
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Austin, Texas 78711
Ph: 512-239-3426
Fax: 512-239-0330
Margaret.ligarde@tceq.texas.gov

City of Frisco:
Mack Borchardt
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Fax: 972-292-6319
mborchardt@friscotexas.gov

ATTACHMENTS

ATTACHMENT 1

E-Bam Particulate Monitors

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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Regional Sales & Service: 3206 Main Street, Suite 106, Rowlett, Texas 75088 • Tel (972) 412-4747 • Fax (972) 412-4716
http://www.metone.com • metone@metone.com

Rev. 08/09

E-BAM

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.

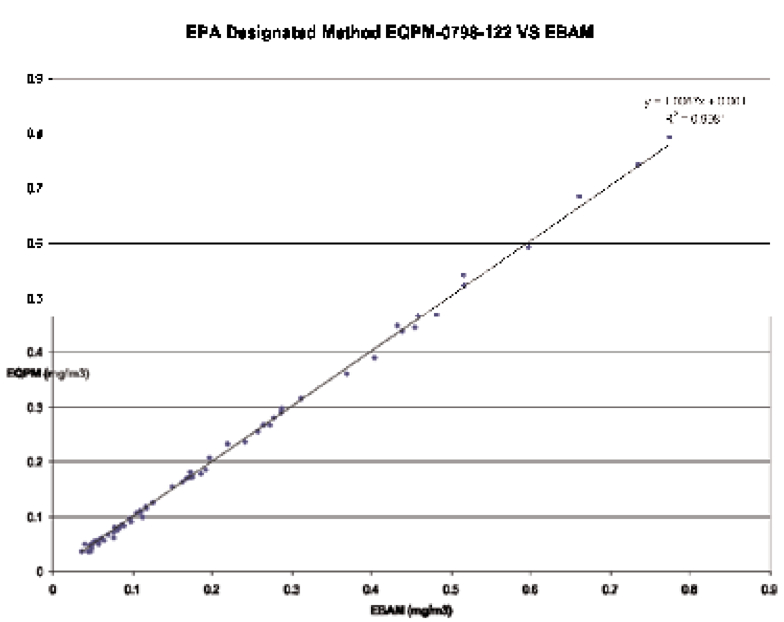
Continuous Monitoring

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.



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.

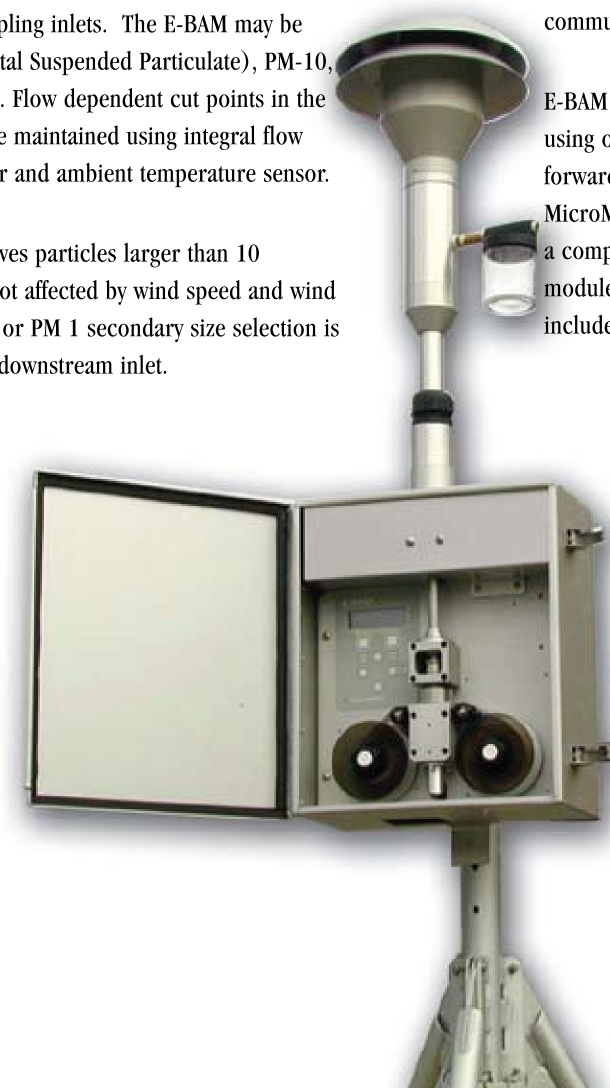
Set up

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 ($\check{S}$): Not evaluated

APPLICABILITY: The working range of this method is up to 100 mg/m^3 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.
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[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 MW	MP (°C)	LOD (µg/mL)	LOQ (µg/mL)	Estimated LOQ (µg/sample)*	Minimum** air vol. (L)	Maximum*** air vol. (L)
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/m^3 (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 under certain conditions (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.

APPENDIX I

NORTH CAMU DUST CONTROL PLAN

APPENDIX I
DUST CONTROL PLAN

for

Class 2 Landfill CAMU Final Operation and Closure Activities

at

Class 2 Landfill CAMU

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Frisco, Texas

Prepared by:

Remediation Services, Inc.

&

ENVIRON International Corp.

January 31, 2013
Updated August 24, 2015

Rev. 2

Reviewed by:

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Table of Contents

1.0 INTRODUCTION....1
1.1 Project Overview....1
1.2 Wind Monitoring and Dust Prevention Team....1
2.0 DUST CONTROL....1
2.1 Training of Personnel....2
2.2 Inspection and Maintenance....2
3.0 POTENTIAL DUST GENERATION ACTIVITIES AND PROPOSED CONTROLS....2
3.1 Dust Suppression Measures....3
3.1.1 Particulate Take Action Levels....3
3.1.2 Particulate Stop Work Levels....3
3.1.3 Visible Dust....3
3.2 On-Site Transportation....4
3.3 Waste Hauling and Placement....4
4.0 POINTS OF CONTACT....4

TABLES

ATTACHMENTS

1. Descriptive Literature on Dust Boss Misting Equipment
2. Additional Dust Suppression Materials

1.0 INTRODUCTION

The purpose of this Dust Control Plan is to identify the measures that will be taken to minimize emissions associated with operation and closure activities at Exide Technologies' Class 2 Landfill (CL2LF) Corrective Action Management Unit (CL2LF CAMU). The CL2LF CAMU (also referred to as the Landfill) is located at the Former Frisco Recycling Center (FRC) near Frisco, Collin County, Texas (Site). Specifically, this Dust Control Plan specifies the requirements and methods for minimizing dust generation during Landfill operation and closure 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 Dust Control Plan is to identify the steps that will be taken to reduce particulate emissions during Landfill operation and closure activities, and includes site specific dust suppression procedures. Best management practices (BMPs) will be implemented throughout the project. BMPs will include wetting active work areas, minimizing or ceasing activity during periods of high wind (greater than 20 miles per hour), sweeping or wetting paved areas, wetting unpaved areas, and application of dust suppressant materials. The *Dust Control Plan* provides specific information about the generation and control of dust emissions during Landfill operation and closure activities. This Dust Control Plan is to be used in conjunction with the *Air Monitoring Plan*. The following sections detail potential dust sources and dust control means and methods.

1.1 Project Overview

The overall project consists of the placement of Class 2 wastes in the Landfill and subsequent final Landfill closure activities. Waste placed in the Landfill will be waste generated during the ongoing demolition and remediation activities at the Site, including metals-impacted soils from the Undeveloped Buffer Property (J-Parcel) surrounding the Site (PBW, 2013). 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 Plan. These team members are also responsible for maintenance and revisions of the Dust Control Plan.

Employee Name	Employee Title	Designated Dust Control Responsibility
TBD	Project Manager, RSI	On-site project manager responsible to insure Dust Control Planis followed by all project team members.
John Gillman	Principal in Charge, RSI	Senior management authority; provide corporate support to ensure availability of necessary resources to maintain compliance with the Dust Control Plan.
Dan Roth	Director of Corporate Health and Safety, RSI	Qualified Individual; review and modify the Dust Control Plan to keep it current; ensure proper record keeping

2.0 DUST CONTROL

Dust control is a high priority during remediation activities. During all materials handling activities, 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 and 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. In addition, water trucks with a spray bar and spray hose(s) will be used to wet work areas prior to beginning work and as a supplemental dust control mechanism during the activities. 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 if needed. 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 ten minute period) exceeds 20 miles per hour, it is a “high wind condition.” When there is a high wind condition, all Landfill operation and closure activities must cease until the sustained wind speed declines to 20 miles per hour or lower for at least 20 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 Dust Control 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 Dust Control Plan.

2.2 Inspection and Maintenance

Dust suppression equipment will be inspected at least once a week and properly maintained. RSI will maintain records of the weekly inspections.

3.0 POTENTIAL DUST GENERATION ACTIVITIES AND PROPOSED CONTROLS

Landfill operation and closure 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 Landfill operation and closure 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	Use of airborne dust wet suppression system during operating hours for all material handling activities and otherwise as needed. Water spray/mist to wet work areas prior to beginning work and as a supplemental system. Adjust the waste placement rate. Suspend work under high wind conditions until sustained wind speed is below 20 mph for at least 20 consecutive minutes.

Truck Traffic	Wetting unpaved and paved haul roads prior to the start of activities each morning and as needed during working hours.
Waste Hauling and Placement	Use of airborne dust wet suppression system. Water spray/mist the work area prior to placement and as a supplemental system.

3.1 Dust Suppression Measures

3.1.1 Particulate Take Action Levels

If the thirty-minute (30-minute) average PM_{10} concentration from the downwind monitors exceeds the applicable Take Action Level set forth in Table 1 of the *Air Monitoring Plan*, RSI 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
- 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

3.1.2 Particulate Stop Work Levels

If the one-hour (60-minute) average or thirty-minute (30-minute) average PM_{10} concentration from the downwind monitors exceeds the applicable Stop Work Level set forth in Table 1 of the *Air Monitoring Plan*, RSI will immediately stop all Landfill operation and closure work. During the work stoppage period (minimum 15 minutes), RSI 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
- 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

3.1.3 Visible Dust

If visible dust is present in the active work zone, increased wetting of the area using water trucks or spray misters will be implemented. If visible dust is observed leaving the active work zone, work will stop until additional dust control measures are implemented. These additional dust control measures may include:

- Increased wetting/misting of work area
- Adding surfactant to the water used for dust control
- Adjusting the rate/speed and/or quantity of equipment in the work area.
- Applying temporary cover (paper mulch with tackifier) to areas not being actively worked
- 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

All employee vehicles will enter the Landfill area from the east or northwest construction entrances and employees will park in the designated parking area on the east side of the facility. No private vehicles will be allowed into the site.

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 and paved roads will be wetted using a water truck prior to the start of activities each morning and during working hours, as appropriate to minimize dust formation without creating runoff or tracking issues.

3.3 Waste Hauling and Placement

Controls for dust mitigation during waste hauling and placement will include operation of the airborne dust wet suppression system. In addition, a water mist/spray hose from a water truck will be used to wet material that is not already moist prior to work beginning and as a supplemental system during loading, hauling and placement to control dust.

4.0 POINTS OF CONTACT

Concerns regarding activities conducted at the Exide Technologies Frisco Recycling Center should be addressed to the following points of contact:

Exide:
Eduardo Salazar
P.O. Box 250
Frisco, Texas 75034
Ph: 972-335-2121
Cell: 972-786-5404
Fax: 972-377-2707
Eduardo.Salazar@exide.com

Texas Commission on Environmental Quality:
Margaret Ligarde
Office of Legal Services
MC-173
P.O. Box 13087
Austin, Texas 78711
Ph: 512-239-3426
Fax: 512-239-0330
Margaret.ligarde@tceq.texas.gov

City of Frisco:
Mack Borchardt
City of Frisco
6101 Frisco Square Blvd.
Frisco, Texas 75034
Ph: 972-292-5127
Fax: 972-292-6319
mborchardt@friscotexas.gov

ATTACHMENTS

ATTACHMENT 1

Descriptive Literature on Misting Equipment

Monsoon

DUST CONTROLLER-
DIESEL COMPLETE

BUFFALO TURBINE

Made in America

180 Zoar Valley Road, Springville, NY 14141 | ph 716.592.2700 | www.buffaloturbine.com | *Dealer Inquiries Welcome*

MONSOON **DUST CONTROLLER W/OSCILLATION** - ***DIESEL***

Applications

Demolition Sites | Landfills | Wood Recycling
Scrap Metal Recycling | Aggregate Processing
Waste Transfer

TOP BENEFITS

- Extended engine life when compared to traditional gas models
- Powerful and versatile
- Easy to operate and maintain
- Self contained

TOP FEATURES

- High speed oscillation up to 270°
- Dual 6 gallon fuel tanks for additional run time
- Low oil shut-off feature
- Low intake airflow shut-off
- 3 wheel off-road trailer package for ease of transport

ENGINE SPECS

- Kohler 3-cylinder diesel engine
- Liquid cooled, tier-4 compliant
- 3 year engine warranty
- 12 gallon fuel capacity

PHYSICAL SPECS

- Length w/wheels & handle removed: 88”
- Overall length w/nozzle & tow handle: 136”
- Width: 55”
- Max height w/nozzle in upright position: 54”
- Weight: 975 lbs.

GENERAL INFO

- Hand held wireless transmitter (water resistant) with push button control (manual control option available)
- Gyratory atomizing nozzle system
- Hose input: 3/4” utility / garden hose
- Min/Max water pressure: 40psi - 120psi
- Min/Max water volume: 1/3 gallon - 20 gallons per minute
- Throw distance (neutral wind conditions): Vertical: up to 50 ft, Horizontal: up to 125 ft
- Input RPM: Up to 3600 rpm
- Outlet size: 12”
- Droplet size: 50 - 200 microns

***Optional** Lifting Bracket

***Optional** Fork Lift Pockets

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	14.6	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

PLYMOUTH TECHNOLOGY

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

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: 280ºF Minimum (138ºC) 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

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/m^3 (oil mist)

ACGIH TLV: 5 mg/m^3 (oil mist)

ACGIH TLV STEL: 5 mg/m^3 (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 @ 68ºF (20ºC)
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

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® 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

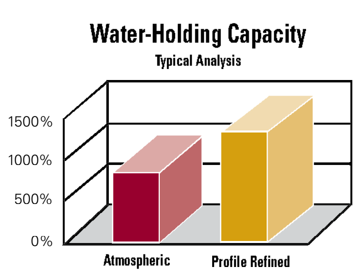
Nothing illustrates Conwed Fibers superior quality than a comparison of our wood fibers to those of our competitors.

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.

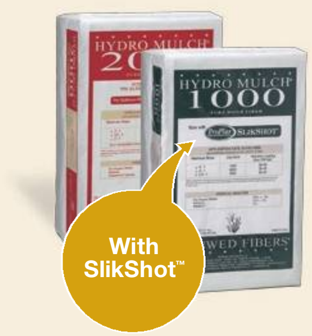
Convenient 50-lb Bales

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 hydrocolloid 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 Enviro-Blend 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
- 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 for more water holding capacity and a stronger bond
- 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

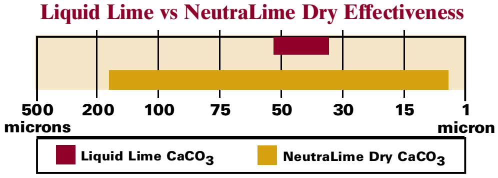
- **NeutraLime™ Dry –** Nothing balances soil pH faster – within 6-10 days of application – with the added plus of longer control – up to 18 weeks. Contains 50% more active ingredients than liquid lime.

  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

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  Packaging: 6-5 lb pails per case (A and C only), 2-16 lb jugs per case, 25-lb bag and 50-lb drum

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- **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)

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CF-12
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APPENDIX J

CONTINGENCY PLAN

GOLDER

REPORT

CONTINGENCY PLAN

Exide Technologies Frisco Recycling Facility
7471 Old Fifth Street, Frisco, Texas

R Bryan Luper
5-29-19

STATE OF TEXAS
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LICENSED
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May 2019

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5-29-19

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Table of Contents

1.0 INTRODUCTION AND PURPOSE 4

1.1 Introduction 4

1.2 Purpose 4

2.0 EMERGENCY COORDINATORS 5

3.0 TRAINING 6

3.1 On-Site Exide Employees and Contractors 6

3.2 Other Parties 6

3.3 Emergency Response Contractor 6

4.0 CONTINGENCY PLAN IMPLEMENTATION 7

5.0 EMERGENCY RESPONSE PROCEDURES 8

5.1 Notification 8

5.2 Identification Of Hazardous Material 8

5.3 Assessment 9

5.4 Control Procedures 10

5.4.1 Fire 10

5.4.2 Explosion 11

5.4.3 Tornadoes / Severe Weather / Flood 11

5.4.4 Material Spills 12

5.5 Prevention of Reoccurrence or Spread of Fires, Explosions or Releases 13

5.6 Wastewater Discharge 13

6.0 EMERGENCY EQUIPMENT 14

7.0 EVACUATION PLAN 15

7.1 Notification 15

7.2 Evacuation Routes 16

8.0 POST-INCIDENT PROCEDURES 17

8.1 Storage and Treatment of Released Materials 17

8.2 Post-Emergency Equipment Maintenance 17

8.3 Restoration 17

8.4 Required Written Reports 17

9.0 CONTINGENCY PLAN UPDATE, DISTRIBUTION AND CONTROL 19

9.1 Distribution and Coordination Agreements 19

9.2 Updates/Amendments 19

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5-29-19

List of Tables

Table 1 Potential Types of Incidents

List of Figures

Figure 1 Site Layout and Evacuation Route Map
Figure 2 Hospital Route Map

List of Appendices

Appendix A Emergency Coordinators and Emergency Response Contact Numbers
Appendix B Notifications
Appendix C Incident Report Form
Appendix D Emergency Equipment
Appendix E Fire Hydrant Flow Test Data Report

1.0 INTRODUCTION AND PURPOSE

1.1 Introduction

The Exide Technologies Frisco Recycling Center is located at Old 7471 5th Street in Frisco, Texas (“the Facility”). The 89-acre Facility is located near the intersection of Parkwood Drive and Eagan Way/Old 5th Street, approximately 1 mile north of the Frisco Police station and 1 mile south of Main Street. The layout of the Facility is shown on Figure 1. The locations of the Facility’s active wastewater, stormwater and waste management units, the North Corrective Action Management Unit (North CAMU), the flood wall, and the proposed Remediation Consolidation Area (RCA), as well as the closed units at the Facility are also shown on Figure 1. A summary of potential types of incidents and responses is provided in Table 1

1.2 Purpose

As appropriate, this Contingency Plan was developed to be consistent with 30 Texas Administrative Code §§ 335.152, 335.153 and 40 CFR 264 Subpart C (Preparedness and Prevention) and 40 CFR 265 Subpart D (Contingency Plan). This Contingency Plan describes the actions that personnel will take in response to severe weather, fires, explosions, or any unplanned sudden or non-sudden release of waste constituents to air, soil, or surface water at the Facility. This Contingency plan addresses measures applicable during the active remediation period and, to the extent provisions remain relevant, the post-closure period when the Facility will have limited on-site personnel. This Contingency Plan was also developed to meet the applicable requirements of 44 CFR 65.10(c)(3), which requires that sound emergency practices be included as a part of operating plans and criteria for the flood wall at the Facility.

2.0 EMERGENCY COORDINATORS

At all times, there will be at least one employee of Exide or their representative either on the Facility premises or on call (i.e., available to respond to an emergency by reaching the Facility within a short period of time) with the responsibility for coordinating all emergency response measures. A person shall be designated as the Emergency Coordinator (EC) and their contact information will be listed in Appendix A. During the times that remediation and closure activities are being performed at the Site, the Emergency Coordinator (or his formally delegated, qualified and authorized representative) will be on-Site. During the post-closure period and when the site is inactive or unattended, the EC will be on call but will be on the Facility premises when activities or conditions warrant (such as during maintenance activities). The Emergency Coordinator will be thoroughly familiar with all aspects of the Contingency Plan, all operations and activities at the Facility, the location and characteristics of waste, waste handling procedures, the location of all records at the Facility, and the Facility layout. In addition, the EC will have the authority to commit the resources needed to carry out the Contingency Plan.

There may be changes to the Facility's emergency contact information from time to time and Appendix A will be revised as necessary and kept on file at the Facility to maintain a current list of the responsible individuals and organizations and their contact information. Changes to emergency contacts will be revised through a class 1 permit modification with associated written notification made to the relevant personnel and organizations. The notifications will be promptly posted on the Exide Frisco website.

If an individual is injured, or a situation is created that could negatively impact the community, the first call made by the EC will be to 911.

3.0 TRAINING

3.1 On-Site Exide Employees and Contractors

Training on the content of this Contingency Plan will be provided by the EC to each Exide employee and contractor working at the Site as part of the initial health and safety training that is required for all on-Site visitors and personnel. Exide and contractor employees will be required to sign off on a Site orientation form that confirms their understanding of this Contingency Plan, and other health and safety policies required for the Site. The training will be required on the first day of work/visit at the Site and annually thereafter. Should changes be made to this Contingency Plan, additional training will be provided when the revised plan is implemented. The Contingency Plan will also be provided electronically to contractors prior to mobilizing to the Site to ensure that requirements can be incorporated into standard work procedures and plans that will be used at the Site.

3.2 Other Parties

As described in Section 9.1, the Contingency Plan will be provided to local emergency responders and the City of Frisco Management following the TCEQ’s approval of the Closure Plan and this Contingency Plan. An offer will also be made to brief these organizations on the type of materials and activities involved at the Facility.

3.3 Emergency Response Contractor

As listed in Appendix A, Remediation Services, Inc. (RSI) will be designated as the primary emergency response contractor. In the event that RSI is not present at the Site at the time of the incident, Sunbelt Industrial Services (Sunbelt) will be utilized as the local contractor for emergency response. RSI and Sunbelt will have a copy of this Contingency Plan and personnel who may respond to the Site in case of an emergency will be trained on the contents of the plan.

4.0 CONTINGENCY PLAN IMPLEMENTATION

The Contingency Plan will be implemented whenever the emergency coordinator/alternate determines an imminent or actual hazard exists which could threaten human health or the environment. This section provides the criteria used by the emergency coordinator/alternate in making the decision to implement the Contingency Plan. The Contingency Plan will be implemented in the following situations:

- Any event at the Facility involving fire and/or an explosion
- In the event of tornadoes or severe weather
- In the case of flood events,
  - Adverse weather projections (flood warnings);
  - Observed increased water flows
  - Potential or actual flood wall breaches
- Any spill occurring outside of the active waste disposal management area
- Any spill within the containment system with the potential for leakage or overflow from the containment system
- Any spill which could result in a fire and/or explosion
- Any spill or release that has the potential for damaging human health or the environment.

In no circumstance should an employee or contractor put themselves in danger. Therefore, it is imperative to assess the situation as rapidly and as accurately as possible. Never attempt to act in any emergency situation without first alerting an emergency coordinator, supervisor, or outside emergency responder. The first duty of employees is to remain safe and report the emergency to the EC. The EC will provide instructions on how to proceed if different than described for each emergency procedure listed in Section 5. In the event of an imminent or actual emergency situation, the EC will follow the emergency response procedures as described in Section 5, notify all Facility personnel or contractors who may be at the Facility, and notify appropriate state or local agencies with designated response roles if their help is needed. Should an evacuation be required, Figure 1 provides an evacuation route map. (Evacuation procedures are described in Section 7). Should any injuries or suspected injuries occur, Figure 2 indicates the route from the Facility to the nearest medical facility.

5.0 EMERGENCY RESPONSE PROCEDURES

The following emergency procedures shall be followed in the event of an imminent or actual emergency situation. Emergency situations and response instructions will be communicated to on-site staff, contractors and visitors in person or using a radio or cellular telephone.

5.1 Notification

In the event of an emergency:

1. The person first noticing the incident will immediately notify the EC or the on-call alternate. All Facility contractors working at the Facility will be trained to immediately notify other personnel and the EC of a potential hazard. Contractors are to be trained annually (or following any revision to the Plan) on the entire content of the Contingency Plan.
2. The EC will determine whether or not to implement the Contingency Plan.
3. The Contingency Plan may be implemented for less than the entire Facility area.
4. Upon notification, the EC will assess the incident. This assessment will include all of the following:
   A. Materials involved in the incident
   B. Need for evacuation or other actions (e.g. move to higher ground)
   C. Threat to human health or the environment outside the Facility area
   D. “In-house” incident response capabilities
5. If the emergency coordinator determines that evacuation is required, the EC will activate the EVACUATION PLAN (see Section 7).
6. In the event of an incident that may threaten human health or the environment outside the Facility area, the emergency coordinator will notify the appropriate outside agencies by telephone (see Appendix A). Otherwise, any required notifications will be made after the emergency is under control, according to the protocol outlined in this section.
7. When notifying any response agency, the following information will be given:
   A. The name and telephone number of the person calling
   B. The name and address of the Facility
   C. The time and type of incident (e.g., release, fire, etc.)
   D. The name and quantity of material(s) involved, to the extent known
   E. The extent of injuries, if any
   F. Any known possible hazards to human health or the environment outside the Facility area

5.2 Identification of Hazardous Material

In the event of an incident at the Facility, the EC will first identify the sources, amount and types(s) of material involved, as well as the area/extent of the release, fire, flood, or explosion. The initial identification will be by visual analysis of the incident location and the materials involved, review of available records and manifests, or, if necessary, by chemical analyses.

With the release information, the EC will assess possible hazards to human health, the environment, the Facility, and other materials on-site. The assessment will consider both direct and indirect effects of the release, fire, explosion, flood, or other emergency event. Consideration will be given to the effects of any toxic, irritating, or asphyxiating gases that could be generated and the effects of any hazardous surface water run-offs from water or chemical agents used to control fire and heat induced explosions. Considerations for transport of materials or wastes during flood events will also be considered.

Waste and hazardous materials expected to be at the Facility include the following:

- The following wastes authorized to be contained in the North Corrective Action Management Unit (CAMU):
  - The treated slag that currently exists in cells 1 through 12 of the CAMU
  - Remediation waste associated with clean-up activities for VCP No. 2541 (J Parcel) and other remediation waste approved in the final Remediation Action Plan (RAP) for the Facility and/or the final Closure Plan
- The following wastes authorized to be contained in the Remediation Consolidation area (RCA):
  - Surface soils exceeding applicable protective concentration levels (PCLs) excavated from affected property at the Facility where no cap is planned
  - Sediments and waste materials exceeding applicable PCLs removed from portions of Stewart Creek on or downstream from the Facility
  - Other remediation waste approved in the final RAP and/or the final Closure Plan
- Liquids associated with routine operation of vehicles and power equipment in use by the contractor
- Contact and non-contact storm water
- Wastewater treatment chemicals

5.3 Assessment

The EC will first determine the nature of the incident (e.g., flood, fire, explosion, or other release of material). If an explosion or fire occurs that could threaten human health or the environment, the EC will attempt to ascertain the immediate cause in order to determine the potential for another explosion or if additional fires could be started. In the event of an explosion or fire that could threaten human health or the environment, the EC will first notify the Frisco Fire and Police Departments. Subsequently, the National Response Center (phone numbers listed in Appendix A) will be advised of any reportable release. Upon identifying the material causing the incident, the EC will assess the potential and existing hazards through knowledge of hazards posed by individual materials and wastes.

Records for these wastes and materials are available from the following locations:

- Contractors will maintain a book of Safety Data Sheets (SDSs) at the Facility for any hazardous materials used during the Site remediation and closure process of the North CAMU and the RCA
- Information regarding the typical chemical composition of slag such as that disposed in the North CAMU will be kept along with the SDS sheets in the Exide trailer or will be available from an Exide representative or designated consultant or on-site contractor

- Sampling results for remediation wastes will be available in the Exide trailer or will be available from an Exide representative or designated consultant or contractor

The EC will convey all such information to responding emergency assistance teams.

5.4 Control Procedures

After assessing the extent of the emergency situation and the possible hazards posed, the emergency coordinator will initiate the following type-specific control procedures with the assistance of Facility contractor personnel and/or any necessary outside agencies. In general, these procedures will be consistent with the emergency response procedures outlined above. The initial response priority in any emergency will be to protect human health and safety and then the environment. Identification, containment, treatment, and disposal assessments will be the secondary response. The EC will document all control, response, and clean-up procedures.

While the Facility is in operation, the Exide trailer will be used as the Emergency Operations Center, if needed and it is safe to do so. In the event that the Exide trailer is not available or is inaccessible, the EC will designate an alternate location as the Emergency Operations Center. The Emergency Operations Center will serve as a location where key personnel can coordinate a response.

5.4.1 Fire

No ignitable, corrosive, incompatible, or reactive materials will be accepted in support of the Facility closure. Non-waste related fires from the use of small amounts of these materials (liquids associated with routine operation of vehicles and power equipment in use by the contractor) could occur (vehicle fires, building fires, etc.) and would be responded to as detailed below.

Any fires will be assessed by the Facility contractors. All Facility contractors will be trained to first notify appropriate persons. Any fire will be assessed to determine if it is an incipient stage fire[1]. If so, if facility contractors have been trained on using portable fire extinguishers, they may use the portable fire extinguisher to fight the fires. If the fire has passed the incipient stage, Facility personnel will be trained to call 911 immediately. In no case will Facility contractors risk injury or life fighting a fire.

The fire extinguishers located at the Exide trailers, near the generator located at the North CAMU and at the wastewater treatment plant (see Appendix D) are classified as ABC type. Any fire extinguishers brought to the Site and used by contractors should also be ABC type.

Under no circumstances shall any Facility contractor attempt to fight a fire that cannot readily be extinguished by use of a portable fire extinguisher. Any fire of greater size requires evacuation of the area and notification of the emergency coordinator.

If it possible to do so without risk of injury (following criteria listed above) and the Facility contractor has been appropriately trained, the Facility contractor will attempt to extinguish the fire with the appropriate fire suppression equipment as described below:

[1] 29 CFR 1910.155(c)(26) defines "incipient stage fire" as a fire which is in the initial or beginning stage and which can be controlled or extinguished by portable fire extinguishers, class II standpipe or small hose systems without the need for protective clothing or breathing apparatus.

- Do use the PASS technique as described in Fire Extinguisher training.
- Do NOT attempt to extinguish a fire
  - That has become too large for a single extinguisher.
  - Places the fire between you and safe egress.
  - If you cannot see your safe egress.
  - Without alerting others.

5.4.2 Explosion

Explosive materials are not expected to be used or disposed of at the North CAMU or the RCA or elsewhere at the Facility. The only materials that might be present that represent an explosion hazard are fuels for on-site vehicles and equipment. In the unlikely event of an explosion, the Facility contractor will alert the emergency coordinator and outside emergency personnel.

It is imperative that extreme caution be utilized in assessing emergencies involving an explosion. The Facility contactor will assess the surroundings for the cause of the explosion. The contractor will look specifically for situations where another explosion is imminent or possible. If it is safe to do so, the contractor will remove ignition sources or other causes of explosion.

If there are no signs of further imminent explosions, the fire response will proceed as described above.

5.4.3 Tornadoes / Severe Weather / Flood

The following Severe Weather Sheltering Procedures should be followed when there is potential or confirmed severe weather in the area. The designated location to seek shelter for a tornado is the Frisco Police Department located at 7200 Stonebrook Parkway, approximately one mile to the south of the Facility along Parkwood Boulevard. The location is shown on Figure 1.

- In the event of severe weather (tornado, severe thunderstorm or flood watches/warnings), the EC or a designee will monitor the weather status of the area.
- If the local emergency siren blows, or in the event of imminent danger to the Facility, the EC or a designee will provide a verbal warning or notify Facility personnel using another means of communication.
- All employees and contractors should immediately stop work and turn off any equipment in the affected area or in the entire Facility if it is safe to do so, as warranted.
- In the event of a flood warning, equipment and materials should be moved to higher ground, if it is safe to do so. The priorities for a flood emergency are: protection of human health, environment and property; communication of hazardous conditions; and restoration of normal operations.
- For a tornado warning, employees and contractors should proceed by vehicle to the severe weather shelter at the Frisco Police Department in a calm and orderly manner. For a severe thunderstorm warning or flood warning, employees and contractors should seek shelters in vehicles or job trailers, or in areas of higher ground (for flood events).

- Employees and contractors should not leave the severe weather shelter until instructed to do so by the emergency coordinator or designee.
- The EC or designee shall monitor the current weather situation and local emergency services to determine when it is safe for employees and contractors to leave the severe weather shelter.
- After the all clear signal is given and it is safe to leave the severe weather shelter, EC or designee will perform a Facility walkover and follow the procedures for follow-up actions as indicated in Section 8 of this Plan.

5.4.4 Material Spills

For material spills during loading, unloading, or transfer of waste or hazardous substances, the EC and/or contractors will don appropriate personal protective equipment, which may include gloves, disposable coveralls, protective boots, face shields/goggles, and respirators. Any nearby electrical power or potential ignition sources will be isolated.

The worst-case spill or release scenario would occur in connection with a release of materials from a truck prepared to dump waste into the North CAMU or RCA. This worst-case spill could involve up to 30 cubic yards of class 2 waste or waste exceeding applicable PCLs. Such quantity would not cause material to spill beyond the unit boundaries and could be readily contained, recovered, and appropriately placed into the appropriate waste management unit.

Spilled remediation wastes (already approved for disposal at the Facility) will be contained, removed, and transferred into the North CAMU or the RCA. Where necessary and as appropriate, the spill area(s) will be decontaminated or excavated to ensure complete cleanup. Surrounding soils will be sampled and analyzed for the presence of appropriate constituents to assure complete cleanup.

It should be noted that no liquid waste will be disposed in the North CAMU or the RCA. Therefore, any potential hazardous liquid spills would be related to maintenance chemicals, fuels, etc. Absorbent may be applied around liquid spills to contain and absorb free-standing liquid. If necessary, appropriate neutralizing agents would be applied prior to clean-up efforts. Any containers near the spill area would be moved to eliminate the possibility of other leaks. The leaking container would be transferred into a new container. Overpack drums would be packed with absorbent or pozzolanic reagents. Once controlled and absorbed, spilled material would be placed into a compatible empty drum.

In the event of a release, waste will be excavated and placed in compatible 55-gallon drums or roll-off boxes for bulk disposal, as appropriate. Surrounding soils will be sampled and analyzed for the presence of appropriate constituents to confirm effective clean-up.

Any drums and material generated from spill clean-up (other than waste already approved for disposal in the North CAMU or RCA as described above) will be properly labeled and sent to an approved off-site treatment and/or disposal facility. In the event materials are shipped off-site, appropriate manifest system, recordkeeping and reporting requirements will be used.

5.5 Prevention of Reoccurrence or Spread of Fires, Explosions or Releases

During an emergency, the EC will take all reasonable measures necessary to ensure that fires, explosions, or releases do not occur, recur, or spread. These measures could include stopping processes, traffic, and operations. Additionally, containers will be isolated or removed to prevent further involvement of the emergency event.

If a fire, explosion or release were to occur during loading, unloading or transfer of waste, the subject operations would cease. Trucks and/or other equipment involved would be moved from the incident area as directed by the EC. Where necessary and practicable, a trench excavation or a containment berm would be made by the heavy equipment in order to contain the release. If this is not practicable, absorbent booms or pads would be used to contain the release. Equipment used would be decontaminated at the point of the incident to limit any spreading by tires or tracks.

5.6 Wastewater Discharge

Leachate from the North CAMU is directed to a leachate storage tank and contact stormwater is directed to the Solar Evaporation Pond. If there are any releases of reportable quantities within a 24-hour period from the leachate storage tank or Solar Evaporation Pond, the EC or alternate will call as soon as possible to report the release. The call should go to both the Texas Commission on Environmental Quality (TCEQ) Region IV office spill reporting hotline (800-832-8224) and the National Response Center (NRC) (800-424-8802). See Appendix A for additional information.

6.0 EMERGENCY EQUIPMENT

A list of potential emergency equipment is provided as Appendix D and will be updated as needed. An up-to-date version of this list will be maintained at the on-site Exide trailer or will be available from an Exide representative or designated consultant or contractor following final closure activities. The list will include the location and a physical description of each item on the list and a brief outline of its capabilities.

Protective clothing and equipment will be provided to protect employees during normal and emergency operations. Such equipment may include, if necessary, first aid kit, gloves, goggles, disposable coveralls, and respirators. Monthly inspections are performed for the Automated External Defibrillators (AED) at the Facility and the eyewash and emergency showers are inspected weekly. AEDs will only be used in emergency situations and will only be operated by properly trained personnel. Inspections will also be performed after storms or emergency events.

The Frisco Fire Department has its own emergency equipment that is subject to the department's regular inspection and maintenance procedures to respond to any incidents that may occur. The City of Frisco provides fire suppression services for the Facility and has an Insurance Services Office, Inc. (ISO) Public Protection Classification (PPC) of 1 (best public protection on a scale of 1 to 10) based on Classification designated by the State Fire Marshal. Water is provided to the Facility by the City of Frisco and is accessible to City of Frisco emergency responders by hydrants available at the Facility (see Figure 1). The water pressure from the hydrants is sufficient for emergency response needs at the Facility. Fire hydrant flow test data is included in Appendix E.

7.0 EVACUATION PLAN

This Contingency Plan includes an evacuation plan for Facility personnel where there is a possibility that evacuation could be necessary. The following paragraphs describe notification and signals to be used to begin evacuation, evacuation routes, and alternate evacuation routes (in cases where the primary routes could be blocked by releases of hazardous waste or fires).

7.1 Notification

If in the assessment of the emergency event the EC determines that evacuation of the Facility or local areas may be advisable, they will immediately notify Facility personnel by telephone or radio and appropriate local authorities by telephone, indicate the extent and type of emergency that exists (fire, spill, etc.), and make themselves available to help appropriate officials with evacuation planning. The foremost local authority is identified as the Frisco Fire Department (911).

In the event of an emergency where environmental contamination associated with reportable releases is imminent, in addition to notifying the Frisco Fire Department (911 emergencies), the following governmental agencies will be notified by the Exide Technologies EC or an alternate Exide Technologies contact:

Agency	Emergencies Notified for:	Telephone #
Frisco Fire Department	Any Potential fire or explosion	911 (Emergencies)
Frisco Hazardous Materials Team	Any hazmat Contingency Plan incident	911 (Emergencies)
Police Department	Any potential evacuation, traffic or security control	911 (Emergencies)
Emergency Medical Service	Any medical emergency	911 (Emergencies)
Collin County Local Emergency Planning Committee (Collin County Fire Marshal)	In the event of a reportable release	972-548-5576
TCEQ Region IV (State Emergency Response Commission, SERC)	All reportable spills or release incidents must be reported within 24 hours	800-832-8224 (24 hr)
National Response Center (NRC) Coast Guard	All reportable spills or releases – RQ	800 424-8802 (24 hr)

The emergency coordinator will provide the following information in the notification:

- Name and telephone number of reporter
- Name and address of facility

- Time and type of incident (e.g., release, fire)
- Name and quantity of material(s) involved, to the extent known
- The extent of injuries, if any
- The possible hazards to human health, or the environment, outside the Facility

Upon the determination that a reportable incident has occurred, the responsible person shall notify the agency as soon as possible but not later than 24 hours after the discovery of the spill or discharge.

In the event of emergencies involving leaks, fire, or explosions (which may require additional assistance), at the direction of the emergency coordinator, the qualified emergency response contractor will be contacted. RSI will be designated as the primary emergency response contractor. In the event that RSI is not available at the time of the incident, Sunbelt will be utilized as the local contractor for emergency response. RSI and Sunbelt will each have a copy of this Contingency Plan and will be trained on the contents of the plan.

7.2 Evacuation Routes

Any evacuation of the Facility will follow the normal emergency evacuation procedures as posted within the Exide trailer.

The primary evacuation Route is included as Figure 1. In general, the evacuation route from the North CAMU is to travel south along the west side of the North CAMU along the road and then to the east, exiting the Facility via Eagan Way. The evacuation routes from the RCA and the Exide trailer also travel east and exit the Facility via Eagan Way.

Any evacuation of the surrounding properties will be coordinated with the local fire and police departments.

8.0 POST-INCIDENT PROCEDURES

8.1 Storage and Treatment of Released Materials

Immediately after an emergency, the EC will provide for treating, storing, or disposing of recovered waste, contaminated soil or surface water, or any other material that results from a release, fire, or explosion at the Facility. When the emergency response and cleanup have been completed, all wash waters and disposable cleaning materials need to be contained and packaged as the same waste category as the waste involved in the emergency and disposed of in accordance with the regulations for that class of waste. The EC will ensure that, in the affected area(s) of the Facility, no waste that may be incompatible with the released material is treated, stored, or disposed until cleanup procedures are completed.

8.2 Post-Emergency Equipment Maintenance

All emergency equipment listed in this Contingency Plan will be cleaned and fit for its intended use before waste management operations are performed. Non-expendable items such as tools and material handling equipment are to be inspected and cleaned in an appropriate solvent or detergent and placed back in the original location. Inoperable emergency equipment will be serviced, repaired, or replaced.

All tanks and containerized waste will be thoroughly inspected for leaks, pressure build-up and structural integrity by the construction manager (during closure activities) or the EC. Any deficiencies will be immediately corrected.

8.3 Restoration

As soon as practical, but no later than 48 hours after an incident is concluded, the restoration process will be initiated. This process may include the following activities (or other activities as appropriate):

- Inspection and repair of waste management unit caps to their original integrity and Closure Plan specifications
- Any sampling and comparison to appropriate Texas Risk Reduction Program (TRRP) screening levels, with additional actions as required
- Reseeding of repaired cap surfaces in accordance with the original Closure Plan specifications
- Inspection and repair of any damaged Facility equipment, security fencing, flood wall, drainage structures, etc.

8.4 Required Written Reports

When this Contingency Plan is implemented to address fire, explosion, or release of reportable quantities of constituents, a follow-up notification letter will be delivered by Exide to the Texas Commission on Environmental Quality, Remediation Division, MC225, PO Box 13087, Austin, Texas 78711-3087, as soon as practicable, but no later than 15 days after the incident or within 5 days for unauthorized discharge to waters (per TPDES permit). If warranted, a written report or follow-up will be provided to the National Response Center (NRC) or other appropriate agencies (such as Environmental Protection Agency), as appropriate. The follow-up notice will update the following information included in the initial notification and provide information on actual response actions taken and advice regarding medical attention necessary for citizens exposed.

- Name, address, and telephone number of the owner or operator

- Name, address, and telephone number of the facility
- Date, time, and type of incident (e.g., fire, explosion)
- Name and quantity of material(s) involved
- The extent of injuries, if any
- An assessment of actual or potential hazards to human health or the environment, where this is applicable
- Estimated quantity and disposition of recovered material that resulted from the incident

An Incident Report form is included as Appendix C.

9.0 CONTINGENCY PLAN UPDATE, DISTRIBUTION AND CONTROL

9.1 Distribution and Coordination Agreements

Copies of this plan will be distributed, at a minimum, to the following local authorities and service agencies that may be summoned in the event of an emergency:

FIRE DEPARTMENTT/EMERGENCY MANAGEMENT:
Frisco Fire Department (Central Fire Station)
Mr. Mark Piland (Fire Chief/Emergency Management Coordinator)
Mr. Jason Lane, Deputy Emergency Management Coordinator
8601 Gary Burns Drive
Frisco, TX 75034
972-292-6300

POLICE:
Frisco Police Department
Mr. John Bruce (Chief of Police)
7200 Stonebrook Parkway
Frisco, Texas, 75034
972-292-6100

CITY OF FRISCO
Mack Borchardt
Special Assistant to the City Manager
City of Frisco
6101 Frisco Square Blvd.
5th Floor
Frisco, Texas 75034
972-292-5127

The Contingency Plan will be provided to these local emergency responders and the City of Frisco Management following the TCEQ's approval of the Closure Plan and this Contingency Plan. Exide will also provide a copy of the plan to any contractor or consultant requested by the City of Frisco. An offer will also be made to brief these organizations on the type of materials and activities involved at the Facility. Letters of notification and a copy of the Agreement Request to the above organizations are included as Appendix B. The Contingency Plan will be incorporated as an Appendix to the Site-Specific Health and Safety Plan (HASP) for the Site. The Contingency Plan and HASP will be provided to all on-Site workers and appropriate State or local oversight staff. If updates are made to the Contingency Plan, revised copies will be submitted to these organizations (and any contractors or consultants requested by the City of Frisco). Exide will consider input to this Contingency Plan from the City of Frisco if it is submitted to the Exide Emergency Coordinator in writing.

9.2 Updates/Amendments

Updates or amendments will be reviewed and immediately implemented if

- The Final Closure Plan is revised;
- This Plan fails in an emergency;

- The Facility design, construction, operation, maintenance, or other circumstances change to increase the potential for fires, explosions, or releases of hazardous wastes or hazardous waste constituents, or change the response necessary in an emergency;
- Emergency coordinators are changed; or
- Emergency equipment changes.

TABLES

Table 1: Potential Types of Incidents
Exide Technologies Frisco Recycling Facility
Contingency Plan

Fire Incidents	
Type of Incident	**Potential Response (See Section 5.4.1)**
Vehicle or equipment fire	Extinguish or notify and evacuate
Brush fire (lightning)	Extinguish or notify and evacuate
Explosion	
Type of Incident	**Potential Response (See Section 5.4.2)**
Explosion from vehicle or equipment	Notify
Severe Weather	
Type of Incident	**Potential Response (See Section 5.4.3)**
Tornado or severe thunderstorm watch	Notify and monitor weather
Tornado or severe thunderstorm warning`	Notify, take cover in designated area of Exide trailer or at Frisco Police Department, and monitor weather
Ice/snow storm	Notify, monitor weather, and demobilize from Site as needed
Potential Flooding	Notify, monitor weather, move equipment/materials, and demobilize from Site as needed
Material/Waste/Wastewater Spills	
Type of Incident	**Potential Response (See Section 5.4.4 and 5.6)**
Waste spill (soil, sediment or other approved remediation waste)	Transfer waste to North CAMU or RCA, characterize and remove impacted surrounding soil (as appropriate)
Release of fuel or fluids from equipment or vehicles	Deploy spill kits, notify if needed, characterize and remove impacted surrounding soil (as appropriate).
Release of fuel from on-site storage tank (contractor portable tank)	Deploy spill kits, notify if needed, characterize and remove impacted surrounding soil (as appropriate)
Release from North CAMU leachate storage tank or solar evaporation pond	Deploy spill kits, notify if needed, characterize and remove impacted surrounding soil (as appropriate).

Notes:

- Notify – Notify emergency coordinator and all on-site personnel (i.e., Exide, contractors, visitors) of potential emergency.
- Evacuate – Follow evacuation procedures listed in Section 6.0 of the Contingency Plan.
- Extinguish – If fire is small and can be contained using portable fire extinguisher, contractor can attempt to extinguish if trained.

FIGURES

LEGEND

- Disposal Area
- Remediation Consolidation
- Approximate North CAMU Extent
- Former Operating Plant Property Boundary
- Equipment Staging
- Proposed Flood Wall
- Evacuation Route
- Fire Hydrant
- Severe Weather Shelter

R Bryan Luper
5-29-19

STATE OF TEXAS
R. BRYAN LUPER
83963
LICENSED
PROFESSIONAL ENGINEER

500 250 0 500
Feet

REFERENCE

1. AERIAL IMAGERY - SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY AND PLANT SITE TAKEN 4/1/2017

CLIENT
EXIDE TECHNOLOGIES

PROJECT
RCRA PERMIT RENEWAL

TITLE
SITE LAYOUT AND EVACUATION ROUTE

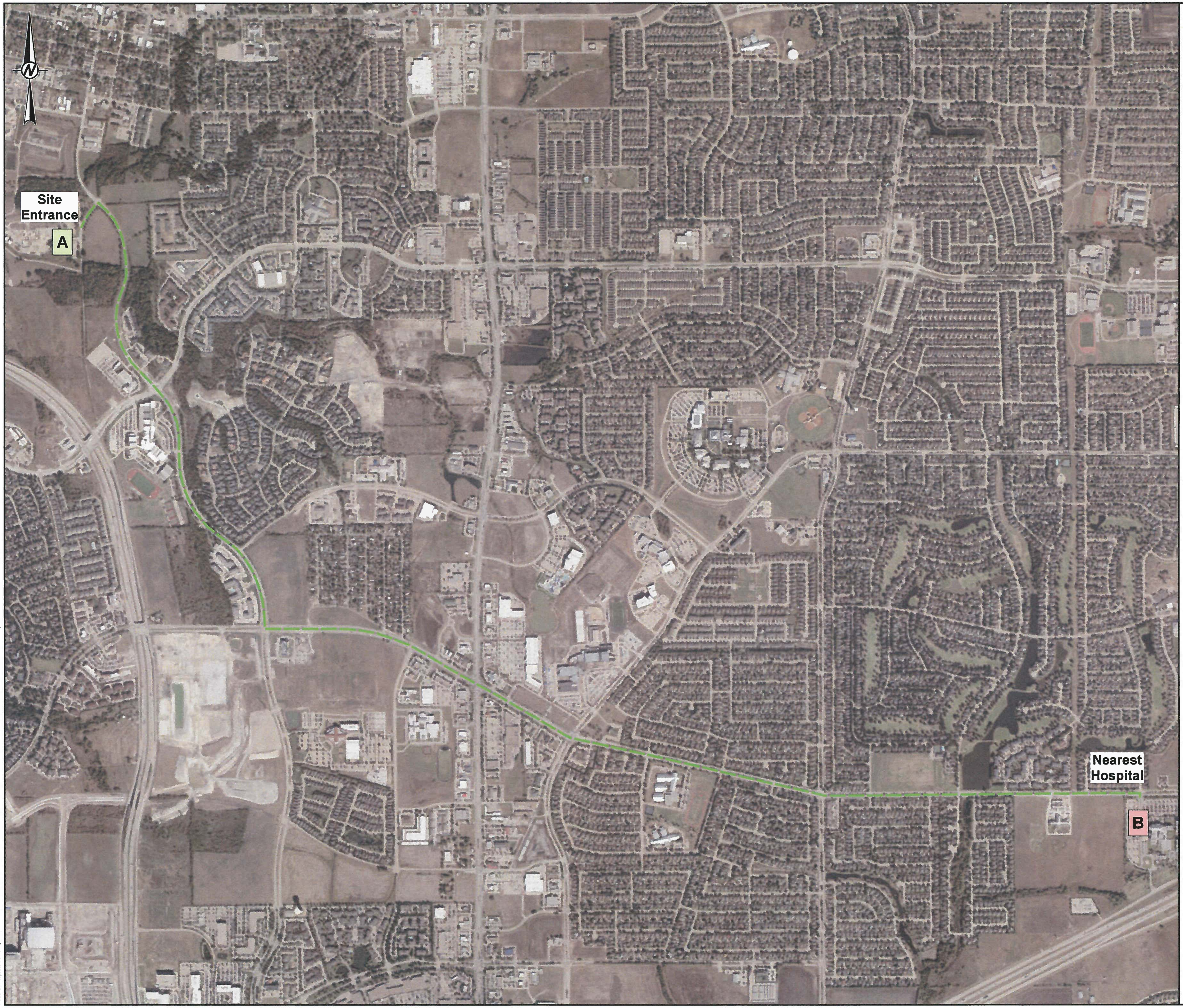
CONSULTANT

GOLDER

YYYY-MM-DD	2019-05-06
PREPARED	EFT
DESIGN	EFT
REVIEW	EPW
APPROVED	AMF

PROJECT No.	CONTROL	Rev.	FIGURE
13-0208606	1302086ZF034.mxd	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI B



LEGEND

Route to Hospital

R Bryan Luper
5-29-19

STATE OF TEXAS
R. BRYAN LUPER
83963
LICENSED
PROFESSIONAL ENGINEER

A

Turn left onto Eagan Way

Restricted usage road

0.2 mi

Turn right onto Parkwood Blvd

1.4 mi

Turn left onto Lebanon Rd

2.7 mi

Turn right at Palmetto Dr

367 ft

B

1,500 750 0 1,500
Feet

REFERENCE

1. AERIAL IMAGERY - SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY AND PLANT SITE TAKEN 4/1/2017

CLIENT
EXIDE TECHNOLOGIES

PROJECT
RCRA PERMIT RENEWAL

TITLE
HOSPITAL ROUTE

CONSULTANT

GOLDER

YYYY-MM-DD	2019-05-02
PREPARED	EFT
DESIGN	EFT
REVIEW	EPW
APPROVED	AMF

PROJECT No.	CONTROL	Rev.	FIGURE
13-02086-06	1302086ZF035.mxd	0	2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI B

APPENDIX A

EMERGENCY COORDINATORS AND EMERGENCY RESPONSE CONTACT NUMBERS

EMERGENCY RESPONSE CONTACT INFORMATION

PRIMARY EMERGENCY COORDINATOR

Eduardo Salazar, Health and Safety Supervisor and Site Manager

Office	Home
7471 Old 5th Street	5940 Madison Drive
Frisco, Texas 75034	The Colony, Texas 75056
Cell: (972) 786-5404	
Office: (972) 335-2121	
eduardo.salazar@exide.com	

ALTERNATE EMERGENCY COORDINATOR

Brad Weaver, Remediation Director

Office	Home
7471 Old 5th Street	3718 Bluegrass Drive
Frisco, Texas 75034	Grand Prairie, TX 75052
Cell: (214) 893-4803	
Office: (972) 335-2121	
brad.weaver@exide.com	

OTHER EXIDE EMERGENCY CONTACTS

Office

Billy King, Operations Manager
7471 Old 5th Street
Frisco, Texas 75034
Office: (972) 335-2121
Cell: (214) 674-0197
billy.king@exide.com

EMERGENCY (FIRE/POLICE/AMBULANCE)

911

FIRE DEPT/EMERGENCY MANAGEMENT

Frisco Fire Department (Central Fire Station)
8601 Gary Burns Drive
Frisco, Texas, 75034
(972) 292-6300

POLICE

Frisco Police Department
7200 Stonebrook Parkway
Frisco, Texas 75034
(972) 292-6000

TCEQ REGIONAL OFFICE

Regional Director: Tony Walker
2309 Gravel Drive
Fort Worth, TX 76118-6951
(817) 588-5800

Spill reporting: (800) 832-8224

LOCAL EMERGENCY PLANNING COMMITTEE

Collin County Fire Marshal's Office
Attn: Collin County LEPC
4690 Community Ave #200
McKinney, TX 75071
(972) 548-5576

HOSPITAL

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

PRIMARY RELEASE RESPONDER/CONTRACTOR:

Remediation Services, Inc. (RSI)
Grant Sherwood
Office: 620-331-1200
Cell: 918-671-6106

Sunbelt Contact Information
Lance McClure
Office: 972-492-5108
Cell: 214-415-5219

OTHER EMERGENCY NUMBERS

■ National Response Center	(800) 424-8802
■ Centennial Medical Center (ER)	(972) 963-3039
■ Frisco Medical & Surgical (Staff Doctor)	(972) 377-2447
■ Chemtrek	(800) 424-9300
■ The Spill Center	(800) 847-0959
■ National Poison Number	(800) 222-1222
■ Atmos Energy (gas) emergency number	(866) 322-8667
■ TXU (electricity) transmission and distribution utility for Lewisville and North Texas	(888) 866-7456
■ City of Frisco Water Resources Division	(972) 292-5800
■ Telephone (AT&T)	(800) 499-7928

Phone numbers on this page will be updated as needed and kept on file.

APPENDIX B

NOTIFICATIONS

May 29, 2019 130208606

Jason Lane, Deputy Emergency Management Coordinator
Frisco Central Fire Station
8601 Gary Burns Drive
Frisco, TX 75034

RE: CONTINGENCY PLAN, EXIDE TECHNOLOGIES FRISCO RECYCLING CENTER, FRISCO, TEXAS

Dear Mr. Lane:

Golder Associates Inc. (Golder), on behalf of Exide Technologies (Exide), is providing the enclosed Contingency Plan for the Exide Technologies Frisco Recycling Center at 7471 Old Fifth Street in Frisco, Texas (Facility), which is in the process of being remediated and closed. The Facility is comprised of 89 acres and is located near the intersection of Parkwood Drive and Eagan Way/Old 5th Street. Exide is requesting that the Frisco Police and Fire Departments agree to be the primary emergency authorities responding to a potential emergency and 911 call from the Facility. We would be happy to meet with you to review the following:

- Layout of the facility
- Properties of materials at the facility and associated hazards
- Places where facility personnel generally work
- Entrances to roads inside the facility
- Possible evacuation routes

Golder Associates Inc.
13515 Barrett Parkway Drive, Suite 260,
Ballwin, Missouri, USA 63021

T: +1 314 984-8800 F: +1 314 984-8770

We are requesting that you review the attached Contingency Plan and sign and return the attached Agreement at your earliest convenience. If a Facility visit is desired, please suggest a date that is convenient for you. If there are any questions or comments regarding the enclosed Contingency Plan or a meeting, please contact Mr. Brad Weaver of Exide at (972) 335-2121.

Sincerely,

GOLDER ASSOCIATES INC.

-DRAFT-

Emily P. White
Project Geological Engineer

-DRAFT-

Anne M. Faeth-Boyd, R.G., P.E. Missouri
Associate and Senior Engineer

cc: Mr. Brad Weaver – Exide Technologies
Ms. Aileen Hooks – Baker Botts

Attachments: Contingency Plan, Exide Technologies Frisco Recycling Center, Frisco, Texas

Emergency Coordination Agreement
Exide Technologies
Frisco Recycling Center
7471 Old Fifth Street
Frisco, Texas 75034

Participating Agency or Organization: City of Frisco, Emergency Management

The following information has been provided or discussed:

- Facility Contingency Plan
- The layout of the facility
- Properties of wastes handled at the facility and their associated hazards
- Places where facility personnel would normally be working
- Entrances to the facility
- Roads inside the facility
- Possible evacuation routes
- Types of injuries that could result from fires, explosions or releases at the Facility

Please state that your agency or organization has received the Contingency Plan and is in agreement to act as the primary emergency authority if an unexpected emergency were to take place.

____
____
____
____
____

Signature		Signature	
Title		Title	
Date		Date	

Please return a signed copy of this agreement to:

Anne Faeth-Boyd
Golder Associates
13515 Barrett Parkway Drive
Suite 260
Ballwin, MO 63021

May 29, 2019

Project No. 130208606

Mr. Mark Piland, Fire Chief/Emergency Management Coordinator
Frisco Fire Department
8601 Gary Burns Drive
Frisco, Texas 75034

RE: CONTINGENCY PLAN, EXIDE TECHNOLOGIES FRISCO RECYCLING CENTER, FRISCO, TEXAS

Dear Mr.Piland:

Golder Associates Inc. (Golder), on behalf of Exide Technologies (Exide), is providing the enclosed Contingency Plan for the Exide Technologies Frisco Recycling Center at 7471 Old Fifth Street in Frisco, Texas (Facility), which is in the process of being remediated and closed. The Facility is comprised of 89 acres and is located near the intersection of Parkwood Drive and Eagan Way/Old 5th Street. Exide is requesting that the Frisco Police and Fire Departments agree to be the primary emergency authorities responding to a potential emergency and 911 call from the Facility. We would be happy to meet with you to review the following:

- Layout of the facility
- Properties of materials at the facility and associated hazards
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13515 Barrett Parkway Drive, Suite 260,
Ballwin, Missouri, USA 63021

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Sincerely,

GOLDER ASSOCIATES INC.

-DRAFT-

Emily P. White
Project Geological Engineer

-DRAFT-

Anne M. Faeth-Boyd, R.G., P.E. Missouri
Associate and Senior Engineer

cc: Mr. Brad Weaver – Exide Technologies
Ms. Aileen Hooks – Baker Botts

Attachments: Contingency Plan, Exide Technologies Frisco Recycling Center, Frisco, Texas

Emergency Coordination Agreement
Exide Technologies
Frisco Recycling Center
7471 Old Fifth Street
Frisco, Texas 75034

Participating Agency or Organization: City of Frisco, Emergency Management

The following information has been provided or discussed:

- Facility Contingency Plan
- The layout of the facility
- Properties of wastes handled at the facility and their associated hazards
- Places where facility personnel would normally be working
- Entrances to the facility
- Roads inside the facility
- Possible evacuation routes
- Types of injuries that could result from fires, explosions or releases at the Facility

Please state that your agency or organization has received the Contingency Plan and is in agreement to act as the primary emergency authority if an unexpected emergency were to take place.

____

____

____

____

____

Signature		Signature	
Title		Title	
Date		Date	

Please return a signed copy of this agreement to:

Anne Faeth-Boyd
Golder Associates
13515 Barrett Parkway Drive
Suite 260
Ballwin, MO 63021

May 29, 2019

Project No. 130208606

Mr. John Bruce, Chief of Police
Frisco Police Department
8601 Gary Burns Drive
Frisco, Texas 75034

RE: CONTINGENCY PLAN, EXIDE TECHNOLOGIES FRISCO RECYCLING CENTER, FRISCO, TEXAS

Dear Mr. Bruce:

Golder Associates Inc. (Golder), on behalf of Exide Technologies (Exide), is providing the enclosed Contingency Plan for the Exide Technologies Frisco Recycling Center at 7471 Old Fifth Street in Frisco, Texas (Facility), which is in the process of being remediated and closed. The Facility is comprised of 89 acres and is located near the intersection of Parkwood Drive and Eagan Way/Old 5th Street. Exide is requesting that the Frisco Police and Fire Departments agree to be the primary emergency authorities responding to a potential emergency and 911 call from the Facility. We would be happy to meet with you to review the following:

- Layout of the facility
- Properties of materials at the facility and associated hazards
- Places where facility personnel generally work
- Entrances to roads inside the facility
- Possible evacuation routes

We are requesting that you review the attached Contingency Plan and sign and return the attached Agreement at your earliest convenience. If a Facility visit is desired, please suggest a date that is convenient for you. If there are any questions or comments regarding the enclosed Contingency Plan or a meeting, please contact Mr. Brad Weaver of Exide at (972) 335-2121.

Sincerely,

GOLDER ASSOCIATES INC.

-DRAFT-

Emily P. White
Project Geological Engineer

-DRAFT-

Anne M. Faeth-Boyd, R.G., P.E. Missouri
Associate and Senior Engineer

cc: Mr. Brad Weaver – Exide Technologies
Ms. Aileen Hooks – Baker Botts

Attachments: Contingency Plan, Exide Technologies Frisco Recycling Center, Frisco, Texas

Emergency Coordination Agreement
Exide Technologies
Frisco Recycling Center
7471 Old Fifth Street
Frisco, Texas 75034

Participating Agency or Organization: City of Frisco, Emergency Management

The following information has been provided or discussed:

- Facility Contingency Plan
- The layout of the facility
- Properties of wastes handled at the facility and their associated hazards
- Places where facility personnel would normally be working
- Entrances to the facility
- Roads inside the facility
- Possible evacuation routes
- Types of injuries that could result from fires, explosions or releases at the Facility

Please state that your agency or organization has received the Contingency Plan and is in agreement to act as the primary emergency authority if an unexpected emergency were to take place.

____

____

____

____

____

Signature	________________	Signature	________________
Title	________________	Title	________________
Date	________________	Date	________________

Please return a signed copy of this agreement to:

Anne Faeth-Boyd
Golder Associates
13515 Barrett Parkway Drive
Suite 260
Ballwin, MO 63021

APPENDIX C

INCIDENT REPORT FORM

GOLDER

CONTINGENCY PLAN INCIDENT REPORT

Name, Address and Telephone Number of Owner or Operator:

Name: ____________________

Address: ____________________

____

Telephone Number: ____________________

Name, Address and Telephone Number of the Facility:

Name: ____________________

Address: ____________________

____

Telephone Number: ____________________

Incident Date: ____________________

Incident Time: ____________________

Type of Incident: ____________________

____

Name and Quantity of Materials Involved: ____________________

____

Extent of Injuries, if any: ____________________

____

Assessment of actual or potential hazards to human health or the environment, where it applies:

____

____

Estimate quantity and disposition of recovered material that resulted from the incident:

____

____

Brief description of the incident: ____

____

____

____

____

Response Action Taken: ____

____

____

____

____

APPENDIX D

EMERGENCY EQUIPMENT

EMERGENCY EQUIPMENT

Protective clothing and equipment will be provided to protect employees during normal and emergency operations. Such equipment may include, if necessary, first aid kit, gloves, goggles, and disposable coveralls. The following is a list of equipment available at the Site:

Equipment	Location	Physical Description	Capabilities
General tools (i.e., pipe wrenches, screwdrivers, hose clamps, wiring splice kits (for underwater), and electrical tape)	Exide trailer and wastewater treatment plant (WWTP)	Standard hardware and tape	General maintenance and emergency repairs
Fire extinguisher	Exide trailers, North CAMU and WWTP[1]	Standard, cylindrical, red fire extinguishers, ABC Type	Extinguish minor fires
Eye Wash Station and Showers	WWTP and stormwater treatment plant	The eye wash station looks like a water fountain with a faucet on each side. There is a large sign labeled "Emergency Eye Wash" above the station. The facility also has a bottle eye wash station which consists of two bottles of saline solution stored on a dedicated rack on the wall. The shower looks like a free-standing showerhead. A large, triangular handle hangs from the top of the shower. There is a large sign labeled "Emergency Shower" on the piping.	Decontamination of eyes and personnel
First Aid Supplies	Exide trailer	Standard first aid supplies	Bandaids, ointment, gauze, etc.
PPE (leather gloves, nitrile or latex gloves, Tyvek chemical resistant coveralls, safety goggles or glasses, respirators)	Exide trailer	Blue and/or white gloves, plastic-like overalls, clear goggles and glasses, and face masks	Hand, eye, and skin protection and protection from inhalation of hazardous chemicals
AED	Exide trailer	Small case, with handle, labeled "AED"	Cardiac emergency response
Walkie talkies for communication	Exide trailer	Small, hand-held, plastic devices	Communications
Flashlights	Exide trailer	Standard flashlights	Emergency lighting
Spill kits	Exide trailer and WWTP	Yellow bucket with absorbent pads	Small spill response
Water for emergency response	City of Frisco Hydrants	Municipal Water Supply	Extinguish major fires

[1] Note: Locations of the WWTP, SWTP and Exide trailer are depicted on Figure 1.

APPENDIX E

FIRE HYDRANT FLOW TEST DATA REPORT

GOLDER

PROGRESS IN MOTION

Fire Hydrant Flow Test Data Report

Address of Test: PARKWOOD BLVD & EAG

Work Order ID: 248961

Location Details: PARKWOOD BLVD & EAG

Date/Time of Test: 8/3/2018 10:30:26AM

Test Performed By: PURDOM, BLAKE A at the City of Frisco

Static and Residual Hydrant

Main Size	Static (PSI)	Residual (PSI)
8	127	98

Flow Hydrant (Pitot)

Main Size	Outlet Size Flowed	Pitot 1 (PSI)	Pitot 2 (PSI)	Coefficient
8	2.5	25	30	0.9

Operating Levels of Nearest Elevated Water Tank

Approximate Site Elevation (feet)	Level at Time of Flow Test (feet)	Water Normal Operating Range (feet)
646	924	921 to 941

Flow (GPM)

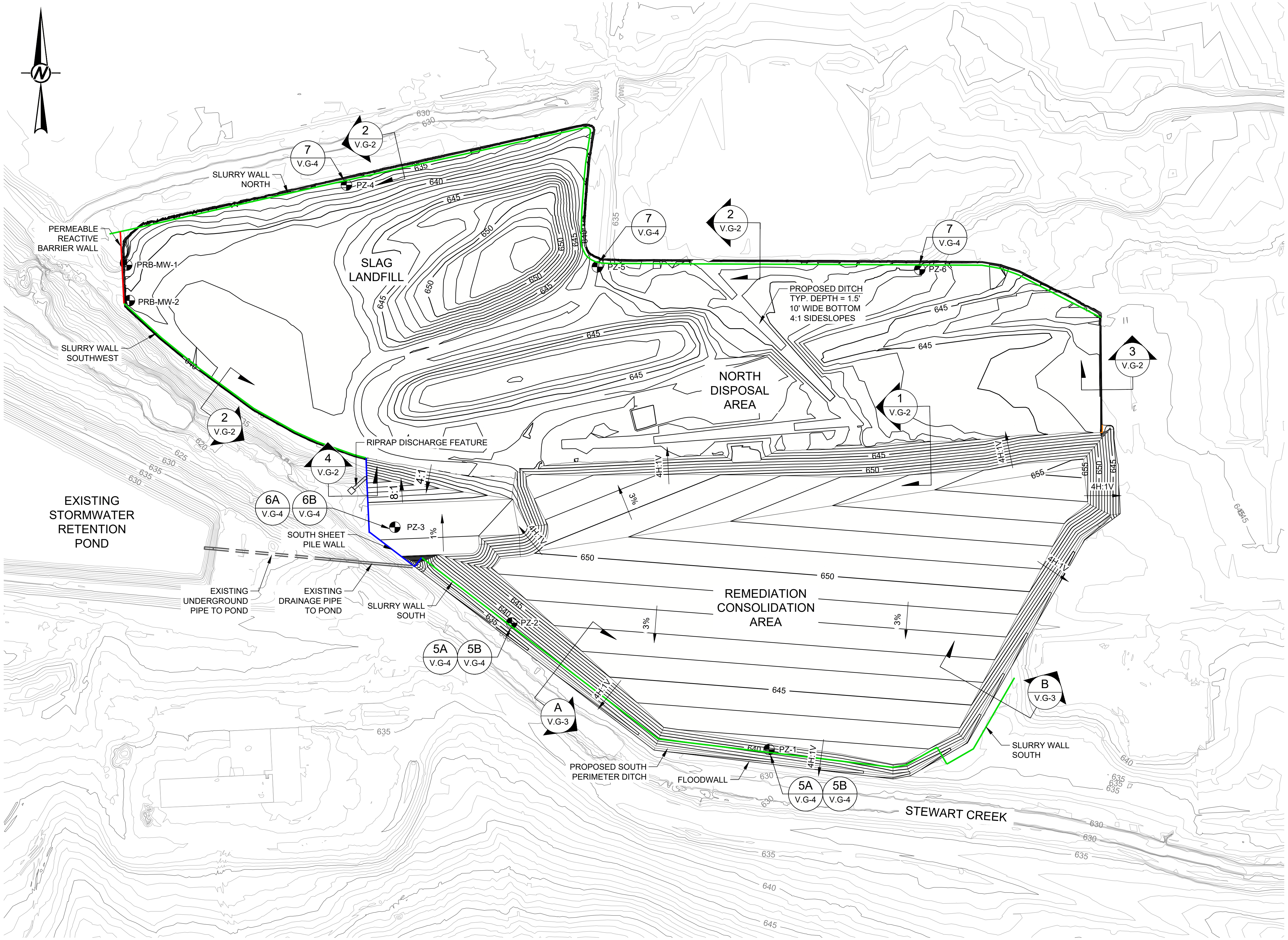
1,678

Note: ***1. The test result data is for reference only. The system must be designed in accordance with the 2006 International Fire Code with local amendments.***
2. The test data must be modified to adjust the pressure for the lowest normal operating level of the tank with the level of the tank at time of the flow test.
3. The provided hydrant flow test information and the modification data of the hydrant flow test must be shown on the submitted drawings and hydraulic calculation sheets.

golder.com

APPENDIX K

FINAL FOP COVER DRAWINGS



LEGEND

	EXISTING GRADE 10 ft CONTOUR
	EXISTING GRADE 2 ft CONTOUR
	PROPOSED CAP 10 ft CONTOUR
	PROPOSED CAP 2 ft CONTOUR
	PROPOSED SHEET PILE WALL
	PROPOSED PERMEABLE REACTIVE BARRIER WALL
	PROPOSED SLURRY WALL

STATE OF TEXAS
JEFFREY B. FASSETT
85675
LICENSED
PROFESSIONAL ENGINEER
5/30/19

GOLDER ASSOCIATES INC.
TEXAS REGISTRATION F-2578

ISSUED FOR PERMITTING PUROPOSES ONLY

0 75 150
1" = 150' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
A	2019-05-28	ISSUED FOR PERMITTING PUROPOSES ONLY	JVH	JVH	RBL	JBF

SEAL

GOLDER ASSOCIATES, INC
TEXAS REGISTRATION F-2578

CLIENT
EXIDE TECHNOLOGIES
EXIDE FRISCO RECYCLING CENTER
FRISCO, TEXAS

CONSULTANT
GOLDER

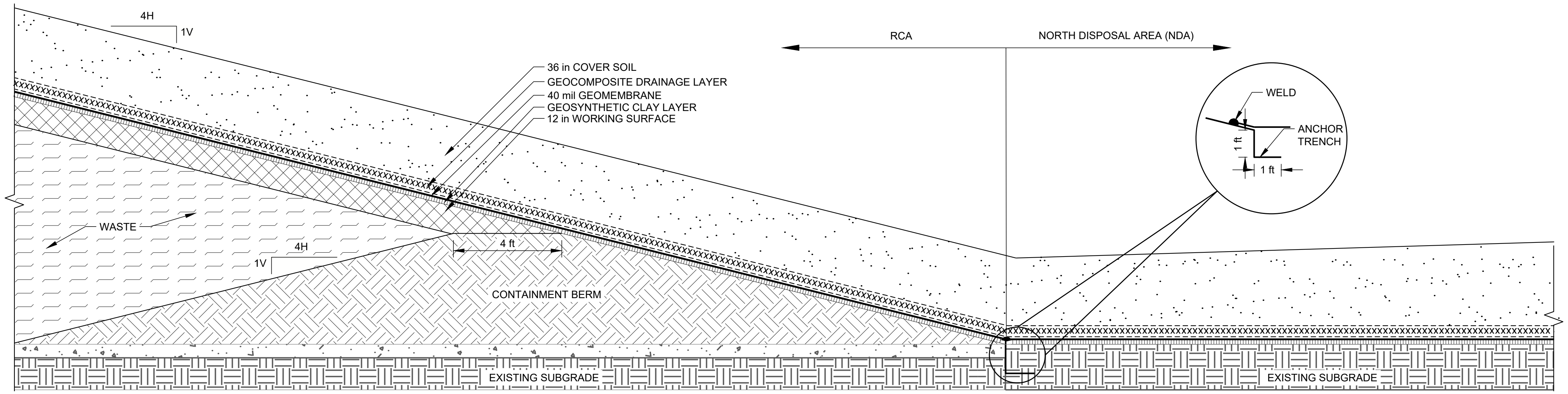
HOUSTON OFFICE - NORTH
14950 HEATHROW FOREST PKWY, STE 280
HOUSTON, TEXAS 77032
USA
[+1] (281) 821 6868
www.golder.com

PROJECT
RCRA PERMIT RENEWAL APPLICATION
FINAL CLOSURE PLAN
FRISCO, COLLIN COUNTY TEXAS

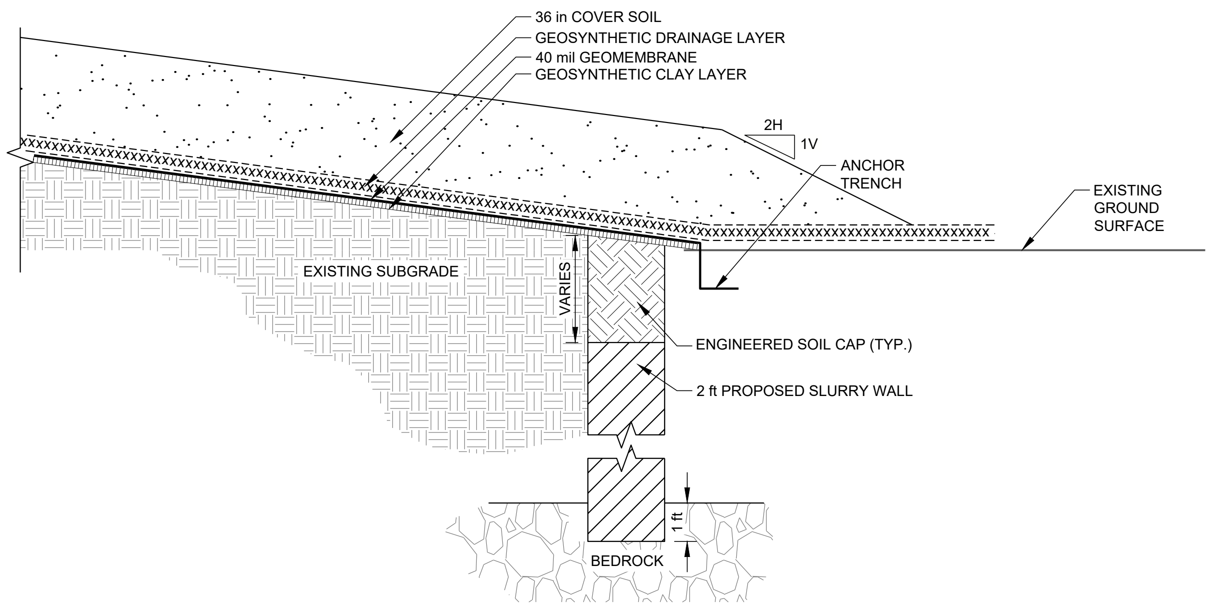
TITLE
FORMER OPERATING PLANT
FINAL COVER GRADING

PROJECT NO.	SCALE	REV.	1 of 4	FIGURE
130208606	AS SHOWN	A		1

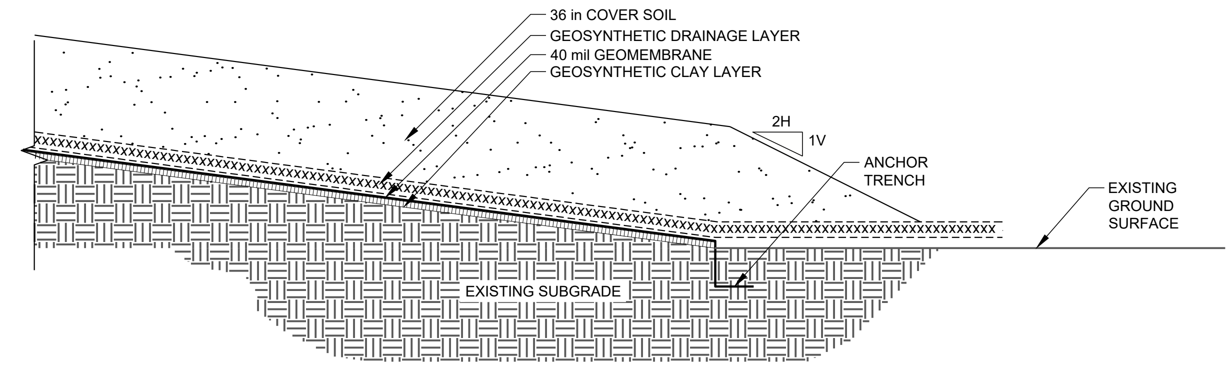
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
1 in



SCALE 1" = 5' 1 V.G-2 RCA AND NDA FINAL COVER TRANSITION DETAIL



SCALE 1" = 5' 2 V.G-2 NDA & SLAG LANDFILL COVER DETAIL



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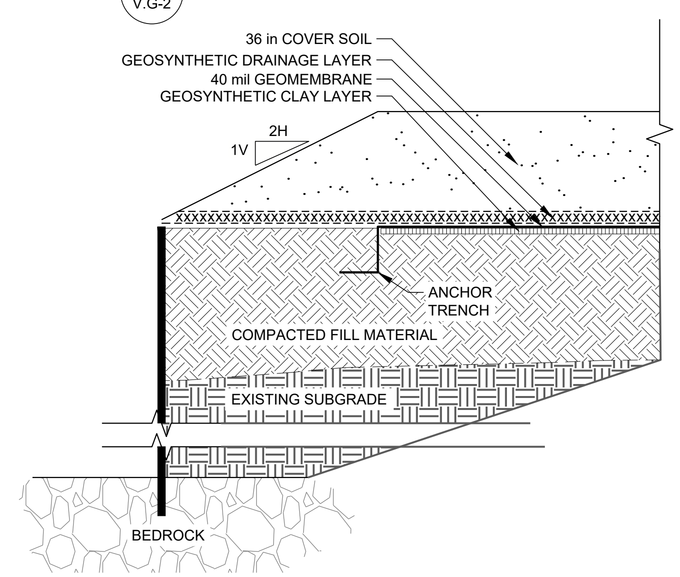

SCALE 1" = 5' 4 V.G-2 SOUTH SHEET PILE WALL DETAIL

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1" = 5' FEET

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PROJECT
RCRA PERMIT RENEWAL APPLICATION
FINAL CLOSURE PLAN
FRISCO, COLLIN COUNTY TEXAS

TITLE
FORMER OPERATING PLANT
FINAL COVER SYSTEM DETAILS

PROJECT NO.	SCALE	REV.		FIGURE
130208606	AS SHOWN	A	2 of 4	2

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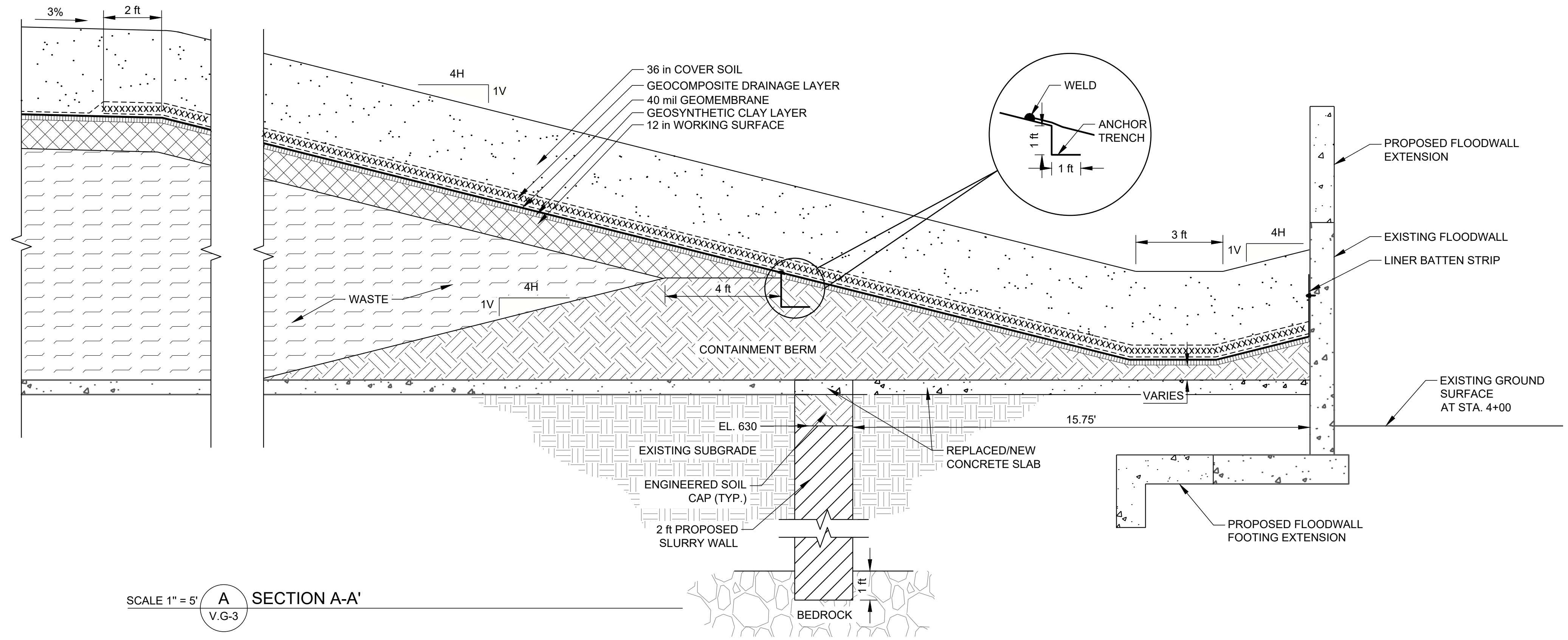

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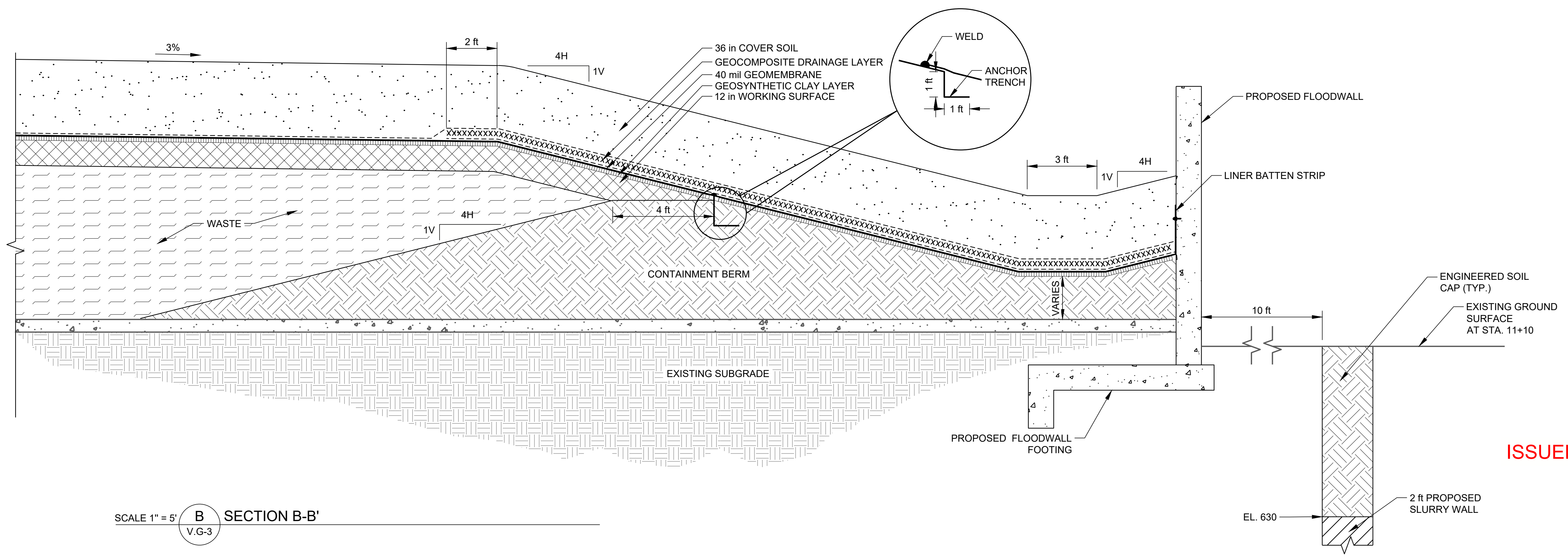

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5/30/19
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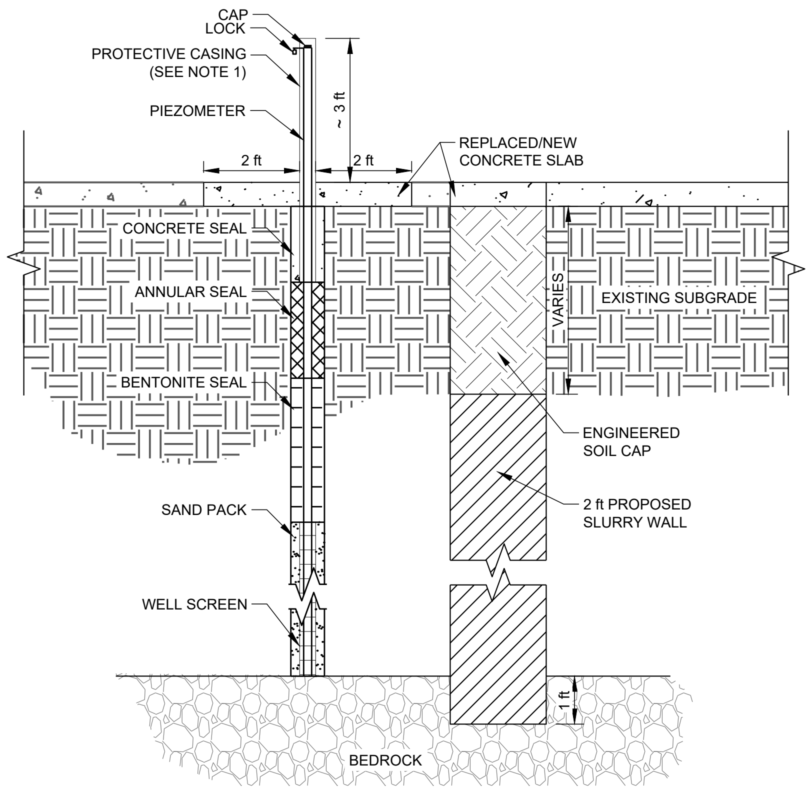
PROJECT
RCRA PERMIT RENEWAL APPLICATION
FINAL CLOSURE PLAN
FRISCO, COLLIN COUNTY TEXAS

TITLE
FORMER OPERATING PLANT FINAL COVER PERIMETER CHANNEL SECTIONS

PROJECT NO.	SCALE	REV.		FIGURE
130208606	AS SHOWN	A	3 of 4	3



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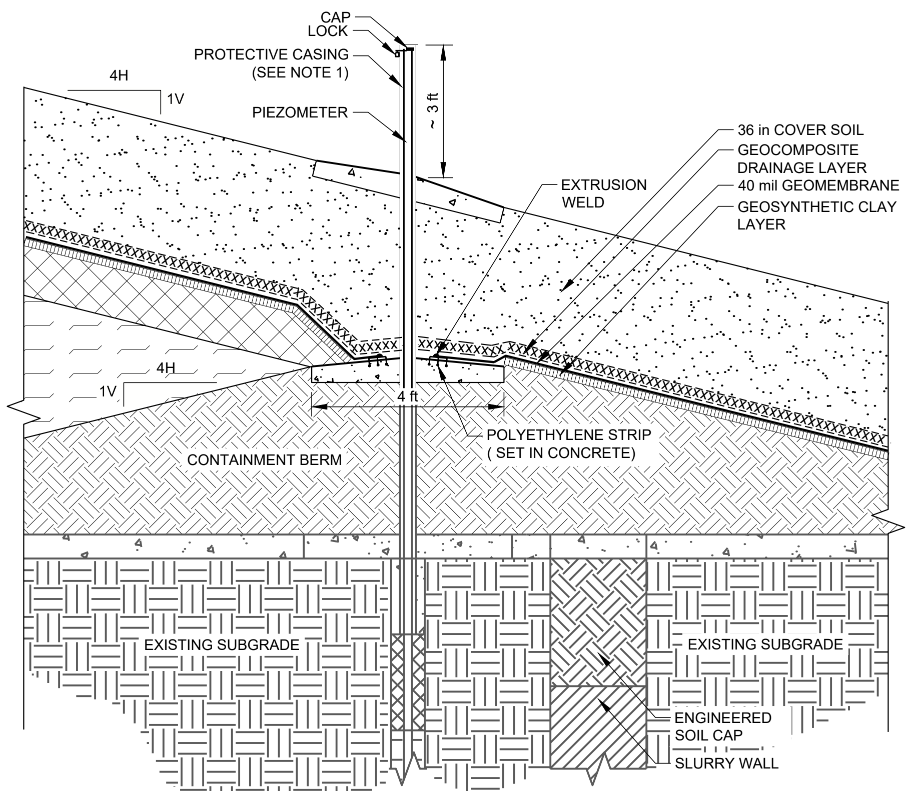

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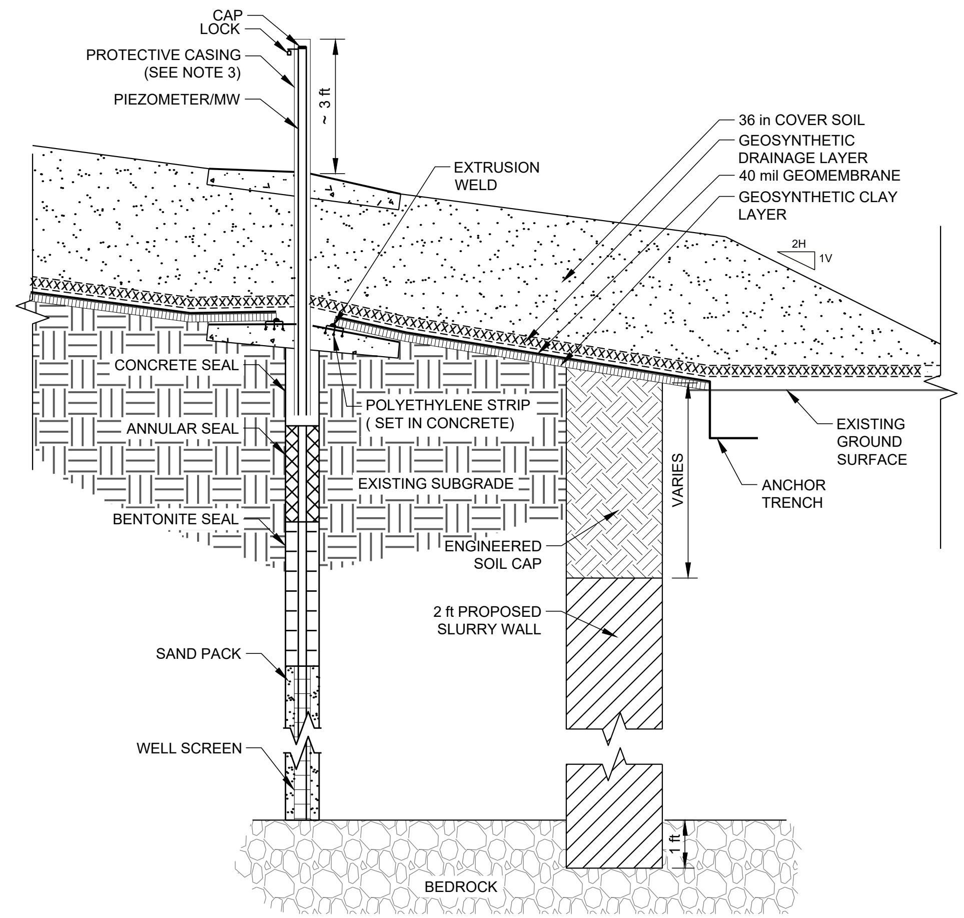

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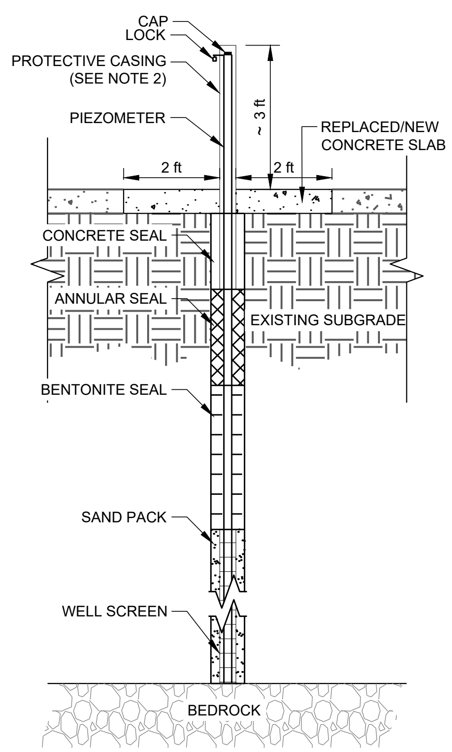

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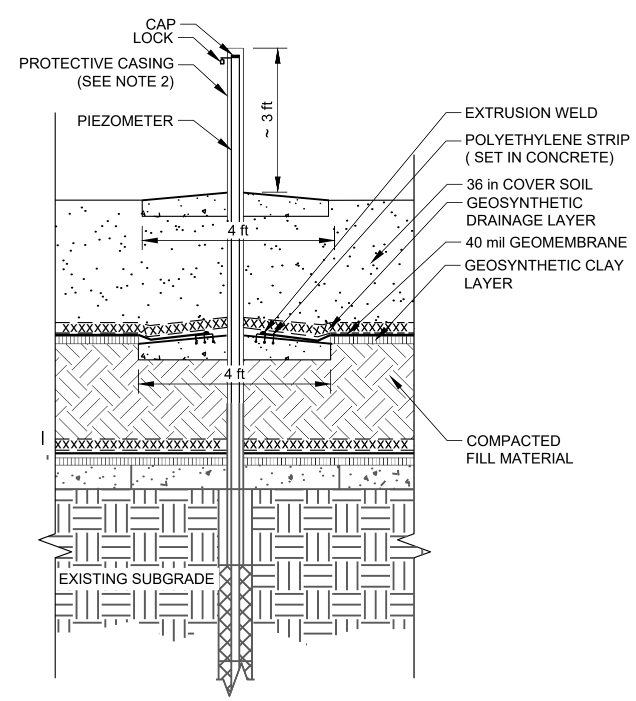

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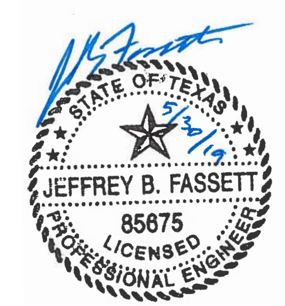

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NOTE(S)

1. ABOVE GROUND PIEZOMETERS PZ-1 AND PZ-2 IN RCA WILL BE INSTALLED FOLLOWING SOUTH SLURRY WALL CONSTRUCTION. THE PIEZOMETER AND PROTECTIVE CASING WILL BE EXTENDED (i) DURING PLACEMENT OF THE CONTAINMENT BERM AND (ii) DURING CONSTRUCTION OF THE FINAL COVER.
2. ABOVE GROUND PIEZOMETER PZ-3 WILL BE INSTALLED FOLLOWING CONSTRUCTION SHEETPILE WALL. THE PIEZOMETER AND PROTECTIVE CASING WILL BE EXTENDED DURING CONSTRUCTION OF THE FINAL COVER.
3. ABOVE GROUND PIEZOMETER/MONITORING WELLS IN NORTH DISPOSAL AREA (NDA) AND SLAG LANDFILL WILL BE INSTALLED FOLLOWING SLURRY WALL CONSTRUCTION.THE PIEZOMETER/WELL AND PROTECTIVE CASING WILL BE EXTENDED DURING CONSTRUCTION OF THE FINAL COVER.

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PROJECT
RCRA PERMIT RENEWAL APPLICATION
FINAL CLOSURE PLAN
FRISCO, COLLIN COUNTY TEXAS

TITLE
PEIZOMETER DETAILS

PROJECT NO.	SCALE	REV.		FIGURE
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APPENDIX L

FOP OPERATIONS AND MAINTENANCE PLAN

FOP O&M PLAN

FORMER OPERATING PLANT WASTE AREAS OPERATION & MAINTENANCE PLAN

Former Exide Technologies Frisco Recycling Facility
Frisco, Texas

STATE OF TEXAS
JEFFREY B. FASSETT
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GOLDER ASSOCIATES INC.
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Submitted To: Exide Technologies
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May 2019 **130208606**

Table of Contents

1.0 INTRODUCTION 1
1.1 Background 1
1.2 Organization of Report 1
2.0 ACTIVE WASTE PLACEMENT OPERATIONS PROCEDURES 3
2.1 Preparation for Waste Placement 3
2.1.1 RCA 3
2.1.2 NDA and Slag Landfill 4
2.2 Waste Acceptance Limits and Testing 4
2.3 Method of Waste Placement 5
2.3.1 Hauling 5
2.3.2 Rainfall Events 5
2.3.3 Interim Storage 6
2.3.4 Waste Lifts 6
2.3.5 Ponded Water 6
2.4 Physical Criteria of Waste 6
2.5 Daily Cover Operations 7
2.6 Equipment Decontamination 7
3.0 FINAL CLOSURE PROCEDURES 9
3.1 Working Surface Soil 9
3.2 Geosynthetic Clay Liner 9
3.3 Geomembrane Barrier 10
3.4 Geotextile/Geocomposite 10
3.5 Clean Fill Material 10
3.6 Vegetative Cover Soil 10
4.0 CONTACT WATER AND STORMWATER MANAGEMENT PROCEDURES 11
4.1 Water Management During Active Filling and Closure Operations 11
4.1.1 Contact Storm Water Management 11
4.1.2 Exterior Storm Water Management 11
4.1.3 Decontamination Water 11
4.2 Post-Closure Water Management 11
4.2.1 Storm Water Management 12
5.0 SUPPORT OPERATIONS PROCEDURES 13
5.1 Waste Hauling Vehicles and Traffic Control 13
5.2 Surveying 13
5.3 Soil Erosion and Sediment Control 13
5.4 Noise Control 13
5.5 Odor Control, Air Monitoring and Dust Suppression 13

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5.6 Site Security 14
5.7 Fire Protection and Emergency Measures 14
6.0 INSPECTIONS AND MONITORING 15
6.1 Active Operations Site Inspections and Monitoring 15
6.1.1 General FOP Waste Area Conditions and Operating Conditions 15
6.1.2 Final Cover 16
6.2 Post-Closure Inspections, Maintenance and Monitoring 17
7.0 EQUIPMENT 18
7.1 Heavy Equipment 18
7.2 Support Equipment 18
7.3 Stationary Operating Equipment and Tools 18
7.4 Equipment Maintenance Requirements 19
8.0 PERSONNEL AND TRAINING 20
8.1 Personnel 20
8.1.1 Site Manager 20
8.1.2 Equipment Operators 21
8.1.3 Laborers 21
8.2 Personnel Training 21
8.3 Worker Safety Programs 22
8.4 Coordination 22

List of Appendices

Appendix A Inspection and Maintenance Forms

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1.0 INTRODUCTION

Golder Associates Inc. (Golder) has prepared this operation and maintenance plan (O&M Plan) for the Remediation Consolidation Area (RCA), the North Disposal Area (NDA) and the Slag Landfill at the Former Operating Plant (FOP) of the Exide Technologies (Exide) Frisco Recycling Center in Frisco, Collin County, Texas. A Site Location Map is provided as Figure 1 of the Final Closure Plan, to which this Operations and Maintenance Plan (O&M Plan) is an appendix. The Site Layout is depicted in Figure 2 of the Final Closure Plan. The RCA (and potentially the NDA, and Slag Landfill) will be used for the disposal of excavated soil from affected properties at the FOP and excavated sediment from Stewart Creek (RCA only). An engineered cap will be placed over the RCA, NDA and Slag Landfill once waste placement is complete.

1.1 Background

For the purposes of this O&M Plan, the Remediation Consolidation Area (RCA), the North Disposal Area (NDA), and the Slag Landfill will be referred to as the “FOP waste areas”. The RCA will be constructed over the former operational areas of the FOP, as shown on Figure 2 of the Closure Plan. Per the Response Action Plan (RAP) for the FOP, which is submitted with the May 2019 supplement to the hazardous waste permit renewal application, the RCA will contain a) surface soils exceeding applicable protective concentration levels (PCLs) excavated from affected property at the FOP where no cap is planned, b) sediments and waste materials exceeding applicable PCLs removed from portions of Stewart Creek downstream from the FOP and c) other approved remediation waste.

Following removal of topsoil and vegetation on the Slag Landfill and NDA, excavated soil, battery case fragments, concrete or other remediation waste from affected properties on-Site (which is approved for placement in the RCA in accordance with Attachment Q of the of May 2019 supplement to the hazardous waste permit renewal application) may be placed on the top of the footprint of the Slag Landfill or NDA to facilitate achieving final waste grades before capping. This is permitted through the use of the AOC policy as further described in Attachment M (RAP) of the May 2019 supplement to the hazardous waste permit renewal application.

As described in the RAP, approximately 82,000 cubic yards of soils and/or sediments (in place cubic yards) will be placed in the RCA. An engineered cover will be placed over the consolidated soil and sediment after this response action has been implemented.

1.2 Organization of Report

This O&M Plan provides general instructions to be followed by Site management and operating personnel for operations throughout the operating life of the RCA and waste placement within the NDA and Slag Landfill. This O&M Plan also includes a description of waste management practices to be followed during closure, including removal and decontamination of equipment and devices during closure activities. The operations and maintenance items included in this O&M Plan are as follows:

- Section 2.0 presents the RCA, NDA and Slag Landfill Filling Procedures;
- Section 3.0 presents the Final Closure Procedures;
- Section 4.0 details the specific Storm Water Management Procedures;
- Section 5.0 presents Support Operations Procedures;
- Section 6.0 presents Inspection and Monitoring Procedures;
- Section 7.0 outlines Equipment Descriptions; and
- Section 8.0 discusses Personnel and Training.

Inspections, monitoring, and maintenance protocols during the post-closure period are included in the Final Closure Plan text, to which this O&M Plan is an appendix. Other information previously submitted in existing documents or in the Final Closure Plan is referenced where appropriate.

2.0 ACTIVE WASTE PLACEMENT OPERATIONS PROCEDURES

This section describes the site-specific procedures for preparation and active FOP waste areas filling operations including management objectives, the waste acceptance criteria, working face practices, and placement of waste lifts. Support functions including stormwater management procedures to be followed during the active period are presented in Section 4.0 of this document.

2.1 Preparation for Waste Placement

2.1.1 RCA

Monitoring wells within the RCA will be abandoned prior to waste placement activities (see Figure 3 of the Final Closure Plan as well as the RAP for additional information on well abandonment). Concrete walls and foundations associated with the FOP operations are present within the RCA. To facilitate waste placement, to the extent practical, the walls and above grade foundations will be demolished. The resulting rubble will be spread on the surface of the existing concrete slab.

The Facility's on-site wastewater treatment facility will be demolished prior to waste placement. Remaining concrete walls and foundations will be demolished and spread over the concrete slab prior to extending the waste placement in this area.

A barrier wall to protect against potential flood waters from Stewart Creek was constructed along the southern boundary of the FOP as part of the 1987 Agreed Order with the Texas Water Commission. The steel-reinforced concrete barrier wall effectively forms a new bank to the creek. A vertical extension of the existing barrier wall and a new lateral extension of this wall along the eastern boundary of the RCA has been designed to protect the facility from potential 100-year flood waters. The extended wall sections will also be made of 10-inch thick steel-reinforced concrete. The construction of the flood wall extensions will be completed prior to waste placement in the RCA. Additional information for the design of the flood wall is included in the Engineering Report for the RCA which is included as Attachment F of the May 2019 supplement to the hazardous waste permit renewal application.

A slurry wall will be constructed on the downgradient (south) side of the RCA as part of the Corrective Action Program for the RCA. Construction of the south slurry wall will be completed prior to placement of waste in the RCA. Additional information for the south slurry wall is included in the Engineering Report for the RCA which is included as Attachment F and the Response Action Plan which is included as Attachment M to the May 2019 supplement to the hazardous waste permit renewal application.

A number of utilities are present below the concrete slab in the RCA. These utilities consist of pipes, manholes, and sumps for the sanitary sewer, the storm sewer, and process drains. To prevent liquid from accumulating in the utilities and to remove the potential for collapse, the pipes, sumps, and manholes will be plugged with flowable fill or other low-permeable material (such as concrete or bentonite) prior to waste placement activities. In addition, overhead utilities in and around the RCA will be disconnected and removed.

2.1.2 NDA and Slag Landfill

The NDA and Slag Landfill have been capped and closed by placement and compaction of a clay soil cover and establishment of vegetation. A concrete access road traverses the NDA from east to west and runs along the southern and eastern limit of the Slag Landfill.

Subgrade preparation will consist of removal or the upper 3 to 4 inches of soil to remove the vegetation and placement of approximately 6 inches of soil over the concrete access road. The stripped vegetative soil will be deposited as waste within the RCA.

A slurry wall will be constructed on the upgradient (north) side of the NDA and Slag Landfill as part of the Corrective Action Program for the RCA. A permeable reactive barrier (PRB) will be constructed on the western limit of the Slag Landfill. Additional information for the slurry wall and PRB gate is included in the Engineering Report for the RCA which is included as Attachment F and the Response Action Plan which is included as Attachment M to the May 2019 supplement to the hazardous waste permit renewal application.

Several surface water control features are present within the NDA. These features consist of pipes and drop boxes. To prevent liquid from accumulating in the utilities and to remove the potential for collapse, all subsurface drainage features will be removed or plugged with flowable fill or other low-permeable material (such as concrete or bentonite) prior to waste placement activities.

2.2 Waste Acceptance Limits and Testing

The following wastes are eligible to be placed in the RCA which is a corrective action management unit (CAMU) (after following the waste analysis plan procedures outlined in Attachment Q of May 2019 supplement to the hazardous waste permit renewal application):

- Excavated soil, battery case fragments, concrete or other remediation waste from affected properties on-Site. This includes soils or debris generated from the installation of the monitoring wells, slurry wall, and permeable reactive barrier wall at the Site or solid decontamination residue.
- Excavated soils, sediment, battery case fragments, concrete or other remediation waste from off-site Stewart Creek affected property (defined below as Off-site Stewart Creek Remediation Waste).
- Excavated soils, sediment, battery case fragments, concrete or other remediation waste from on-Site Stewart Creek affected property (defined below as on-Site Stewart Creek Remediation Waste).
- Soil stockpiled at the Railroad Museum (off-Site)

Excavated soil, battery case fragments, concrete or other remediation waste from affected properties on-Site (which is approved for placement in the RCA in accordance with Attachment Q of the of May 2019 supplement to the hazardous waste permit renewal application) may also be placed on the top of the footprint of the Slag Landfill or NDA to facilitate achieving final waste grades before capping. This is permitted through the use of the AOC policy as further described in Attachment M of the May 2019 supplement to the hazardous waste permit renewal application.

Waste characterization will be performed in accordance with the Waste Analysis Plan (WAP) included as Attachment Q to the May 2019 supplement to the hazardous waste permit renewal application.

Other remediation waste may also be placed in the RCA or on top of the Slag Landfill or NDA. These wastes may include soils from surface or subsurface excavation areas, concrete, sediment, or other wastes that meet the criteria for placement in the RCA. Demolition waste that meets the disposal criteria from any remaining demolition activities required at the FOP may also be placed in the RCA or on top of the Slag Landfill or NDA.

2.3 Method of Waste Placement

Excavated soils and sediments will be placed in lifts. The general operational approach dictates that the lifts be placed with the primary objective of limiting settlement and providing a surface suitable for equipment operation. The following subsections provide a narrative of how waste placement requirements will be implemented during the filling operations.

2.3.1 Hauling

As shown on the Site Layout (Figure 1 in Appendix K of the Final Closure Plan), waste hauling vehicles will use existing (or new if needed) roads to access the FOP waste areas, then, once in the FOP waste areas, use access roads established within the FOP waste areas, as directed by the Construction Manager. Waste hauling vehicles will unload in the designated drop area. This drop area will be demarcated by use of temporary barriers. Tracked or wheel equipment (loader and dozer) will be stationed within the FOP waste areas and will work in tandem to place the waste in lifts as required.

2.3.2 Rainfall Events

A significant rainfall event (determination to be made by the Construction Manager) would stop all loading and transportation activities in the FOP waste areas. No waste will be loaded, transported, or placed into the FOP waste areas during such an event. Work will resume as soon as possible after the rain stops and conditions allow. The decision to resume work will be the responsibility of the Construction Manager.

2.3.3 Interim Storage

Hazardous remediation wastes with TCLP concentrations that do not meet the CAMU treatment standards will be stabilized on-Site (for the presence of metals) in less than 90-day tanks or containers in compliance with applicable regulations and reanalyzed to confirm the CAMU treatment standard is met prior to placement in the RCA, or will shipped to an off-site facility permitted to accept the waste.

While wastes are being stored or stabilized they will be staged in an area within the footprint of the RCA that is lined and bermed to provide secondary containment. Containers will be covered to prevent storm water contact.

2.3.4 Waste Lifts

Waste will be placed in loose lifts compacted to a general thickness of approximately 1 foot. The waste will be compacted by a combination of the tracked dozer and appropriately sized compactor operating on the surface. Following compaction, the soil waste should have sufficient strength to adequately support construction equipment.

2.3.5 Ponded Water

Ponding of water over waste filled areas within the FOP waste areas will be prevented using the following techniques:

- Proper grading of interim waste slopes to promote positive water surface drainage toward drainage features (Figure 1 of Appendix K of the Final Closure Plan), then collected contact surface water will be handled as described below;
- Proper grading of final waste slopes to the elevations shown in the design plans (Appendix K of the Final Closure Plan), which provide surface water drainage without depressions or low spots; and
- Installation of upgradient temporary diversion berms as required to minimize the amount of water entering the disposal area.

Waste fill areas will be inspected to identify depressions or other potential ponding locations. If ponded water on the waste area is observed, action will be taken to remedy the problem. If water begins to accumulate in the active waste placement area, it will be removed with a small portable pump and transferred to the stormwater retention pond. The area of ponding will be filled with clean soil or waste fill and re-graded within seven days of the occurrence, weather permitting. Water that has been in contact with waste will be disposed of off-site as described in Section 4.0.

2.4 Physical Criteria of Waste

Soil, slag, sediment, and other approved remediation waste to be placed in the FOP waste areas shall not contain free water. Putrescible wastes shall not be placed in the FOP waste areas. Wastes shall be placed in a manner to minimize formation of bridging or voids and to allow adequate compaction to prevent excessive consolidation or settlement after placement.

2.5 Daily Cover Operations

Daily cover of the active area will not be required because the waste will not attract birds or animals and does not contain material susceptible to being windblown. A Dust Control Plan is included as Appendix I to the Final Closure Plan. The exposed face of the waste will be limited to the area actively being filled. Other areas of exposed waste may be covered by a spray applied cover or temporary cover.

2.6 Equipment Decontamination

The existing equipment decontamination pad at the Wastewater Treatment Plant (WWTP) is anticipated to be used for equipment decontamination. If this existing pad is not used, an equipment decontamination area will be constructed within or near the FOP waste areas. Berms will be constructed around the perimeter. The decontamination area will be large enough to accommodate the largest piece of equipment that will be used during the operation and closure activities. 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) geomembrane will be placed over the graded area extending over the berms. The HDPE geomembrane will be anchored at the bottom of the berms to prevent it from becoming windblown. Timbers will be installed over the HDPE geomembrane 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's on-site wastewater treatment facility or transferred to an off-site treatment facility for treatment and disposal in accordance with applicable regulations. To limit the generation of contact storm water, if an equipment decontamination pad other than the existing pad at the WWTP is used, the decontamination pad will be covered with poly sheeting weighted with sandbags during periods of inactivity and during significant storm events.

During the operation and closure activities, decontamination residue will be containerized and placed in the FOP waste areas provided capacity is available for this waste. If the decontamination waste is not placed in the FOP waste areas, it will be characterized and disposed off-site in accordance with local, state, and federal requirements. If an equipment decontamination pad other than the existing pad at the WWTP is used, the geomembrane and timbers will be decontaminated using high pressure water which will subsequently be collected and transferred to the facility's on-site wastewater treatment facility or transferred to an off-site facility for treatment and disposal in accordance with applicable regulations. The liner and timbers will be placed in the RCA provided capacity is available for this waste. If not, the liner and timbers will be transferred to a less than 90-day container for characterization, storage and disposal off-site in accordance with local, state and federal requirements.

If the decontamination pad is outside the FOP waste areas, following completion of decontamination activities and removal of the decontamination pad, three grab samples will be collected from the top six inches of soil using a hand auger or hand trowel beneath the decontamination area (exact dimensions of the decontamination pad to be determined) to confirm that there are no soil impacts beneath the decontamination pad from decontamination activities. Sampling and decontamination procedures will be the same as those described for excavation floor samples in Appendix 6.1 of the Response Action Plan included as Attachment M to the Part B Renewal Application.

The samples will be analyzed for total lead, cadmium, arsenic, antimony, and selenium. Should any of the results exceed applicable Protective Concentration Limits (PCLs) for any of these five metals, a minimum of six (6) inches of material underlying the decontamination area will be removed and placed into a temporary, less than 90-day container meeting applicable standards for waste characterization and analysis. This process will be repeated as required until the grab samples exhibits results that meet the PCLs for these five metals. Material will be transported off-site for disposal in accordance with local, state and federal requirements.

3.0 FINAL CLOSURE PROCEDURES

This section describes the site-specific procedures for Final Closure activities within the RCA, NDA and Slag Landfill, including placement of final cover. Final closure procedures and specifications are included in the Final Closure Plan and FOP QA/QC Plan and included here for reference.

Support functions, including contact water and storm water management procedures during final closure, will be the same as those identified during active operations and summarized in Sections 2.0 and 4.0 of this O&M Plan.

3.1 Working Surface Soil

The final surface of waste will be covered with a working surface soil layer (see the QA/QC Plan for the FOP final cover which is included as Appendix M to the Final Closure Plan for more detail). The surface will be drum rolled to a smooth condition and surveyed at 100-foot intervals to establish the elevations of the surface prior to placement of a geosynthetic clay liner (GCL). The working surface soil material will be obtained from an on- or off-site source, delivered using haul trucks, and spread with a dozer to prepare a smooth surface for the GCL. The working surface soil layer may be composed of waste placed, given the top 4 inches of the working surface is smooth and free of all sharp, angular objects as described in Appendix M. The surface should provide a firm, unyielding foundation for the GCL with no sudden sharp or abrupt changes or break in grade.

The NDA and Slag Landfill have been capped and closed by placement and compaction of a clay soil cover and establishment of vegetation. A concrete access road traverses the NDA from east to west and runs along the southern and eastern limit of the Slag Landfill.

Subgrade preparation will consist of removal or the upper 3 to 4 inches of soil to remove the vegetation and placement of approximately 6 inches of soil over the concrete access road. The stripped vegetative soil will be deposited as waste within the RCA.

Portions of the Slag Landfill will be regraded to reduce existing slopes to 4H:1V.

If waste is placed in the NDA or Slag Landfill, a working surface layer, as described above, will be placed over the waste prior to final cover construction.

3.2 Geosynthetic Clay Liner

Following the grading and smoothing of the working surface soil, a GCL will be placed directly above the working surface soil as shown on Figure 2 in Appendix K of the Final Closure Plan. The new GCL will extend to the flood wall along the south, and will extend to the FOP waste area perimeter as shown on Figures 2 and 3 in Appendix K of the Final Closure Plan.

3.3 Geomembrane Barrier

Following the installation of the geosynthetic clay liner, a textured 40-mil linear-low density polyethylene (LLDPE) geomembrane will be installed over the RCA, NDA and Slag Landfill GCL. The geomembrane will be anchored in the containment berm and attached to the flood wall with a batten strip along the south and east and will terminate in an anchor trench elsewhere along the FOP waste area perimeter. These details are shown on Figures 2 and 3 in Appendix K of the Final Closure Plan.

3.4 Geotextile/Geocomposite

A nonwoven geotextile layer shall be placed over the 40-mil textured LLDPE geomembrane in areas where the final cover slopes are 5% or less. The geotextile shall be 8-ounce per square yard (oz/sy), nonwoven and needle-punched. In areas with slopes greater than 5%, a 200-mil double-sided geocomposite drainage layer shall be placed over the geomembrane.

3.5 Clean Fill Material

An 30-inch thick layer of general clean fill material will be placed on top of the geotextile/geocomposite layer. The clean fill soil layer will consist of suitable soil obtained from an approved borrow source.

3.6 Vegetative Cover Soil

A 6-inch thick layer of soil capable of supporting vegetation will then be placed above the general clean fill layer in a loose condition and will be amended as necessary to establish a dense growth of vegetation. Once placement of the vegetative growth layer is completed, the area will be hydroseeded.

4.0 CONTACT WATER AND STORMWATER MANAGEMENT PROCEDURES

This section presents the contact water and stormwater management procedures to be used during the active operations and closure of the RCA, NDA and Slag Landfill as well as during the post-closure period. Inspection and monitoring requirements are presented in Section 6.0.

4.1 Water Management During Active Filling and Closure Operations

4.1.1 Contact Storm Water Management

As described in the Final Closure Plan, the RCA base consists predominantly of a concrete slab. The concrete slab has an existing surface water collection system that collects and directs water to the southwestern portion of the concrete slab, where it is conveyed via a pipe to the stormwater retention pond to the southwest of the former operational areas. Sediment dikes or check dams will be maintained at the pipe inlet in order to control sediment transport from the RCA to the stormwater retention pond.

Water infiltrating through the concrete slab is collected in a French Drain System (FDS) located along the flood wall and conveyed to a sump located at the southwest end of the facility where it can be collected and pumped to storage tanks at the WWTP for off-site disposal or treatment and discharge, if authorized. Prior to placement of waste, the FDS will be abandoned and the slurry wall will be installed at the Site. Water infiltrating through the concrete slab would be contained by the slurry wall.

Prior to waste placement in the RCA, a minimum 3-foot high containment berm will be constructed around the entire perimeter of the RCA waste placement area. The containment berm will prevent surface water run-on from the north will contain contact water run-off within the RCA.

Prior to significant rains, temporary soil berms may be formed to contain contact water and temporary covers may be placed over non-active areas to reduce the volume of contact water.

4.1.2 Exterior Storm Water Management

A containment berm will surround the areas of waste placement to prevent storm water from outside the FOP running on to waste. The flood wall will protect the area from flood waters in Stewart Creek.

4.1.3 Decontamination Water

Decontamination procedures and protocols to be used at this site are discussed in Section 2.6 above. Decontamination waters will be handled as described in Section 2.6.

4.2 Post-Closure Water Management

After the FOP waste areas are filled and the cover system installed, the water volume within the waste is expected to be negligible and only non-contact storm water will be generated, simplifying the associated management procedures.

4.2.1 Storm Water Management

Following final closure, storm water on southern and eastern facing slopes of the RCA will flow to a perimeter channel formed adjacent to the flood wall and/or directed to the existing drainage pipe and directed to the stormwater retention pond as shown on Figure 1 in Appendix K of the Final Closure Plan. Run-off from the northern portion of the RCA will flow radially toward the NDA.

In general, existing grades and drainage patterns will be maintained on the NDA and Slag Landfill cover. The majority of the NDA drain to a ditch formed in the NDA final cover. The proposed ditch is located above an existing drainage channel, which will direct surface water to the northern tributary of Stewart Creek. The westernmost portion of the RCA and NDA will drain to a v-ditch, which directs flow around the northern edge of the sheet pile wall.

Calculations for channel sizing are included in Appendix O of the Final Closure Plan.

Storm water drainage facilities will be inspected regularly as described in the Final Closure Plan. Fill material, siltation, and excessive plant growth will be removed from drainage waterways to prevent obstruction of flow. Erosion on the sides or bottoms of the drainage waterways will be repaired and reconstructed as necessary.

5.0 SUPPORT OPERATIONS PROCEDURES

This section describes the site-specific support operations procedures for hauling and handling waste.

5.1 Waste Hauling Vehicles and Traffic Control

Vehicles for hauling waste must be suitable for transporting this material from Stewart Creek or FOP areas. The waste haulers will not allow waste from their vehicles to impact any roadways on which they travel. In addition, waste haulers will be responsible for observing the speed limits, traffic and safety requirements. Waste hauling vehicles shall be covered to minimize dust migration during transportation. Waste hauling vehicles will follow only those routes designated by the Construction Manager.

Waste hauling vehicles will track each load, documenting the quantity and time loaded. The Construction Manager designee at the entry to the FOP waste areas will stop each truck and log its arrival in the records, or the information will be recorded in an equivalent manner. An inventory number will be assigned to each load by the Construction Manager designee. These logs will become part of the final recordkeeping as described in the Final Closure Plan.

5.2 Surveying

As described in the QA/QC Plan, the working surface layer and the soil cover layers will be surveyed by a surveyor or professional engineer licensed in the state of Texas.

5.3 Soil Erosion and Sediment Control

Erosion and sedimentation will be reduced and controlled using best management practices. Erosion control measures will include hydroseeding, as appropriate. Erosion calculations, included in Appendix O of the Final Closure Plan, indicate that, once the final cover is installed and vegetation is established, the potential for erosion and sedimentation will be minor.

5.4 Noise Control

Waste placement operations are expected to occur during daytime hours and will be contained within the FOP boundary; therefore, no special noise controls are needed. However, noise levels for equipment used at the FOP will comply with applicable Occupational Safety and Health Administration (OSHA) requirements as described in each contractor's Health and Safety Plan (to be prepared prior to the start of work at the Site).

5.5 Odor Control, Air Monitoring and Dust Suppression

Odorous constituents are not expected to be an issue based upon the types of wastes that are approved for acceptance at the FOP waste areas. Ambient air monitoring will be performed as described in the Air Monitoring Plan (included as Appendix P to the Final Closure Plan) and each contractor's health and safety plan, which will be prepared prior to the start of work at the Site. A Dust Control Plan has also been prepared for the FOP waste areas and is included as Appendix Q to the Final Closure Plan.

5.6 Site Security

Unauthorized personnel will not be permitted in or near the FOP. The site will not be open to the public at any time. Security devices, including chain-link fencing, gates, locks, and signs, will be maintained around the perimeter of the FOP or around the capped areas throughout the post closure care period, unless otherwise approved by TCEQ. A security guard is contracted for the FOP when the FOP is not staffed [during the closure process]. Once closure is complete, the need for security guard will be re-evaluated.

To minimize the possibility that wildlife or unauthorized individuals will enter the area, a 6-foot high fence, with a lockable entrance gate, will be installed around the FOP perimeter following final closure activities (see Figure 2 of the Closure Plan). The fence will reduce the possibility for large wildlife or unauthorized individuals to enter the FOP and potentially damage liners, interfere with operations, come in contact with waste materials, or track waste materials outside of the FOP.

During active operations, the Construction Manager designee, located at the entrance to the FOP or the FOP waste areas, will stop each vehicle or person to determine whether they are permitted in the waste placement area. At other times the gate to the FOP will be locked.

All Site security elements are included in the periodic inspections discussed in Section 6.0 and the Final Closure Plan.

5.7 Fire Protection and Emergency Measures

A Contingency Plan addressing fire protection and emergency measures has been prepared and is included as Appendix J to the Final Closure Plan.

6.0 INSPECTIONS AND MONITORING

6.1 Active Operations Site Inspections and Monitoring

During active operations, the FOP waste areas will be inspected a minimum of weekly and after each significant storm event to detect evidence of the following:

- Deterioration, malfunction, or improper operation of surface water control features;
- Erosion of cap or berms;
- Signs of seepage, settlement, cracks or other signs of damage to the flood wall;
- Indications of sand boils outside the flood wall;
- The presence of trees or high vegetation growing along the flood wall;
- Procedures followed by operations and maintenance staff; and
- The condition of the operating equipment, including earth moving equipment, alarms and pumps.

An inspection check form with explanations of observations made will document each of these weekly inspections and become part of the site records (See Appendix A for Inspection and Repair Forms). In addition, inspections of the security system (existing fences, gates, locks, etc.), emergency equipment, and communications equipment will be conducted weekly during active operations. These areas are described in the following subsections and documented on the Inspection Form, which is included in Attachment A of this O&M Plan. If, during a periodic inspection, damage, deterioration, or malfunction of any of the systems, components, or facilities is observed, steps shall be initiated to rectify the situation. Site personnel, or their designated contractor, will perform minor maintenance activities as described in this O&M Plan. Maintenance and repair actions will be documented on the Repair Report From included in Attachment A of this O&M Plan.

6.1.1 General FOP Waste Area Conditions and Operating Conditions

The following will be inspected weekly and noted on the Inspection Form:

- Date of inspection;
- Name of inspector;
- Project features that were inspected;
- Overall condition of project features;
- Photographs showing flood damages, deficiencies, and overall project condition;
- Signs of erosion, obstructions, or ponding on the exterior berm slopes and on temporary water control systems, including ditches and culverts;
- Condition of heavy and support equipment, including signs of leaks or other items requiring maintenance;
- Access road conditions (potholes, washouts, ponding, or other deterioration);

- Inventory and condition of emergency and communications equipment (all should be available, stocked, and functioning);
- Conditions of any tanks used on-site for fuel or other material storage;
- Conditions of existing fences, locks, gates, and signs (i.e., note any missing items, damage, or signs of tampering);
- Flood wall conditions;
- Maintenance that has been completed;
- Maintenance that is currently being performed; and
- Maintenance items that need to be accomplished in the future

The FOP access road will be inspected and maintained so that routine inspections can be performed. Any potholes, washouts, or excessive “washboarding” of the road will be repaired and the road will be graded, as needed.

6.1.2 Final Cover

The final cover and any temporary cover will be inspected by walking the FOP waste areas to confirm positive drainage from the cover to the perimeter drainage features and assess the condition of the cover. Any subsidence that significantly alters drainage from the cover will be corrected. Any areas that allow water to pond on the cover will be backfilled and revegetated. The inspector will look for evidence of erosion, subsidence, ponded water, animal burrows, cracks along the cover, and loss of soil. Any excessive erosion will be identified and corrected. Erosion over large areas will be backfilled and revegetated. The following should be noted on the inspection form:

- Rills, gullies and crevices 6 inches or deeper in the vegetative soil layer
- Cover settling or subsidence that affects surface water run-off
- Reworked surfaces and areas with sparse or eroded vegetation in excess of 100 square feet cumulatively
- Brush, trees or similar invasive vegetation with tap roots growing in areas not designated for this type of vegetation
- Evidence of burrowing or other cover disturbance by burrowing animals
- Effectiveness of storm water drainage features

The vegetative surface will be mowed after initial establishment of the planted species. Mowing is assumed to occur twice a year. Any areas with rills and gullies greater than 6 inches in depth will be filled with soil and the vegetation re-established. Settlement, subsidence, or displacement of the RCA will be corrected. Temporary erosion and sediment control measures will be employed on steep slopes to enhance restoration of the restored surfaces.

6.2 Post-Closure Inspections, Maintenance and Monitoring

Post-closure inspections, maintenance and monitoring are included in the Final Closure Plan to which this document is an appendix.

7.0 EQUIPMENT

The following section describes the general types of equipment to be used at the FOP waste areas, the functions this equipment performs and equipment maintenance requirements. All equipment and tools used in the performance of the work are subject to the approval of the Construction Manager before work is started.

7.1 Heavy Equipment

Heavy equipment available for day-to-day operations of the disposal area may consist of bulldozer, earth moving equipment, waste or soil compactors (as needed), drum rollers, and a water truck, as well as other equipment as needed. When major repairs to heavy equipment are needed, the landfill operator or contractors will make additional equipment of similar size and function available. All heavy equipment shall be fitted with fully enclosed cabs while operating over exposed waste.

7.2 Support Equipment

In addition to the required heavy equipment, miscellaneous pickups, and/or other light utility vehicles, as well as various portable water pumps, instruments, and safety and training equipment will be on-site as necessary. Pickup trucks shall be used to haul landfill personnel within the FOP to conduct site duties. A portable pump shall be used for pumping stormwater from excavations and from ponded areas, as needed.

CAMU support equipment includes mobile and portable equipment used in operating and maintaining the FOP waste areas. The support equipment may include

- Trucks (dump, pickup, all-terrain, etc.);
- Portable pumps;
- Portable generator;
- Portable air compressor;
- Temporary light fixtures;
- Roll off containers;
- Tankers;
- Fuel storage tank;
- CQA/testing equipment; and
- Health and safety equipment.

7.3 Stationary Operating Equipment and Tools

Stationary operating equipment will include the equipment installed at the FOP waste areas during construction, such as

- Contact storm water storage and treatment tanks (if needed);

- Emergency power generating equipment;
- Piping; and
- Water hoses.

Emergency equipment is discussed in the Contingency Plan included as Appendix J to the Final Closure Plan.

7.4 Equipment Maintenance Requirements

Maintenance is necessary to keep equipment in a condition that assures continuous proper operation of the assigned functions. Maintenance can be divided into three basic categories:

- Preventive Maintenance – routine work that can be accomplished with minimal or no downtime of equipment. These tasks include routine inspections, lubrication, and adjustments.
- Corrective Maintenance – the non-routine repair work that may require some equipment downtime. These tasks include changing belts and replacing work bearings and brushes, etc.
- Major Overhauls – large jobs that usually require extensive downtime. These tasks can involve considerable expenditures of money and may require additional labor.

The heavy equipment maintenance program can be divided into two major categories:

- Equipment maintenance and repair to be performed by the heavy equipment suppliers; and
- Maintenance activities to be performed by operator and/or maintenance personnel.

Maintenance must also be performed on the support and stationary equipment. The frequency and extent of maintenance will be as recommended by the manufacturer.

Each piece of mechanical equipment on the FOP, from personal exposure meters to heavy equipment, will be inspected routinely. All emergency equipment will be regularly inspected to assure that it is present, functional and decontaminated. Whenever a problem is discovered with equipment necessary for safe operations, operations will be curtailed until a satisfactory repair or replacement can be put in place.

8.0 PERSONNEL AND TRAINING

The Site personnel will include at a minimum, a Site manager and/or supervisor (Exide representative or designated Contractor Construction Manager), equipment operators and laborers. Personnel described in this section will possess the required credentials for their respective roles, in accordance with OSHA and safety requirements. Information regarding personnel credentials will be provided to Exide and records regarding personnel credentials will be maintained at the Exide trailer at the FOP or an alternate location specified by Exide and approved by the TCEQ Executive Director (as described in the Closure Plan Section 5.0).

8.1 Personnel

8.1.1 Site Manager

The Site Manager (SM) will be responsible for all activities at the FOP and will be the designated contact person for regulatory compliance matters. The SM or his designated alternate will provide on-site management of the Facility operations and will be responsible for day-to-day operations with applicable regulatory requirements and this O&M Plan. The SM or designated alternate will provide adequate staffing to operate the facility in accordance with applicable regulatory requirements and this O&M Plan. The SM or his designated alternate will be responsible for inspection and/or maintenance of all equipment and operating systems required for the operations and closure activities.

The SM or designated alternate must be an experienced personnel manager, who is familiar with and has the aptitude to implement operational aspects of waste disposal operations including knowledge of relevant regulations and permit requirements, and safe management practices.

Direct operation and maintenance activities, as described throughout this report, are the responsibility of the SM. The major responsibilities of the SM during operation of the FOP waste areas include the following:

- Operate and coordinate all disposal of waste;
- Ensure that all applicable health and safety protocols are followed in accordance with the approved plan;
- Ensure that all personnel are properly trained for operations;
- Maintain records of methods of placement within the FOP waste areas;
- Ensure waste is placed in accordance with procedures described in this O&M Plan;
- Divert storm water away from waste material to the extent practical and appropriately manage contact stormwater;
- Maintain records of applicable inspections outlined in this O&M Plan;
- Perform any corrective measures required as a result of these inspections;
- Perform routine maintenance on equipment;
- Attain all required record survey information;

- Control potential traffic congestion; and
- Maintain site dust and erosion control throughout the duration of operations.

8.1.2 Equipment Operators

Equipment operators will operate vehicles and heavy equipment associated with FOP waste area operations and closure in a safe manner to achieve functions necessary for operation and closure of the Facility. Duties may include spreading waste and final cover materials, maintaining access roads, establishing and maintaining stormwater drainage, and placement of soils.

8.1.3 Laborers

Site laborers will have responsibilities as directed by the SM or the designated alternate. These duties may include dust control, inspection and maintenance of gates, perimeter fencing, and other duties as necessary.

8.2 Personnel Training

The SM will be responsible for training operators and laborers on the requirements of this O&M Plan, the Contingency Plan, and other items as needed. Documentation of on-site training will be maintained.

Personnel are trained on

- Procedures for using, inspecting, repairing, and replacing facility emergency and monitoring equipment,
- Key parameters for waste feed (i.e., waste hauling vehicles) cut-off systems,
- Communications or alarm systems,
- Response to fires or explosions,
- Response to groundwater contamination incidents, and
- Shutdown of operations procedures.

Personnel are fully trained on all relevant O&M and safety procedures within six months after the date of their employment or appointment to a new position. Personnel who have not yet been fully trained do not work in unsupervised positions until they have received all necessary training. Exide maintains records at the facility which include each employee’s name, job description, the amount of both introductory and continuing training necessary for the position, and the current status of the employee’s training.

The training program covering the FOP waste area’s O&M and safety procedures is reviewed annually. All personnel are required to participate in the review. Documentation of on-site training will be maintained at the FOP.

8.3 Worker Safety Programs

Operations at the FOP waste areas will comply with the health and safety procedures established by the contractor’s site-specific Health and Safety Plan. Each contractor will be responsible for developing a site-specific health and safety plan in accordance with Exide internal requirements as well as applicable regulatory requirements. Exide will use appropriately trained personnel to operate and maintain the FOP waste areas. Each contractor will be responsible for providing required health and safety training to their personnel and providing appropriate documentation to Exide. All contractors working at the Site will also attend a health and safety orientation provided by an Exide representative prior to beginning work at the Site.

8.4 Coordination

This O&M Plan will be provided to electronically to contractors prior to mobilizing to the Site to ensure that requirements can be incorporated into standard work procedures and plans that will be used at the Site. The SM will be responsible for coordination of all contractor activities and resolving potential conflicts.

APPENDIX A
INSPECTION AND MAINTENANCE FORMS

INSPECTION FORM
EXIDE TECHNOLOGIES FOP WASTE AREAS

Date:________________ Type of Inspection (Storm, Monthly, Quarterly or Semi-Annual):_______________________

Inspector(s):____

Signature(s):____

Instructions: For any items that require maintenance, submit this form and notify the Exide representative of any recommended actions. Schedule remedial actions complete the **REPAIR REPORT FORM** when complete.

Facility Component	Inspection Item	Inspection Frequency				Condition		Notes or Recommended Repairs
		Storm	Monthly	Quarterly	Semi-Annually	Acceptable	Maintenance Needed	
Final Cover	Access road conditions							
	Surface erosion, rills, gullies, and crevasses; minor cover settling or subsidence							
	Major cover settlement							
	Water on unit surface							
	Sparse or eroded vegetation							
	Invasive vegetation							

Facility Component	Inspection Item	Inspection Frequency				Condition		Notes or Recommended Repairs
		Storm	Monthly	Quarterly	Semi-Annually	Acceptable	Maintenance Needed	
	Cover disturbance by burrowing animals							
	Grass							
Surface Water Management	Ditches							
	Storm Water Pond							
	Erosion and sediment control devices							
	Culverts and conveyance pipes							
	Grass							
	Surface water drainage							
Flood Wall	Flood wall waterstop and joint filters							
	Seepage, settlement, sand boils, saturated soil areas, cracks, or other damage to flood wall							

Facility Component	Inspection Item	Inspection Frequency				Condition		Notes or Recommended Repairs
		Storm	Monthly	Quarterly	Semi-Annually	Acceptable	Maintenance Needed	
	Vegetation (no trees or high vegetation along flood wall)							
	No trash or debris accumulation along flood wall							
	No bank erosion/caving observed that would endanger wall stability							
Groundwater Monitoring System	Protective casing							
	Locks							
	Ground surface seal							
	Accumulation of surface water							
	Concrete pad and bollards							
General Facility Components	Fences							
	Locks							
	Gates							

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Facility Component	Inspection Item	Inspection Frequency				Condition		Notes or Recommended Repairs
		Storm	Monthly	Quarterly	Semi-Annually	Acceptable	Maintenance Needed	
	Signs							
	Access Roads							
	Surveyed Benchmarks							
	Safety and Emergency Equipment							

REPAIR REPORT FORM
EXIDE TECHNOLOGIES FRISCO RECYCLING CENTER

Inspector(s):____

Signature(s):____

Instructions: Note the problem(s) identified during the inspection, date the problem(s) was identified, actions performed to address the problem(s), date the problem(s) was addressed, and date the problem(s) was fully addressed.

Deficiency	Date Identified	Action Taken	Date Addressed	Date Completed

GOLDER

Established in 1960, Golder Associates is a global, employee-owned organization that helps clients find sustainable solutions to the challenges of finite resources, energy and water supply and management, waste management, urbanization, and climate change. We provide a wide range of independent consulting, design, and construction services in our specialist areas of earth, environment, and energy. By building strong relationships and meeting the needs of clients, our people have created one of the most trusted professional services organizations in the world.

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Golder Associates

Engineering Earth's Development, Preserving Earth's Integrity

APPENDIX M

FOP QUALITY ASSURANCE / QUALITY CONTROL PLAN

FOP QA/QC PLAN

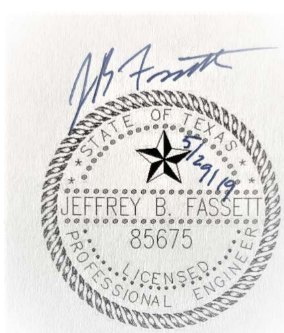
FORMER OPERATING PLANT FINAL COVER

QUALITY ASSURANCE / QUALITY CONTROL PLAN

Former Exide Technologies Frisco Recycling Center
7471 Fifth Street, Frisco, Texas 75034

Submitted To: Exide Technologies
7471 Fifth Street
Frisco, TX 75034

Submitted By: Golder Associates Inc.
14950 Heathrow Forest Parkway, Suite 280
Houston, TX 77032

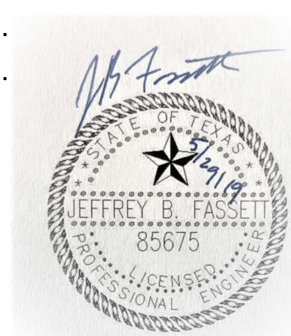


GOLDER ASSOCIATES INC.
Professional Engineering Firm
Registration Number F-2578

May 2019 **Project No. 130208606**

Table of Contents

1.0 INTRODUCTION AND PURPOSE 1
 1.1 Introduction 1
 1.2 Purpose 1
2.0 GEOSYNTHETIC CLAY LINER EVALUATION 3
 2.1 Pre-Installation Material Evaluation 3
  2.1.1 Manufacturer’s Quality Control Certificates 3
 2.2 Installation Procedures 5
  2.2.1 GCL Subgrade Preparation 5
   2.2.1.1 RCA Final Cover Subgrade Preparation 5
   2.2.1.2 NDA and Slag Landfill Final Cover Subgrade Preparation 5
  2.2.2 Anchor Trench Construction 6
  2.2.3 GCL Deployment 6
  2.2.4 GCL Repairs 7
  2.2.5 GCL Protection 7
3.0 GEOMEMBRANE EVALUATION 8
 3.1 Pre-Installation Material Evaluation 8
  3.1.1 Manufacturer’s Quality Control Certificates 8
 3.2 Installation Procedures 11
  3.2.1 GCL Preparation for Geomembrane Installation 11
  3.2.2 Geomembrane Deployment 11
 3.3 Installation Monitoring and Testing 12
  3.3.1 Trial Seam 12
  3.3.2 Non-Destructive Testing 13
  3.3.3 Destructive Seam Testing 13
  3.3.4 Seam Failure Delineation 15
  3.3.5 Seam Failure Repairs and Retesting 15
4.0 GEOTEXTILE LAYER 17
5.0 GEOCOMPOSITE LAYER 18
6.0 SOIL COVER LAYER EVALUATION 19
7.0 QA/QC FOR AIR MONITORING 20
8.0 QA/QC FOR WASTE SAMPLING AND ANALYSIS 21
9.0 GROUNDWATER MONITORING 22
10.0 OTHER QA/QC PROCEDURES 23

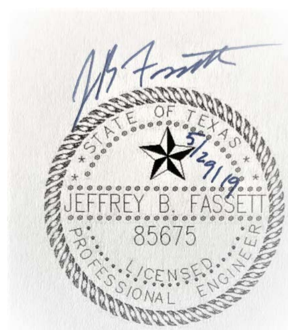


List of Tables

Table 1	GCL Pre-Installation Testing
Table 2	LLDPE Resin QC Test Frequency and Specifications
Table 3	LLDPE Geomembrane (Smooth) Material Specifications
Table 4	Geomembrane Conformance Test Schedule
Table 5	Seam Strength 40-mil LLDPE Geomembrane
Table 6	Geotextile QC Submittal Frequency & Material Specifications
Table 7	Geocomposite Drainage Layer Specifications

List of Figures

Figure 1 Extrusion Weld Seam Break Classifications
Figure 2 Fusion Weld Seam Break Classifications



1.0 INTRODUCTION AND PURPOSE

1.1 Introduction

Golder Associates Inc. (Golder) has prepared this Quality Assurance/Quality Control (QA/QC) Plan for the final cover system over the Former Operating Plant (FOP) at the shut-down Exide Technologies (Exide) Frisco Recycling Center in Frisco, Collin County, Texas. The FOP is composed of the Remediation Consolidation Area (RCA), the North Disposal Area (NDA), and the Slag Landfill. The RCA (and to a lesser extent the NDA and Slag Landfill) will be used for the disposal of excavated media from Stewart Creek and excavated soil from affected areas of the FOP at the facility and other approved remediation waste. An engineered cap will be placed over the FOP once filling is complete.

1.2 Purpose

This QA/QC Plan has been prepared in order to document the quality assurance and quality control procedures that will be followed during construction of the final cover over the FOP. This QA/QC Plan includes a description of the following or references to locations where information is included in other documents:

- Geosynthetic Clay Liner (GCL) Evaluation
- Geomembrane Evaluation
- Geotextile and Geocomposite Layer Evaluation
- Soil Cover Layer Evaluation
- QA/QC for Air Monitoring and Dust Suppression
- QA/QC for Waste Sampling and Analysis
- QA/QC for Groundwater Sampling
- Other QA/QC Procedures

Exide shall contract a qualified QA/QC Professional prior to initiating FOP final cover construction operations. Each phase of the final cover construction shall be conducted under the supervision of the QA/QC Professional. The QA/QC Professional shall be an independent third-party professional engineer (PE) licensed in the State of Texas with experience in civil or geotechnical engineering and soils testing (Engineer). A qualified construction quality assurance (CQA) monitor performing daily QA/QC observation and testing shall be under the direct supervision of the QA/QC Professional. The QA/QC Professional or his/her qualified representative(s) shall provide fulltime monitoring.

Construction quality assurance and quality control measures are also important to the construction of the zero-valent iron funnel and gate permeable reactive barrier and must be followed so that the design criteria for the reactive media are achieved. Golder personnel will oversee all construction activities and perform the construction quality assurance monitoring and required testing. A QA/QC plan for the PRB installation will be submitted for TCEQ review and approval under separate cover following approval of the response action plan for the Site and prior to commencing construction activities.

2.0 GEOSYNTHETIC CLAY LINER EVALUATION

This section presents quality assurance and quality control testing requirements, and installation procedures for the geosynthetic clay liner (GCL) construction. The GCL shall consist of sodium bentonite encapsulated between two geotextile layers, needle-punched or stitched-bonded together.

2.1 Pre-Installation Material Evaluation

2.1.1 Manufacturer's Quality Control Certificates

Prior to the installation of the GCL, the manufacturer or installer shall provide the QA/QC Professional with quality control certificates signed by a responsible party employed by the manufacturer. Each quality control certificate shall include roll identification numbers, testing procedures, and results of quality control tests. The quality control tests shall be performed in accordance with project-specific testing methods and subject to the minimum testing frequency shown in Table 1. Exide Technologies (Exide) may require more frequent testing at its discretion.

The quality control testing may be performed in the manufacturing plant. The QA/QC Professional shall review the test results prior to acceptance of the GCL to ensure that the certified minimum properties meet the values presented in Table 1(A).

In addition to the manufacturer's quality control certificates, samples of rolls of GCL will be obtained for conformance testing. The samples shall be tested by an independent third-party laboratory in accordance with Table 1(B). The QA/QC Professional shall review the test results to ensure that they meet the values presented in Table 1(A).

In order to prevent premature hydration, the GCL rolls shall be shipped in plastic wrapping that shall remain intact until material installation. Upon delivery of the GCL, storage and handling procedures shall be documented. The rolls will be stacked, stored and handled in accordance with ASTM D5888.

TABLE 1. GCL Pre-Installation Testing

(A) QC Submittal Frequency & Material Specifications

Bentonite					
Property	**Qualifier**	**Unit**	**Value**	**Test Method[(1)]**	**Frequency**
Fluid Loss	max.	ml	18	ASTM D5891	1 per 50 tons or every truck or railcar
Free Swell	min.	ml	24	ASTM D5890	
Geotextile					
Property	**Qualifier**	**Unit**	**Value**	**Test Method[(1)]**	**Frequency**
Mass per Unit Area	min.	oz/yd^2	5.9 (nonwoven) 3.0 (woven)	ASTM D5261	1 per 200,000 ft^2
Tensile Properties:	--	lb	--	ASTM D4632	
GCL Product					
Property	**Qualifier**	**Unit**	**Value**	**Test Method[(1)]**	**Frequency**
Bentonite Mass	min.	lb/ft^2	0.8	ASTM D5993	1 per 40,000 ft^2
Bentonite Moisture Content	--	%	--	ASTM D5993	
Grab Tensile Strength	--	lb/in	23	ASTM D6768	1 per 200,000 ft^2
Hydraulic Flux	max.	m^3/m^2-s	1×10^{-8}	ASTM D5887	1 per 250,000 ft^2

Notes:

1. Updated ASTM methods may be implemented based on a review by the QA/QC Professional. Alternate test methods may not be used without first revising the quality assurance plan with TCEQ approval.
2. GCLs that include nonwoven needle-punched geotextiles must be verified to have been continuously inspected for the presence of broken needles using metal detectors and found to be needle-free.
3. For those properties that do not indicate a value, the GCL material must meet the manufacturer's minimum specification

(B) GCL Conformance Test Schedule

TEST	**METHOD[(1)]**	**FREQUENCY**
Bentonite Mass/Unit Area	ASTM D5993	Not less than 1 test per 100,000 ft^2
Hydraulic Flux	ASTM D5887	

Notes:

1. Updated methods may be implemented based on a review by the QA/QC Professional.

2.2 Installation Procedures

2.2.1 GCL Subgrade Preparation

2.2.1.1 RCA Final Cover Subgrade Preparation

The final surface of waste within the RCA will be covered with a minimum 12-inch thick working surface layer placed and graded according to the design plans. The surface will be drum rolled to a smooth condition and surveyed at 100-foot intervals to establish the elevations of the surface prior to placement of the GCL. The working surface soil material will be obtained from an on- or off-site source, delivered using haul trucks, and spread with a dozer to prepare a smooth surface for the GCL. The working surface soil layer may be composed of waste soil.

- The upper 4 inches of the working surface layer must be compacted, smooth, and free of all rocks greater than 0.75-inch diameter, sharp/angular objects, sticks, roots, or debris of any kind. The surface should provide a firm, unyielding foundation for the GCL with no sudden, sharp or abrupt changes or break in grade. Loose rocks and/or dry soil particles that could damage the GCL shall be removed. Excessive voids or dimples shall be filled with soil.
- The lower 8 inches must be compacted and free of rocks greater than 1.5-inch diameter.

Standing water or excessive moisture on the subgrade will not be allowed. The subgrade shall be maintained in a smooth, uniform, and drained condition.

2.2.1.2 NDA and Slag Landfill Final Cover Subgrade Preparation

The NDA and Slag Landfill have been capped and closed by placement and compaction of a clay soil cover and establishment of vegetation. A concrete access road traverses the NDA from east to west and runs along the southern and eastern limit of the Slag Landfill.

Subgrade preparation will consist of removal or the upper 3 to 4 inches of soil to remove the vegetation and placement of approximately 6 inches of soil over the concrete access road. The stripped vegetative soil will be deposited as waste within the RCA.

If waste is placed in the NDA or Slag Landfill, a working surface layer, as described in Section 2.2.1.1, will be placed over the waste prior to final cover construction.

The surface will be drum rolled to a smooth condition and surveyed at 100-foot intervals to establish the elevations of the surface prior to placement of the GCL.

Several surface water control features are present within the NDA. These utilities consist of pipes and drop boxes. To prevent liquid from accumulating in the utilities and to remove the potential for collapse, all subsurface drainage features will be plugged with flowable fill or other low-permeable material prior to final closure of the area.

2.2.2 Anchor Trench Construction

The anchor trench shall be constructed according to Figures 2 and 3 of the Final Cover System Drawings provided in Appendix K of the Final Closure Plan, and the excavation and backfilling operations shall be documented. The inside edge of the trench shall be rounded so as to avoid stresses from sharp bends in the GCL. The GCL will not be placed into the anchor trench on top of any rocks greater than 0.75-inch diameter, sharp/angular objects, sticks, roots, or debris of any kind. The anchor trench shall be adequately drained to prevent ponding or hydration of the GCL while the trench is open. The anchor trench shall be backfilled and compacted, with compaction equipment as deemed suitable by the QA/QC representative.

2.2.3 GCL Deployment

Equipment used to deploy GCL must not cause excessive rutting of the subgrade. Deployed GCL panels should contain no folds or excessive slack. Installation personnel must not smoke or wear damaging shoes on GCL; and GCL should not be placed during excessive winds. Vehicle traffic other than low contact pressure vehicles such as smooth-tired ATVs or golf carts must not be allowed on the deployed GCL. Generators, gasoline or solvent cans, tools, or supplies must not be stored directly on the GCL.

Panels shall be overlapped and seamed as recommended by the manufacturer. End-to-end seams on slopes exceeding 15% shall be kept to a minimum. If end-to-end seams are necessary (i.e., if the GCL roll lengths are insufficient to cover the entire slope length), a minimum overlap of 3 feet will be required. Alternatively, seams may be glued as recommended by the manufacturer. In addition, end-to-end seams may be placed only in the lower half of the slope and must be staggered.

To limit the potential for pre-mature hydration, the GCL deployment shall be limited to the amount that can be covered with the overlying geomembrane liner the same day. GCL deployment shall not be undertaken during precipitation or when there is an impending threat of precipitation.

Following deployment, the CQA monitor shall visually examine the entire surface of the GCL for uneven bentonite distribution, thin spots, or other panel defects. All defects will be recorded and repaired. The QA/QC representative shall also verify and document the following:

- Proper overlap during deployment
- Seams between GCL panels are constructed per manufacturer’s recommendations
- Defects are patched and overlapped properly
- The bentonite has not become excessively hydrated

Excessively hydrated GCL shall be removed and replaced with new GCL in accordance with the specifications.

2.2.4 GCL Repairs

Torn or otherwise damaged geosynthetic facing must be patched with the same type of geosynthetic. The geosynthetic patch must extend at least 12 inches beyond the damaged area and must be adhesive or heat bonded or otherwise attached to the GCL to avoid shifting during backfilling or placement of overlying geosynthetics. If the GCL damage includes loss of bentonite, the patch must consist of full GCL extending at least 12 inches beyond the damaged area. Lapping procedures must be the same as specified for original laps of GCL panels.

2.2.5 GCL Protection

The overlying geosynthetics and soil layers shall be deployed in such a manner as to ensure that the GCL is not damaged. To avoid local bentonite displacement, and the possible impact on the hydraulic performance of a GCL, the soil cover layer shall be placed over a GCL as soon as practicable following installation of the geomembrane and geotextile.

3.0 GEOMEMBRANE EVALUATION

This section presents QA and QC testing requirements and construction specifications for geomembrane installation. The composite final cover system will generally include the following components above the GCL, from bottom to top:

- 40-mil textured linear low-density polyethylene (LLDPE) geomembrane;
- Drainage layer:
  - Double-sided geocomposite (geotextile/geonet/geotextile) drainage layer in areas with slope > 5%.
  - 8-oz/sy nonwoven geotextile for all areas with slope < 5%;
- 36-inch thick layer of cover soil, the upper 6 inches of which must be capable of sustaining native plant growth.

3.1 Pre-Installation Material Evaluation

3.1.1 Manufacturer's Quality Control Certificates

Prior to installation of any geomembrane, the manufacturer or installer shall provide the QA/QC Professional with quality control certificates signed by the responsible party employed by the manufacturer. Each quality control certificate shall include roll identification numbers, testing procedures, and results of quality control tests. The quality control tests shall be performed in the manufacturing plant using the test methods and frequencies listed in the most recent version of the Geosynthetic Research Institute (GRI) test method GM17.

The manufacturer or installer of the LLDPE geomembrane will provide the QA/QC Professional with LLDPE resin quality control certificates signed by a responsible party employed by the supplier using the test methods and frequency listed in Table 2.

Table 2. LLDPE Resin QC Test Frequency and Specifications

Test	Method	Frequency	Required Value
Density	ASTM D1505 or D792	Per manufacturer's specifications	≤ 0.926 g/ml
Melt Index	ASTM D1238		< 1.0 g/10 min.

The QA/QC Professional shall review the test results prior to acceptance of the geosynthetics to assure that the certified minimum properties of the resin meet specified values listed in Table 2, and that the geomembrane meets the specified values as determined by the most recent GRI test method GM17 as shown on Table 3.

The geomembrane must be manufactured from virgin raw materials. Reground, reworked, or trim materials from the same lot may be acceptable but recycled or reclaimed materials must not be used in the manufacturing process. LLDPE material and required welding rods must contain between two and three percent carbon black. All sheets must be free from pinholes, surface blemishes, scratches, or other defects (e.g., non-uniform color, streaking, roughness, agglomerates of carbon black or other undesirable additives or fillers, visibly discernable regrind or rework, etc.).

The rolls delivered to the site shall be inspected and inventoried, recording the manufacturer's name and product identification, and the roll thickness, number and dimensions. Manufacturer's certificates should be cross-referenced to rolls delivered to the site.

Table 3. LLDPE Geomembrane (Textured) Material Specifications

Properties	**Test Method**	**Test Value**	**Minimum Testing Frequency**
Thickness (min. ave.)	D5199	40 mils	per roll
Lowest individual for any of the 10 values		36 mils	
Density g/ml (max.)	D1505/D 792	0.939	200,000 lb
Tensile Properties (1) (min. ave.) • break strength – lb/in • break elongation - %	D6693 Type IV	 60 250	20,000 lb
Tear Resistance – lb (min. ave.)	D1004	22	45,000 lb
Puncture Resistance – lb (min. ave.)	D4833	44	45,000 lb
Carbon Black Content - %	D4218 (2)	2.0 - 3.0	20,000 lb
Carbon Black Dispersion	D5596	(3)	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) (4) (a) Standard OIT - or- (b) High Pressure OIT	D3895 D5885	100 min. 400 min	200,000 lb
Oven Aging at 85°C (5) (a) Standard OIT (min. ave.) - % retained after 90 days - or – (b) High Pressure OIT (min. ave.) - % retained after 90 days	D5721 D3895 D5885	 35 60	Per formulation
UV Resistance (6) (a) Standard OIT (min. ave.) - or – (b) High Pressure OIT (min. ave)-% retained after 1600 hr (8)	D3895 D5885	N.R. (7) 35	Per formulation

Notes:
1. Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
   - Break elongation is calculated using a gage length of 2.0 in.
2. Other methods such as D1603 (tube furnace) or D6370 (TGA) are acceptable if an appropriate correlation to D4218 (tube furnace) can be established.
3. Carbon black dispersion (only near spherical agglomerates) for 10 different views:
   - 9 in Categories 1 or 2 and 1 in Category 3
4. The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
5. It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 days response.
6. The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
7. Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
8. UV resistance is based on percent retained value regardless of the original HP-OIT value.

In addition to the manufacturer's quality control certificates, samples of the geomembrane will be obtained for conformance testing. Either at the manufacturing facility or upon delivery of the rolls of geomembrane, the test samples shall be obtained for conformance testing at an independent third party laboratory in accordance with the testing schedule shown in Table 4.

Resumes of the installer's supervisor(s) or Master Seamer(s) shall be obtained to verify that adequate seaming experience will be utilized on the project. The installer's supervisor or Master Seamer should have had experience totaling a minimum of 2,000,000 square feet of geomembrane installation.

Upon delivery of geosynthetic material, storage and handling procedures shall also be documented. Rolls of geosynthetic materials shall be handled and stored in such a way as not to damage the material. As a general rule, rolls of geosynthetic materials should not be stacked more than four rolls high.

Table 4. Geomembrane Conformance Test Schedule

Test	Method(1)	Minimum Frequency
Thickness (laboratory)	ASTM D5199, (2)	1 per 100,000 ft^2 (not less than 1 per resin lot)
Density	ASTM D1505 or D792	Minimum 1 per 100,000 ft^2 (not less than one per resin lot)
Carbon black content	ASTM D4218	
Carbon black dispersion	ASTM D5596	
Tensile properties (3)	ASTM D6693	

Notes:
1. Test values must meet the values as determined by the most recent GRI test method GM17.
2. No single measurement shall be less than 10% below the required nominal thickness in order for the panel to be acceptable. A minimum of 5 measurements shall be made per panel.
3. 2-inch initial gauge length assumed for elongation at break.

3.2 Installation Procedures

3.2.1 GCL Preparation for Geomembrane Installation

Preparation of the soil underlying the GCL will be as discussed in Section 2. A final inspection of the GCL surface will be conducted prior to deployment of the geomembrane to insure all defects have been properly repaired, no folds are present, and no tools, debris, etc. have been left on the GCL surface.

3.2.2 Geomembrane Deployment

The geomembrane shall be installed in direct and uniform contact with the GCL. Wrinkles shall be walked-out or removed as much as possible prior to field seaming. The geomembrane shall not be placed during inclement weather such as high winds or rain. Seaming should generally not take place when ambient temperatures are below 32 degrees Fahrenheit (°F), unless preheating is used. For fusion welding, preheating may be waived if the installer demonstrates that quality welds may be obtained without preheating. Seaming shall not be permitted at ambient temperatures above 104°F, unless the installer can demonstrate that seam quality is not compromised.

The geomembrane shall be installed over the GCL the same day that the GCL is deployed to prevent damage to the GCL, as described in Section 2.

No vehicular traffic shall be allowed on the geomembrane prior to the placement of the soil cover layer. Only low-ground pressure supporting equipment (e.g., golf carts, ATVs or other small rubber tired equipment with a ground pressure less than 5 pounds per square inch and a total weight less than 750 pounds) may be allowed to traverse the surface of the geomembrane. Personnel working on the geomembrane shall not smoke, wear damaging shoes, or engage in any other activity likely to damage the geomembrane.

Only those sections that are to be placed and seamed in one day should be unrolled. Panels left unseamed shall be anchored with sandbags or other suitable weights. In general, seams shall be oriented parallel to the line of maximum slope, i.e., oriented up and down, not across the slope. In corners and odd-shaped geometric locations, the number of field seams should be minimized.

Panels shall be overlapped as recommended by the manufacturer as appropriate for the type of seam welding to be performed; however, overlapping shall be no less than 2 inches. Field seaming shall be performed by the method or methods approved by the manufacturer only, either by extrusion welding or double-tracked fusion welding. All foreign matter (dirt, water, oil, etc.) should be removed from the area to be seamed. No seaming shall take place without the installer’s supervisor or Master Seamer and QA/QC representative being present. Fishmouths or large wrinkles at the seam overlap shall be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut shall be seamed and/or patched. Seams made to correct fishmouths or large wrinkles shall extend to the outside edge of panels placed in the anchor trench.

Panel layout and field seams shall be given an identification code, mapped, and logged to record relevant installation information. Inspection and testing records shall be logged as well as repair and retest data. Section 3.3 includes a thorough listing of items to be documented during geomembrane construction and testing.

3.3 Installation Monitoring and Testing

Field seaming will be performed in strict accordance with methods approved by the manufacturer. This is usually fusion welding or extrusion welding for linear low density polyethylene (LLDPE). Tack welds (if used) with LLDPE geomembrane will use heat only. No double-sided tape, glue, or other method will be permitted when extrusion or fusion welding is used for bonding.

3.3.1 Trial Seam

Each day prior to commencing field seaming, trial seams shall be made on pieces of geomembrane material to verify that conditions are adequate for production seaming. Trial seams shall be made at the beginning of each seaming period and shift (generally, at least twice each day) for each combination of production seaming machine and operator to be used that day. The trial test seam shall be at least 3 feet long by 1 foot wide (after seaming) with the seam centered lengthwise. Four (6 when possible using dual track fusion welding) 1-inch wide specimens shall be die-cut from the trial seam sample. Two specimens shall be tested in the field for shear and 2 for peel (4 when possible if testing both inner and outer welds for dual track fusion welding) and shall be compared to the minimum seam strength requirements specified in Table 5 and discussed below.

If any of the trial seam specimens fail, the entire trial seam operation shall be repeated. If an additional specimen fails from the second trial seam, the seaming machine and seamer shall not be used for seaming until the deficiencies are corrected and two consecutive successful trial seams are achieved. Additional trial seams shall be performed if frequent field seaming problems are experienced or if power to the seaming machines is interrupted sufficiently long to require rewarming.

Table 5. Seam Strength 40-mil LLDPE Geomembrane

Property	Unit	Specified Value	Test Method
Hot Wedge Seams			ASTM D6392
shear strength(1)	lb/in.	60	
shear elongation at break(2)	%	50	
peel strength(1)	lb/in.	50	
peel separation	%	25	

Property	Unit	Specified Value	Test Method
Extrusion Fillet Seams			ASTM D6392
shear strength(1)	lb/in.	60	
shear elongation at break(2)	%	50	
peel strength(1)	lb/in.	44	
peel separation	%	25	

Notes:

1. Value listed for shear and peel strengths are for 4 out of 5 test specimens; the 5th specimen can be as low as 80% of the listed values.
2. Elongation measurements should be omitted for field testing.

3.3.2 Non-Destructive Testing

Continuous, non-destructive testing shall be performed on all seams by the installer. Air pressure testing on dual-track fusion welds and vacuum-box testing for extrusion welds are the only acceptable methods for LLDPE geomembrane seams. All leaks must be isolated and repaired by following the procedures described in this QA/QC Plan.

Air-Pressure Testing- The ends of the air channel of the dual-track fusion weld must be sealed and pressured to approximately 30 psi, if possible. The air pump must then be shut off and the air pressure observed after 2 or more minutes. A loss of less than 4 psi is acceptable if it is determined that the air channel is not blocked between the sealed ends. A loss of 4 psi or more indicates the presence of a seam leak that must then be isolated and repaired by following the procedures described in this QA/QC Plan. Test results, initial and final pressure readings, and start and stop times will be recorded for all pressure tests. The QA/QC Professional or his/her qualified representatives must observe and record all pressure gauge readings.

Vacuum-Box Testing- A suction value of approximately 3 to 5 inches of gauge vacuum must be applied to all extrusion welded seams that can be tested in this manner. Examples of extrusion welded seams that do not easily lend themselves to vacuum testing would be around boots, appurtenances, etc. The seam must be observed for leaks at least 10 seconds while subjected to this vacuum. The QA/QC Professional or his/her qualified representative must observe and document 100 percent of this testing.

Other Testing- Other non-destructive testing must have prior written approval from the Engineer.

3.3.3 Destructive Seam Testing

Destructive samples shall be taken at a minimum frequency of one test location, selected randomly, within each 500 linear feet of seam length, inclusive of both primary longitudinal and cross seams, cap strips and repairs or 20 ft^2 or larger. Each test sample should be about 44 to 56 inches long and 12 inches wide with the seam located in the middle. Test specimens, approximately 1 inch wide, shall be cut from both ends of the sample for field testing (peel and shear). The remaining sample should be cut into three parts (one for quality assurance laboratory testing, one for installer quality control laboratory testing, and one for archive storage to be maintained at a location selected by the owner).

The field tests shall be conducted on a certified calibrated tensiometer capable of maintaining a constant extension rate of 2 inches per minute. If one of the field test specimens from the ends of the destructive sample fail, then the seam will be considered to have failed, and repairs shall be initiated as described below. If both specimens pass, then a sample for laboratory testing will be sent to the quality assurance laboratory for testing in both peel and shear.

Seam strengths for LLDPE geomembranes shall meet the minimum values specified in Table 5 and as discussed below for weld acceptance criteria.

Weld Acceptance Criteria: For LLDPE seams, the strength of four out of five 1.0-inch wide strip specimens in shear should meet or exceed the values given in Table 5. The fifth must meet or exceed 80% of the given values.

In addition, the peel separation (or incursion) should not exceed the values given in Table 5. The value shall be calculated as described in GRI Test Method GM19.

Regarding the locus-of-break patterns of the different seaming methods in shear and peel, the following are unacceptable break codes per their description in ASTM D6392 (SIP is an acceptable break code);

- Hot Wedge:
  - AD and AD-Brk > 25%
- Extrusion Fillet:
  - AD1, AD2 and AD-WLD (unless strength is achieved).

The break codes are illustrated on Figures 1 and 2.

Destructive test results for both field and laboratory tests shall include qualitative data including the location of the failure and locus-of-break code as described on Figures 1 and 2. Peel tests on double-tracked fusion welds shall be performed on both inside and outside tracks of the weld.

At a minimum, a destructive test must be done for each welding machine used for seaming or repairs. A sufficient amount of the seam must be removed in order to conduct field testing, independent laboratory testing, and archiving of enough material in order to retest the seam when necessary. Field testing shall include at least two peel test specimens (four when testing both tracks on dual-track fusion welded seams) and at least two shear specimens. Destructive seam-testing locations shall be cap-stripped and the cap completely seamed by extrusion welding to the geomembrane. Capped sections shall be non-destructively tested. Additional destructive test samples may be taken if deemed necessary by the QA/QC professional or his\her qualified representative.

3.3.4 Seam Failure Delineation

When a sample fails a destructive test, the installer shall follow the welding path to an intermediate location at least 10 feet in each direction, or a distance determined by the QA/QC Professional, from the point of the failed test in each direction and take 1-inch wide specimens for an additional set of field tests. If these additional samples pass the tests, then two laboratory destructive samples shall be taken adjacent to the intermediate locations or at locations determined by the QA/QC Professional or his/her representative. If these laboratory samples pass the tests, then the seam shall be repaired between these locations. If either sample fails, then the process shall be repeated to establish the zone where the seam should be repaired. All acceptable repaired seams shall be bounded by two locations from which samples passing laboratory destructive tests have been taken.

3.3.5 Seam Failure Repairs and Retesting

Any portion of the geomembrane exhibiting a flaw or failing a destructive or nondestructive test shall be repaired. Repair methods may include spot welding (extrusion) for minor flaws and punctures; patches for larger holes and tears; capping for large lengths of failed seams or panel damage; and extrusion welding of the outer flap for repair on an inadequate fusion seam (less than 100-ft cumulative length) which has an exposed edge. All seam leaks and destructive test locations shall be repaired for a distance of at least six inches on each side of the faulty spot or area detected. At a minimum, those repairs shall be non-destructively retested and possibly destructively tested (refer to destructive testing criteria for repaired seams as described above in Destructive Seam Testing).

For any repair method, the following provisions shall be satisfied:

- Surfaces of the geomembrane which are to be repaired using extrusion methods shall be ground no more than one hour prior to the repair;
- All surface shall be clean and dry at the time of repair;
- Patches or caps shall extend at least six inches beyond the edge of the defect, and all corners of patches shall be rounded with a radius of approximately three inches or more;
- All repairs shall be nondestructively tested as previously described; and
- All seaming equipment, personnel, and operation procedures used in repair work shall meet the same requirements as for new seaming operations.

The QA/QC Professional or his/her qualified representative shall observe and document all destructive and nondestructive testing of repairs and shall record the number of each repair, type, date and test outcome. Repairs that pass the nondestructive tests shall be taken as an indication of an adequate repair. Repairs more than 150 feet long shall also be required to have a destructive test performed. Repairs that fail the initial retest shall be redone and retested until a passing test results. All work and testing of repairs shall be fully documented in a repair log.

When placing overlying material on the geomembrane, every effort must be made to minimize wrinkle development. If possible, cover should be placed during the coolest weather available. Small wrinkles should be isolated and covered as quickly as possible to prevent their growth. In no case shall the geomembrane be allowed to fold over on itself.

4.0 GEOTEXTILE LAYER

A nonwoven geotextile layer shall be placed over the 40-mil LLDPE geomembrane in areas where the final cover grades are less than 5%. The geotextile shall be an 8-oz/sy, nonwoven, needle-punched made from staple fiber. The geotextile shall meet the following material properties. The manufacturer or installer of the nonwoven geotextile will provide the QA/QC Professional with quality control certificates signed by a responsible party employed by the supplier.

Table 6. Geotextile QC Submittal Frequency & Material Specifications

Property	Test Method	Frequency	Min. Ave. Roll Value
Mass per unit area, oz/yd^2	ASTM D5261	90,000 ft^2	8
Grab Tensile Strength, lb	ASTM D4632	90,000 ft^2	220
Grab Elongation, %	ASTM D4632	90,000 ft^2	50
Trapezoidal Tear, lb	ASTM D4533	90,000 ft^2	90

Only low ground pressure rubber-tired support equipment approved by the QA/QC Professional may be allowed on the geotextile. Personnel working on the geotextile shall not smoke, wear damaging shoes, or engage in any activity that damages the geotextile or underlying geosynthetics.

Geotextile panels will be overlapped and seamed as recommended by the manufacturer.

5.0 GEOCOMPOSITE LAYER

The geocomposite drainage layer will be used in areas with final cover grades greater than 5%. The geocomposite layer shall conform to the material and performance properties specified in Table 7. Manufacturers' certificates of material and performance characteristics shall be obtained and documented at the minimum frequency shown on Table 7, with not less than 1 per resin lot. Geosynthetic drainage material conformance testing will consist of transmissivity testing on each material type using the test set-up described in Table 7.

The drainage layer is a double-sided geocomposite that consists of a geonet with a non-woven geotextile heat-bonded on both sides deployed over the final cover area. The double-sided geocomposite shall be anchored as shown on Figures 2 and 3 of the Final Cover System Drawings provided in Appendix K of the Final Closure Plan. The geonet core of the geocomposite will be tied together using plastic ties placed at a frequency of one per 5 feet along the length of the panel and every 6 inches along the ends of the panels. The upper geotextile panels will be secured by either overlapping and heat bonding or field sewn.

Only low ground pressure rubber-tired support equipment approved by the QA/QC Professional may be allowed on the geocomposite. Personnel working on the geocomposite shall not smoke, wear damaging shoes, or engage in any activity that damages the geocomposite or underlying geosynthetics.

Table 7. Geocomposite Drainage Layer Specifications

GEOCOMPOSITE					
Property	**Qualifier**	**Unit**	**Value**	**Test Method**	**Frequency**
Transmissivity	Min.	m^2/sec	6×10^{-5}	ASTM D4716$^{(1)}$	200,000 ft^2
Ply Adhesion	Min.	lb/in	0.5	ASTM D7005	200,000 ft^2
GEONET CORE					
Property	**Qualifier**	**Unit**	**Value**	**Test Method**	**Frequency**
Thickness	Min.	mils	200	ASTM D5199	200,000 ft^2
Density (black resin)	Min.	g/cm^3	0.940	ASTM D1505	200,000 ft^2
Carbon Black Content	Range	%	2 to 3	ASTM D4218	200,000 ft^2
GEOTEXTILE					
Property	**Qualifier**	**Unit**	**Value**	**Test Method**	**Frequency**
Mass per Unit Area	MARV	oz/yd^2	6	ASTM D5261	200,000 ft^2
AOS	MARV	US Sieve (mm)	70 (0.210)	ASTM D4751	540,000 ft^2
Puncture Resistance	MARV	lb	435	ASTM D6241	540,000 ft^2
Grab Tensile Strength	MARV	lb	160	ASTM D4632	540,000 ft^2

Notes:

1. The transmissivity shall be measured at a minimum gradient of 0.1 under a minimum normal pressure of 1,000 psf with a minimum seating period of 1 hour.

6.0 SOIL COVER LAYER EVALUATION

The soil cover layer will consist of an 30-inch thick layer of general clean fill and a 6-inch thick layer of soil capable of supporting vegetation.

Soil cover does not require compaction control; however, it should be stable for construction traffic. Care shall be exercised in placement so as not to shift, wrinkle or damage any underlying geosynthetic layers, and the placement methods shall be documented. Soil cover placement shall be monitored by the QA/QC Professional or his representative on a full-time basis.

Light equipment such as low ground pressure dozers (less than 5 pounds per square inch contact pressure) shall be used to place the soil cover and a minimum of 12 inches of material shall be maintained between the dozer and the underlying geosynthetics. If possible, cover should be placed during the coolest weather available. Soil cover material shall be deployed in “fingers” along the geosynthetics to control the amount of slack, and minimize wrinkles and prevent folds.

The final thickness of the soil cover layer shall be a minimum of 36 inches directly above the geosynthetic drainage layer. The required thickness of the layer shall be verified by survey techniques on an established grid system with not less than one verification point per 10,000 square feet of surface area. A minimum of two verification points is required.

The soil used as the topsoil layer will be capable of sustaining native plant growth and must be hydroseeded immediately after completion of the final cover (weather permitting). Temporary or permanent erosion control materials (i.e. mulches, containment meshes, geomatting systems, etc.) may be used to minimize erosion and aid establishment of vegetation. An alternative erosion layer may also be constructed (subject of the approval of the Engineer) consisting of cobbles, riprap, or other hard armor systems for areas in which the establishment of vegetation cover has proven difficult.

Other quality assurance for the soil cover layer should consist of continuous observation by the QA/QC Professional or his representative during construction, including verification that the soil is free of deleterious materials; and performing any additional test believed necessary by the QA/QC Professional to verify that the layer has been constructed in accordance with the closure plan.

7.0 QA/QC FOR AIR MONITORING

QA/QC Procedures for Air Monitoring activities conducted during closure activities are included in Section 6.0 of the Air Monitoring Plan for FOP Closure Activities, included as Appendix P to the Closure Plan.

8.0 QA/QC FOR WASTE SAMPLING AND ANALYSIS

QA/QC procedures related to sampling and analysis for waste are included in the Waste Analysis Plan, which is included as Attachment Q to the May 2019 supplement to the industrial and hazardous waste permit renewal application.

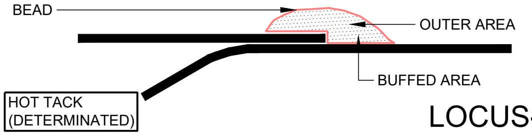
9.0 GROUNDWATER MONITORING

QA/QC procedures for groundwater monitoring for the RCA, Slag Landfill, and NDA are included in the FOP Groundwater Monitoring Plan, which is included as Attachment L to the May 2019 supplement to the industrial and hazardous waste permit renewal application.

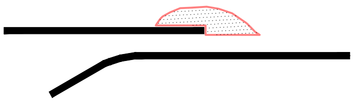
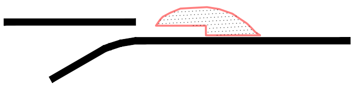
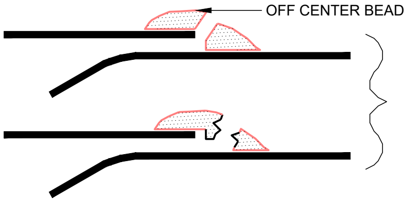
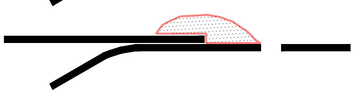
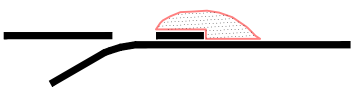
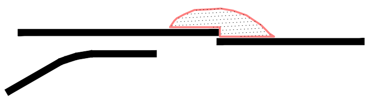
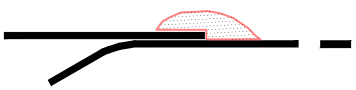
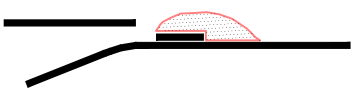
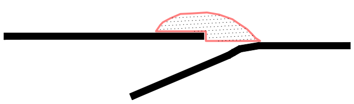
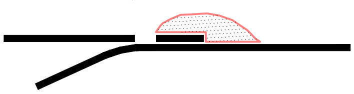
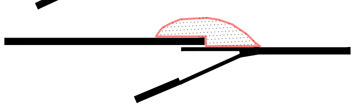
10.0 OTHER QA/QC PROCEDURES

In the event that additional sampling related to closure activities is required, the sampling activities will be performed in general accordance with the procedures outlines in the Sampling and Analysis Work Plan dated November 2011 prepared by Conestoga-Rovers & Associates, which includes a Quality Assurance Project Plan.

FIGURES



UNTESTED SPECIMEN
EXTRUSION WELD WITH LEISTER HEAT SEAM

TYPES OF BREAK	LOCUS-OF-BREAK CODE	BREAK DESCRIPTION
	AD1	FAILURE IN ADHESION. SPECIMANS MAY ALSO DELAMINATE UNDER THE BEAD AND BREAK THROUGH THE THIN EXTRUDED MATERIAL IN THE OUTER AREA.
	AD2	FAILURE IN ADHESION.
	AD-WLD	BREAKS THROUGH THE FILLET. BREAKS THROUGH THE FILLET RANGE FROM BREAKS STARTING AT THE EDGE OF THE THE TOP SHEET TO BREAKS THROUGH THE FILLET AFTER SOME ADHESION FAILURE BETWEEN THE FILLET AND THE BOTTOM SHEET.
	SE1	BREAK AT SEAM EDGE IN THE BOTTOM SHEET. SPECIMENS MAY BREAK ANYWHERE FROM THE BEAD/OUTER AREA EDGE TO THE OUTER AREA/ BUFFED AREA. (APPLICABLE TO SHEER ONLY).
	SE2	BREAK AT SEAM EDGE IN THE TOP SHEET. SPECIMENS MAY BREAK ANYWHERE FROM THE BEAD/ OUTER AREA EDGE TO THE OUTER AREA/BUFFED AREA. (APPLICABLE TO SHEER ONLY).
	SE3	BREAK AT SEAM EDGE IN THE BOTTOM SHEET. (APPLICABLE TO PEEL ONLY).
	BRK1	BREAK IN THE BOTTOM SHEETING. A "B" IN PARENTHESIS FOLLOWING THE CODE MEANS THE SPECIMEN BROKE IN THE BUFFED AREA. (APPLICABLE TO SHEER ONLY).
	BRK2	BREAK IN THE TOP SHEETING. A "B" IN PARENTHESIS FOLLOWING THE CODE MEANS THE SPECIMAN BROKE IN THE BUFFED AREA.
	AD-BRK	BREAK IN THE BOTTOM SHEETING AFTER SOME ADHESION FAILURE BETWEEN THE FILLET AND THE BOTTOM SHEET. (APPLICABLE TO PEEL ONLY).
	HT	BREAK AT THE EDGE OF THE HOT TACK FOR SPECIMENS WHICH COULD NOT BE DELAMINATED IN THE HOT TACK.
	SIP	SEPARATION IN THE PLANE OF THE SHEET.

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CLIENT
EXIDE TECHNOLOGIES

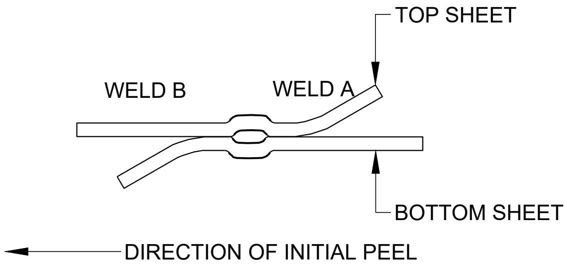
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-06-12
DESIGNED	MGC
PREPARED	MGC
REVIEWED	VK
APPROVED	JBF

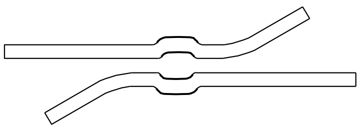
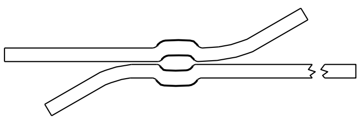
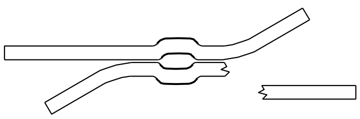
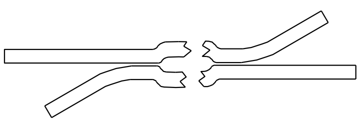
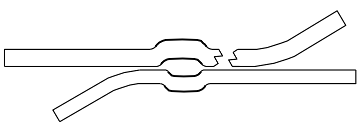
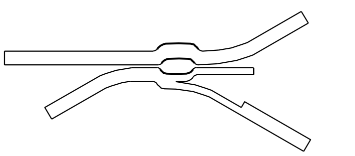
PROJECT
EXIDE TECHNOLOGIES RCRA PERMIT RENEWAL
REMEDIATION CONSOLIDATION AREA
FRISCO, COLLIN COUNTY TEXAS

TITLE
EXTRUSION WELD SEAM BREAK CLASSIFICATIONS

PROJECT NO.	CONTROL	REV.	FIGURE
1302086	1302086A003	A	1



SCHEMATIC OF UNTESTED SPECIMEN

TYPES OF FAILURE	LOCUS-OF-BREAK CODE	BREAK
	AD	ADHESION FAILURE.
	BRK	BREAK IN SHEETING. BREAK CAN BE IN EITHER TOP OR BOTTOM SHEET.
	SE1	BREAK AT OUTER EDGE OF SEAM. BREAK CAN BE IN EITHER TOP OR BOTTOM SHEET.
	SE2	BREAK AT INNER EDGE OF SEAM THROUGH BOTH SHEETS.
	AD-BRK	BREAK IN FIRST SEAM AFTER SOME ADHESION FAILURE. BREAK CAN BE IN EITHER THE TOP OR BOTTOM SHEET.
	SIP	SEPARATION IN THE PLANE OF THE SHEET. BREAK CAN BE IN EITHER TOP OR BOTTOM SHEET.

ISSUED FOR PERMITTING PURPOSES ONLY

CLIENT EXIDE TECHNOLOGIES		PROJECT EXIDE TECHNOLOGIES RCRA PERMIT RENEWAL REMEDIATION CONSOLIDATION AREA FRISCO, COLLIN COUNTY TEXAS	
CONSULTANT Golder Associates	YYYY-MM-DD	2017-06-12	TITLE **FUSION WELD SEAM BREAK CLASSIFICATIONS**
	DESIGNED	MGC	
	PREPARED	MGC	
	REVIEWED	VK	
	APPROVED	JBF	

PROJECT NO.	CONTROL	REV.	FIGURE
1302086	1302086A002	A	2

Established in 1960, Golder Associates is a global, employee-owned organization that helps clients find sustainable solutions to the challenges of finite resources, energy and water supply and management, waste management, urbanization, and climate change. We provide a wide range of independent consulting, design, and construction services in our specialist areas of earth, environment, and energy. By building strong relationships and meeting the needs of clients, our people have created one of the most trusted professional services organizations in the world.

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Engineering Earth's Development, Preserving Earth's Integrity

APPENDIX N

FOP STABILITY CALCULATIONS

FINAL COVER STABILITY

Made By: VK
Checked by: JBF
Reviewed by: AMF

1.0 OBJECTIVE

To investigate the stability of the final cover lining system.

2.0 GIVEN

Maximum slope of the geomembrane within the final cover is approximately 25%.

A geotextile drainage layer will be installed in areas with final cover slope ≤ 5% , while a geocomposite drainage layer will be install in areas with slope > 5%.

3.0 ASSUMPTIONS

Proposed final cover liner system consists of (from top to bottom):

36-inch Soil Cover

Drainage Layer:

Case 1: 200-mil double-sided geocomposite layer for areas with slope > 5%

Case 2: 8-oz non-woven goetextile layer for areas with slope ≤ 5%

40-mil LLDPE textured geomembrane

GCL

For **Case 1**, The soil cover is assumed to be dry since the head is maintained within the thickness of the geocomposite layer as shown in the attached Geocomposite Analysis for Final Cover calculations.
For **Case 2**, the soil cover is assumed to be fully saturated.

Based on a review of available data, the following parameters were assigned to the materials.

Material	Strength Parameters		Unit Weight (pcf)		Reference
	ϕ	c	Moist	Saturated	
Soil cover	28	0	115	132	Estimate-conservative
Soil cover/Geocomposite	28	0	N/A	N/A	Golder(1)
Soil cover/Nonwoven Geotextile	29	0	N/A	N/A	Golder(1)
Geocomposite/Textured Geomembrane(2)	21	0	N/A	N/A	Golder(1)
Nonwoven Geotextile/Textured Geomembrane(3)	21	0	N/A	N/A	Koerner and Narejo, 2005 (Ref. 1)
Textured Geomembrane/GCL	24	0	N/A	N/A	Golder(1)

(1) Based on unpublished testing data for similar materials presented in Figures 1, 2, 3, and 5.

(2)The data indicates a lower-bound angle of 24°, but since the final cover pertains to a long-term condition a conservative angle of 21° is assumed for the calculation.

(3) The data indicates an average peak friction angle of 26 degrees - See Figure 4, but since the final cover pertains to a long-term condition a conservative angle of 21° is assumed for the calculation.

Based on the shear strength parameters, the critical interface occurs along the geocomposite/ textured geomembrane interface for Case 1; this interface was assigned a conservative friction angle of 21 degrees. For Case 2, the critical interface occurs along the nonwoven geotextile/textured geomembrane interface; this interface was assigned a conservative friction angle of 21 degrees.

4.0 METHOD

A model was created representing the final cover slopes. A limit equilibrium analysis was performed to determine the minimum factor of safety against a sliding block failure along the critical interface.

Infinite Slope Analysis

$$\boxed{FS = \frac{c + (\gamma b \cos\beta - \gamma_w d \cos\beta)\tan\phi}{\gamma b \sin\beta}}$$

based on Soong and Koerner 1996 (Ref. 2).

Case 1 Sliding at Geocomposite/Textured Geomembrane Interface

ϕ =	21	interface friction angle	
β =	25%	slope angle - max	
	14.0	slope angle - max (degrees)	0.24497866
c =	0	cohesion of soil (psf)	
γ =	125	saturated unit weight of soil (pcf)	
b =	3.0	soil thickness (ft)	
d =	0	water depth in cover (ft)	
γ_w =	62.4	unit weight of water (pcf)	

FS = 1.54

Case 2 Sliding at Nonwoven Geotextile/Textured Geomembrane Interface

ϕ =	21	interface friction angle	
β =	5%	slope angle - max	
	2.9	slope angle - max (degrees)	0.0499584
c =	0	cohesion of soil (psf)	
γ =	125	saturated unit weight of soil (pcf)	
b =	3.0	soil thickness (ft)	
d =	3	water depth in cover (ft)	
γ_w =	62.4	unit weight of water (pcf)	

FS = 3.85

5.0 RESULTS

Using the Golder Associates interface friction angle data, the critical angle of internal friction was conservatively assumed to be 21 degrees for the geocomposite/textured geomembrane interface. The resulting minimum factor of safety was calculated to be 1.54. Using data from the literature, the critical angle of internal friction was conservatively assumed to be 21 degrees for the nonwoven geotextile/textured geomembrane interface. The resulting minimum factor of safety was calculated to be 3.85

6.0 CONCLUSION

Through analysis of the lining system, the final cover slope is found to be stable.

7.0 REFERENCE

(1) Robert M. Koerner and Dhani Narejo, "Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces," GRI Report #30, Geosynthetic Research Institute, Drexel University, Philadelphia, PA, June 2005.

(2) Te-Yang Soong and Robert M. Koerner, "Cover Soil Slope Stability Involving Geosynthetic Interfaces," GRI Report #18, Geosynthetic Research Institute, Drexel University, Philadelphia, PA, December 1996.

Figure 1

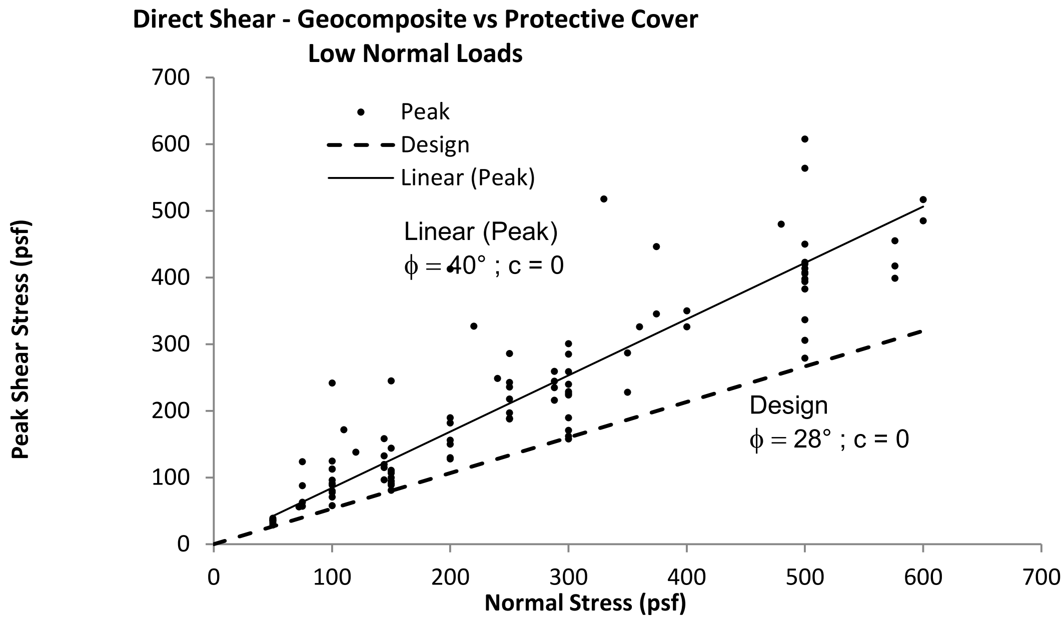


FIGURE 2

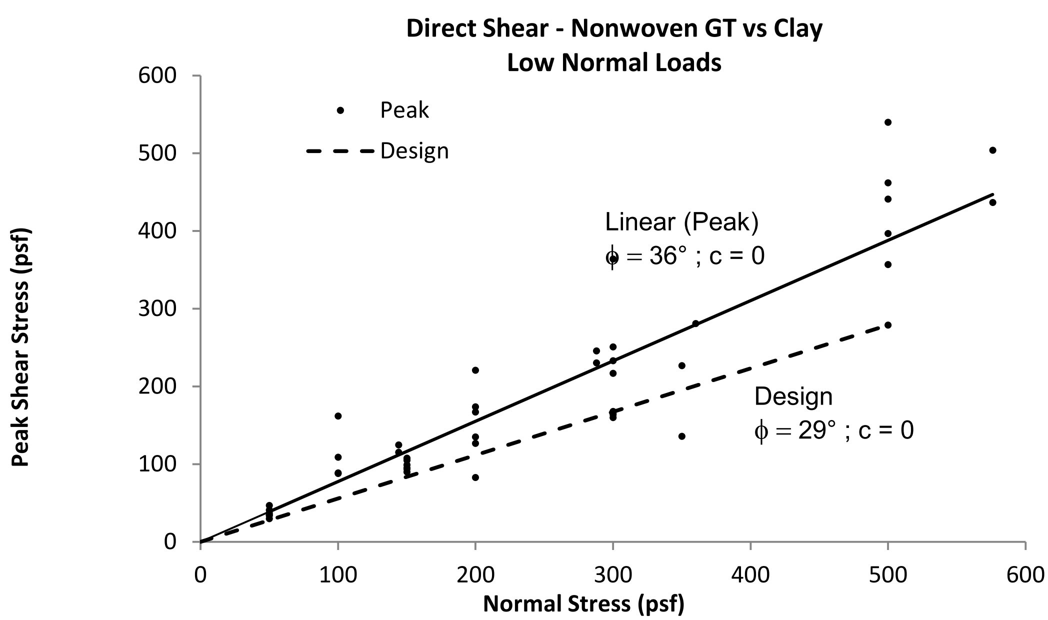


FIGURE 3

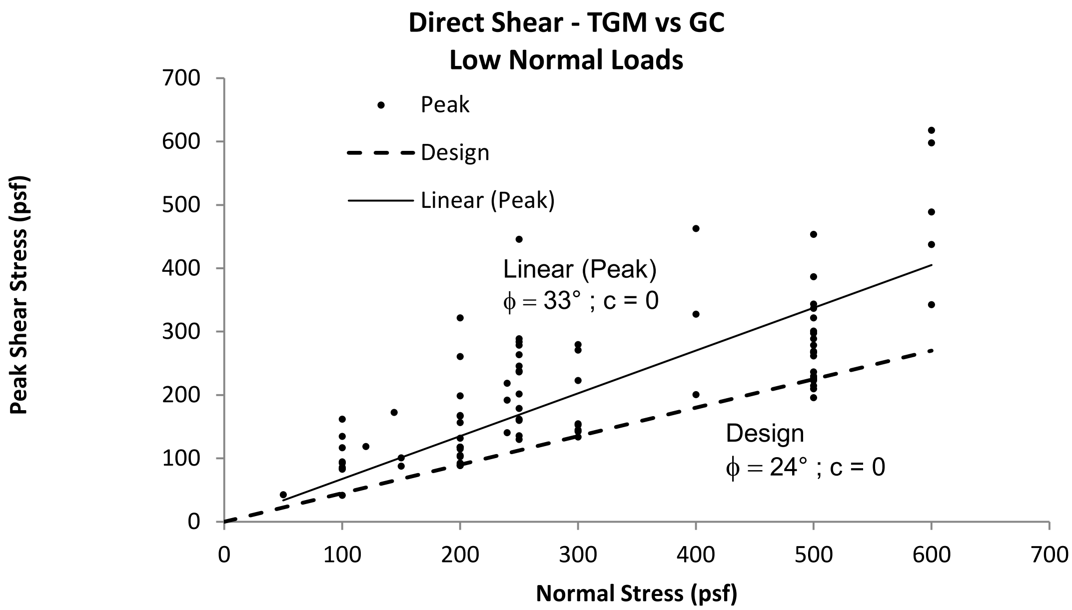


FIGURE 4 Peak Shear Strength; Textured HDPE against NW-NP Geotextile (Figure from Koerner and Narejo 2005)

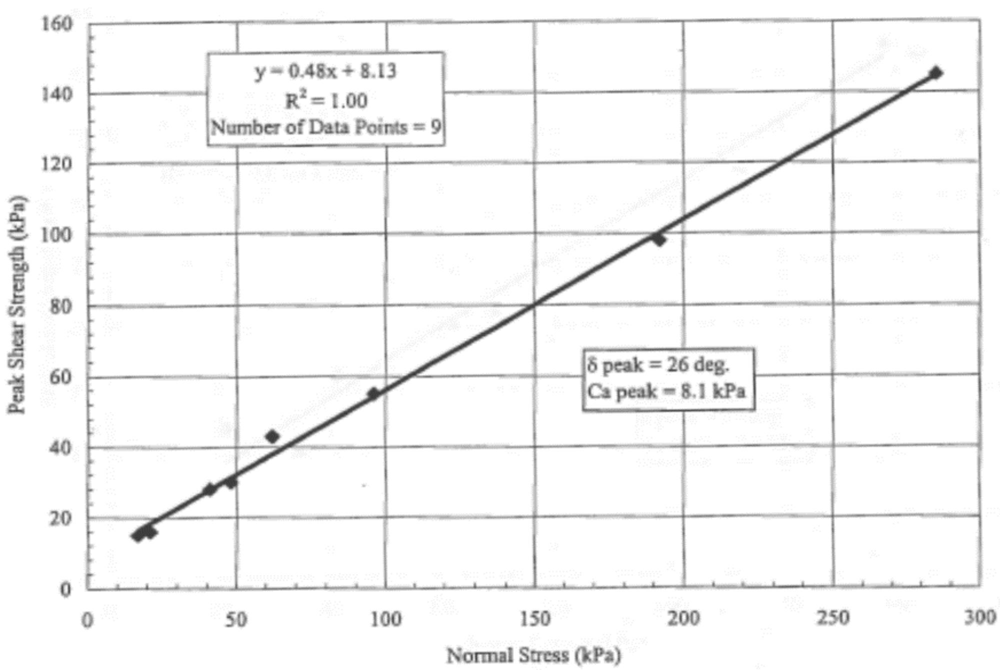
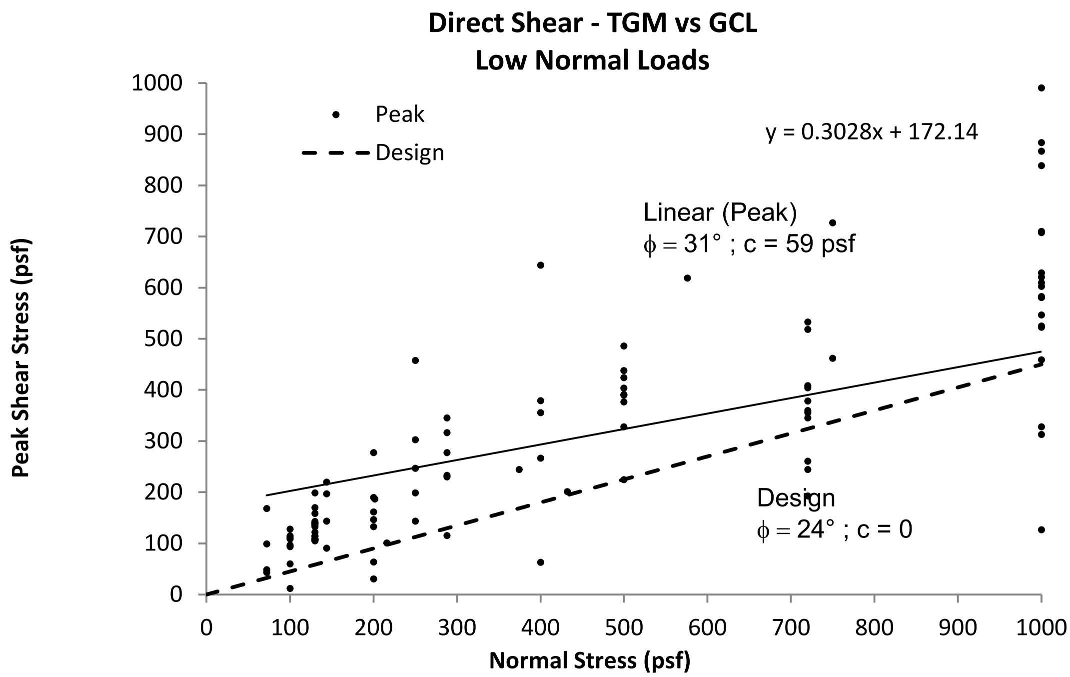


FIGURE 5


Direct Shear - TGM vs GCL
Low Normal Loads
Peak
Design
y = 0.3028x + 172.14
Linear (Peak)
ϕ = 31° ; c = 59 psf
Design
ϕ = 24° ; c = 0
Peak Shear Stress (psf)
Normal Stress (psf)
0
100
200
300
400
500
600
700
800
900
1000

GEOCOMPOSITE ANALYSIS FOR FINAL COVER

Made By: VK
Checked by: JBF
Reviewed by: AMF

1.0 OBJECTIVE

I) Determine the required transmissivity of the final cover geocomposite drainage layer on the maximum final cover slope length.

2.0 GIVEN

Maximum length of the 4H:1V slope is approximately (L) = 60 ft.

3.0 ASSUMPTIONS

The permeability of the vegetative cover, K_{veg} = 1.0E-05 cm/s (typical value)

4.0 METHOD

Determine the required transmissivity of the final cover geocomposite after applying reduction factors and a factor of safety.

$$\Theta_{\text{measured -req}} = FS\Pi(RF)q_h L/(\sin\beta)$$ (Ref. 1)

$\Theta_{\text{measured -req}}$ = required transmissivity of geocomposite measured in laboratory test

Test Conditions: i = 0.1 (min)
Normal Stress = 1,000 psf (min)
Boundary Cond'ns = steel plates
Test Time = 1 hour

FS = factor of safety = 2.0

RF = reduction factors (see below)

$\Pi(RF)$ = product of all reduction factors

q_h = rate of liquid supply expressed per unit surface area measured horizontally.

Worst case condition consists of a saturated vegetative cover over geocomposite. Under this condition, the gradient = 1.0 and q_h is equal to the hydraulic conductivity of the soil.

L = length of geocomposite in direction of flow

β = slope angle

JEFFREY B. FASSETT
85675
LICENSED
PROFESSIONAL ENGINEER
STATE OF TEXAS
5/30/19

GOLDER ASSOCIATES INC.
TEXAS REGISTRATION F-2578

Reduction Factor	Description	Value (Ref. 1)
RF_{in} =	Reduction Factor for intrusion of geotextile into geonet	1.2
RF_{cr} =	Reduction Factor for geonet creep	1.1
RF_{cc} =	Reduction Factor for chemical clogging of geotextile and/or geonet	1.2
RF_{bc} =	Reduction Factor for biological clogging of geotextile and/or geonet	3
	$\Pi(RF)$ =	4.8

5.0 CALCULATIONS

I) Transmissivity for maximum flow length

$$\Theta_{measured\ -req} = 7.7E\text{-}04\ ft^3/s\text{-}ft = 7.2E\text{-}05\ m^3/s\text{-}m$$

6.0 CONCLUSIONS

The required measured transmissivity of a geocomposite drainage layer to adequately convey surface water infiltration on the maximum slope length on the final cover system is 7.2 x 10^{-5} m^3/s/m. The typical transmissivity values for double-sided geocomposites are in the 10^{-4} m^3/s/m range. Hence, the required transmissivity is less than typically achievable values and the geocomposite drainage layer will have adequate capacity.

7.0 REFERENCES

1. Giroud, J.P, Zornberg, J.G., and Zhao, A., "Hydraulic Design of Geosynthetic and Granular Liquid Collection Layers", Geosynthetics International, Vol. 7, Nos. 4-6, 2000.

APPENDIX O

FOP DRAINAGE AND EROSION CALCULATIONS

FINAL COVER EROSION SOIL LOSS CALCULATION - RCA

Made By:	CMF
Checked by:	JBF
Reviewed by:	
Date:	5/30/19

1.0 OBJECTIVE:

Estimate erosion soil loss under final closure conditions for the Remediation Consolidation Area (RCA) at the closed Exide Recycling Canter in Frisco, Texas.

2.0 METHOD:

Erosion loss was determined using the Revised Universal Soil Loss Equation (RUSLE), (UDSA,1997).

I) Use revised universal soil loss equation.

A = R K L S C P Variables described below

Rainfall and erosivity index (R)

From Fig. 1, Ref.1, the average annual rainfall erosion index for the site is approx. **295**

Soil Erodibility Factor (K)

Assume a silty clay loam with an organic matter content of 4% and use Table 1, Ref. 1, to determine the K factor.

Use K = 0.26

Cover and Management Factor [C]

Assume 80% ground cover and interpolate C from values shown on Table 2, Ref. 1

C = 0.013

Support Practice Factor (P)

Surface tracked with dozer -- rough surface

Use P = 1

Length Slope Factor (LS) (Ref. 2)

For regular slopes > 15 ft long, the **Slope Steepness Factor, S** =

$S = 10.8 \sin \Theta + 0.03$; $\sin \Theta < 0.09$ Eqn. 8.39

or $16.8 \sin \Theta - 0.50$; $\sin \Theta \geq 0.09$ Eqn. 8.40

Where: Θ = slope angle

Length Factor, L

$L = [\lambda/72.6]^m$ Eqn. 8.43

λ = slope length (measured as the horizontal projection of plot length)

m is an exponent dependent upon slope given by

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GOLDER ASSOCIATES INC.
TEXAS REGISTRATION F-2578

$$m = \frac{\beta}{1+\beta} \quad \text{Eqn. 8.44}$$

β for soils moderately susceptible to erosion is given by:

$$\beta_{\mathrm{mod}} = \frac{11.16 \sin \Theta}{3.0(\sin \Theta)^{0.8} + 0.56} \qquad \text{Eqn. 8.45}$$

β is modified as follows for soils of low and high susceptibility to erosion:

$\beta_{low} = (1/2)\beta_{mod}$

$\beta_{high} = 2\beta_{mod}$

3.0 ASSUMPTIONS:

Facility slopes are 4H:1V on the sides, 3.0% on top,

R was taken from Figure 1, Average Annual Values of the Rainfall Erosion Index,

K was taken from the USDA soil Interpretation Records, Soil Conservation Services,

S = slope steepness factor (Haan, 1994),

There are three equations available to determine S. If the length of the applicable slope is less than 15 feet, then equation 8.41 which is $S = 3.0 (\sin \Theta)^{0.8}+0.56$. If the applicable slope is greater than 15 feet then equation 8.39 or 8.40 would apply, depending on the angle of the slope. These two equations are:

If $\sin \Theta < 0.09$, then $S = 10.8 \sin \Theta + 0.03$

If $\sin \Theta \geq 0.09$, then $S = 16.8 \sin \Theta - 0.50$

In our specific calculation, the slope angles are as follows:

For the 4 (H): 1(V) slope, $\Theta = 14.04°$

$\sin 14.04° = 0.24 \geq 0.09$, Use eq. 8.40

For the 3.0% slope, $\Theta = 2.29°$

$\sin 2.29° = 0.03 < 0.09$, Use eq. 8.39

L = slope length factor

$$L = \frac{\lambda}{72.6}^{m}$$

where λ = horizontal projection of plot length

$$m = \frac{\beta}{1+\beta}$$

$$\beta = rill\ erosion$$

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$$\beta_{mod} = \frac{11.16 \sin \Theta}{3.0(sin\Theta)^{0.8} + 0.56}$$

The equation for rill erosion applies to moderately erodible soils.

C represents 80% ground cover without appreciable canopy - Table 2, USDA-SCS TR 52,

P was assumed to be 1.0 for long-range prediction & no maintenance.

4.0 CALCULATIONS

A RUSLE calculation was performed for a compound slopes.

A Summary of the RUSLE calculation is presented in Table 1.

5.0 CONCLUSION/RESULTS

RUSLE calculation for a compound slope is found in Tables 1. Annual erosion is calculated to be 3.1 ton/ac/year.

6.0 REFERENCES:

1) Use of the Universal Soil Loss Equation in Final Cover/Configuration Design, Procedural Handbook," TNRCC, Permits Section, October 1993.
2) Haan C.T., B. J. Barfield, and J.C. Hayes. 1994. Design hydrology and sedimentology for small catchments. San Diego CA : Academic Press Inc.
3) TCEQ Regulatory Guidance, "Guidelines for Preparing a Surface Water Drainage Report for a Municipal Solid Waste Facility.", August 2006

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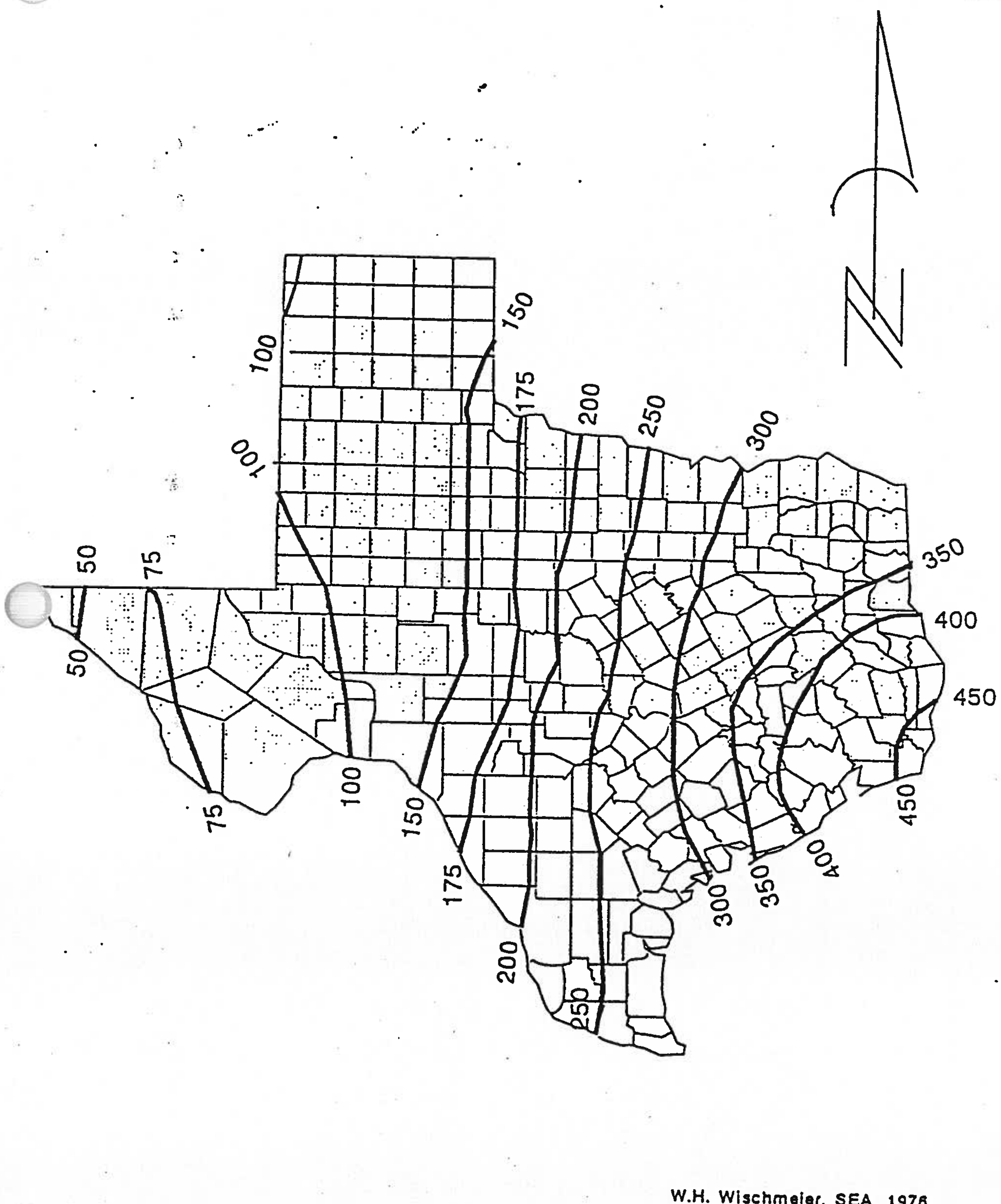
TABLE 1. EXIDE RECYCLING CENTER - ESTIMATED AVERAGE ANNUAL EROSION
MAXIMUM EROSION LOSS

R **ft tonsf in/acre hr year**	**Slope Segment**	**K** ton*ac-hr/hundredths ac-ft*tonf*in	Slope (ft/ft)	Length (l) (ft)	Length **l (m)**	beta eq. 8.45	m eq.8.44 or .5 (Foster & Wischmeier, 1978)	**LS**	**C**	**P**	**A_i** ton/ac/yr
Final Cover - Top (80% cover)											
295	1	0.26	0.03	82	25	0.451	0.3110	0.227	0.013	1.00	0.2
295	2	0.26	0.25	50.9	16	1.774	0.6395	2.875	0.013	1.00	2.9
								Eff. LS: 3.10			**3.1**

NOTES: **R** was taken from Figure 1, Average Annual Values of the Rainfall Erosion Index
M was calculated from Eq. 8.37 (p. 256) - *Design Hydrology and Sedimentology for Small Catchm* 1
K was based on soil survey descriptions obtained from the USDA, Soil Interpretation Records, Soil Conservation Services
LS was calculated from Eqs. 8.39-41 and 43 (p. 261) - *Design Hydrology and Sedimentology for Small Catchments*
C represents 80% ground cover without appreciable canopy - *USDA-SCS TR 51*
P was assumed to be 1.0 for long-range prediction & no maintenance

A = R * K * LS * C * P

where:
A = soil loss, tons/(acre - year)
R = rainfall erosion index
K = soil erodibility factor
LS = slope length and steepness factor
C = vegetative cover factor
P = erosion control practice factor



..GURE 1: - AVERAGE ANNUAL VALUES OF THE RAINFALL EROSION INDEX

Table 1 Approximate Values of Factor K for USDA Textural Classes

TABLE 1

Texture Class	Organic Matter Content <0.5% K	2% K	4% K
Sand	0.05	0.03	0.02
Fine Sand	0.16	0.14	0.10
Very Fine Sand	0.42	0.36	0.28
Loamy Sand	0.12	0.10	0.08
Loamy Fine Sand	0.24	0.20	0.16
Loamy Very Fine Sand	0.44	0.38	0.30
Sandy Loam	0.27	0.24	0.19
Fine Sandy Loam	0.35	0.30	0.24
Very Fine Sandy Loam	0.47	0.41	0.33
Loam	0.38	0.32	0.29
Silt Loam	0.48	0.42	0.33
Silt	0.60	0.52	0.42
Sandy Clay Loam	0.27	0.25	0.21
Clay Loam	0.28	0.25	0.21
Silty Clay Loam	0.37	0.32	0.26
Sandy Clay	0.14	0.13	0.12
Silty Clay	0.25	0.23	0.19
Clay	0.13 - 0.29		

The values shown are estimated averages of broad ranges of specific-soil values. When a texture is near the borderline of two texture classes, use the average of the two K values.

Table 2 Factor C for permanent pasture, range, and idle land[1]

Vegetative Canopy		Cover that contacts the soil surface						
Type and height[2]	Percent cover[3]	Percent ground cover						
		0	20	40	60	70	80	90
No Appreciable Canopy		0.45	0.20	0.10	0.042	.028	0.013	0.006
Tall weeds or short brush with average drop fall height of 20 in.	50	0.26	0.13	0.07	0.035	.023	0.012	0.006
	75	0.17	0.10	0.06	0.032	.022	0.011	0.005

Extracted from:
United States Department of Agriculture, AGRICULTURE HANDBOOK NUMBER 537

[1] The listed C values assume that the vegetation and mulch are randomly distributed over the entire area.

[2] Canopy height is measured as the average fall height of water drops falling from the canopy to the ground. Canopy effect is inversely proportional to drop fall height and is negligible if fall height exceeds 33 ft.

[3] Portions of total-area surface that would be hidden from view by canopy in a vertical projection (a bird's-eye view).

The impact of changes in saturated hydraulic conductivity on the K factor must be accounted for by the nomograph in Fig. 8.9. To accomplish this correction using Eq. (8.38), relationships between hydraulic conductivity and permeability classes used in Fig. 8.9 must be known. Rawls *et al.* (1982) proposed the relationship shown in Table 8.3.

Example Problem 8.4. Effects of rock fragments on K

A silty clay loam soil is classified as permeability class 5. Based on textural information, soil structure, and a permeability class of 5, K is estimated as 0.21 in English units. What would be the value for K as corrected for rock fragments if the percentage of rock fragments greater than 2 mm occupies 40% of the soil mass by weight?

Solution:

1. Impact of rock fragment on hydraulic conductivity. From Table 8.3, k_f for a silty clay loam soil is between 0.04 and 0.08 in./hr. Assume a value of 0.06 in./hr. From Eq. (8.38)

$$k_b = k_f(1 - R_w) = 0.06(1 - 0.40) = 0.036 \text{ in./hr.}$$

2. Estimating the revised permeability class. From Table 8.3, the permeability class for $k_b = 0.036$ in./hr is 6.

3. Estimating the new erodibility. Entering Fig. 8.9 with an estimated K of 0.21 for a permeability class of 5, the K value for a class 6 permeability is estimated as 0.22 (English units).

It is again important to note that this procedure corrects only for the effects of rock fragments on infiltration. Impacts on the C factor must be based on percentage ground cover, as discussed in a subsequent section.

Rough Estimates of K from Textural Information and Experimental Values for Construction and Mined Sites

The USDA–SCS has developed estimates of K based on textural classification for topsoil, subsoil, and residual materials as shown in Table 8.4. These values are first estimates only and do not include the influence of soil structure or infiltration characteristics.

A limited number of data sets have been developed for drastically disturbed lands and for reconstructed soils. A summary of the data is given in Table 8.5 along with a comparison to values from the Wischmeier *et al.* (1971) nomograph shown in Fig. 8.9. The comparison is sufficiently favorable to warrant the use of the nomograph for a first estimate of K on disturbed topsoil or A-horizon material. The comparison is not favorable for subsoil materials.

Length and Slope Factors L and S

The effects of topography on soil erosion are determined by dimensionless L and S factors, which account for both rill and interrill erosion impacts.

Slope Steepness Factor S

The slope steepness factor S is used to predict the effect of slope gradient on soil loss. For slope lengths

Table 8.3 Soil Water Data for the Major USDA Soil Textural Classes (after Rawls *et al.*, 1982)

Texture	Permeability class[a]	Saturated hydraulic conductivity in./hr	Saturated hydraulic conductivity mm/hr	Hydrologic soil group[b]
Silty clay, clay	6	< 0.04	<1	D
Silty clay loam, sandy clay	5	0.04–0.08	1–2	C–D
Sandy clay loam, clay loam	4	0.08–0.20	2–5	C
Loam, silt loam	3	0.20–0.80	5–20	B
Loamy sand, sandy loam	2	0.80–2.40	20–60	A
Sand	1	> 2.40	>60	A+

[a]See Soil Conservation Service National Soils Handbook (SCS, 1983).

[b]See Soil Conservation Service National Engineering Handbook (SCS, 1972, 1984).

[c]Note: Although the silt texture is missing from the NEH because of inadequate data, it undoubtedly should be in permeability class 3.

greater than 15 ft, the S factor from the USLE was modified significantly by McCool *et al.* (1987, 1993) after extensive evaluation of the original USLE data base. The modified version is

$$S = 10.8 \sin\theta + 0.03; \qquad \sin\theta < 0.09 \qquad (8.39)$$

$$S = 16.8 \sin\theta - 0.50; \qquad \sin\theta \geq 0.09, \qquad (8.40)$$

where θ is the slope angle. Based on an evaluation of data from disturbed lands with slopes up to 84%, McIssac *et al.* (1987) developed an equation similar to (8.39) and (8.40) with exponents in the same range; thus McCool *et al.* (1993) recommend that Eqs. (8.39) and (8.40) also be used for disturbed lands.

For slope lengths less than 15 ft, the S factor is not as strongly related to slope (slope exponent less than 1.0) since rilling would not have been initiated. The recommended factor is

$$S = 3.0(\sin\theta)^{0.8} + 0.56. \qquad (8.41)$$

Under conditions where thawing of recently tilled soils is occurring and surface runoff is the primary factor causing erosion (typical of the Pacific Northwest in the spring), the S factor should be (McCool *et al.*, 1987, 1993)

$$S = 4.25(\sin\theta)^{0.6}, \qquad \sin\theta \geq 0.09. \qquad (8.42)$$

For thawing soils with slopes less than 9%, Eq. (8.39) should be used.

The S factor in the RUSLE is significantly modified from the original USLE as a result of an extensive reevaluation of the original data base, addition of the factors for short slope lengths, and new values for thawing soils (McCool *et al.*, 1987). The original data base did not include values beyond 20%. When using the quadratic form of the equation for S developed for the original USLE, projections beyond 20% yielded unreasonably high values for erosion. The RUSLE equation with the linear function corrects this problem.

Table 8.4 K Value Estimates based on Textural Information (English Units) (Soil Conservation Service, 1978)

Texture	Estimated K value[a]
Topsoil	
Clay, clay loam, loam, silty clay	0.32[b]
Fine sandy loam, loamy very fine sand, sandy loam	0.24
Loamy fine sand, loamy sand	0.17
Sand	0.15
Silt loam, silty clay loam, very fine sandy loam	0.37
Subsoil and Residual Material	
Outwash Soils	
Sand	0.17
Loamy sand	0.24
Sandy loam	0.43
Gravel, fine to moderate fine	0.24
Gravel, medium to moderate coarse	0.49
Lacrustrine Soils	
Silt loam and very fine sandy loam	0.37
Silty clay loam	0.28
Clay and silty clay	0.28
Glacial Till	
Loam, fine to moderate fine subsoil	0.32
Loam, medium subsoil	0.37
Clay loam	0.32
Clay and silty clay	0.28
Loess	0.37
Residual	
Sandstone	0.49
Siltstone, nonchannery	0.43
Siltstone, channery	0.32
Acid clay shale	0.28
Calcareous clay shale or limestone residuum	0.24

[a]These values are typical based only on textural information. Values for an actual soil can be considerably different due to different structure and infiltration.

[b]Units on K in this table are English units (tons•acre•hr/hundreds•acre•ft•tonsf•in.). To convert to metric units (t•ha•h/ha•MJ•mm), multiply K values by 0.1317.

Slope Length Factor

The slope length factor was developed by McCool *et al.* (1989, 1993) from the original USLE data base augmented with theoretical considerations. The L factor retains its original form

$$L = \left[\frac{\lambda}{72.6}\right]^m, \qquad (8.43)$$

where λ is the slope length in feet, 72.6 ft is the length of a standard erosion plot, and m is a variable slope length exponent. Slope length, λ, is the horizontal projection of plot length, not the length measured along the slope. The difference in horizontal projections and slope lengths becomes important on steeper slopes.

The slope length exponent is related to the ratio of rill to interrill erosion, β (Foster *et al.*, 1977b; McCool *et al.*, 1989, 1993), by

$$m = \frac{\beta}{1+\beta}. \qquad (8.44)$$

Table 8.5 Experimental K Value Estimates for Disturbed Lands (English Units)

Reclaimed soil or residual material	Location of experimental site	K Exp[a]/Nomo[b]	Reference
Hosmer silt loam	Indiana	0.387/0.485[c]	Stein *et al.* (1983)
Alfred silt loam	Southern Indiana	0.812/0.485	
Ava silt loam	Southern Indiana	0.842/0.478	
Graded overburden	Southern Indiana	0.197–0.835/ 0.250–0.478	
Clinton silt loam[d]	Western Illinois	0.370/0.360	Mitchell *et al.* (1983)
Tama silty clay loam[d]	Western Illinois	0.210/0.310	
Hosmer silt loam[d]	Southern Indiana	0.450–0.650/ 0.470	
Sadler silt loam (A horizon)	Western Kentucky	0.415/0.385	Barfield *et al.* (1988)
Sadler silt loam (B horizon)	Western Kentucky	0.380/0.640	
Shale spoil material	Western Kentucky	0.140/0.180	

[a]Values measured experimentally with rainfall simulators.
[b]Values calculated from Wischmeier *et al.* (1971) nomograph shown in Fig. 8.9.
[c]Values in English units of tons•acre•hr/hundreds•acre•ft•tonsf•in. To convert to metric units of t•a•h/ha•MJ•mm, multiply by 0.1317.
[d]The dominant soil series. Some mixing occurred with other series.

For soils that are classed as being moderately susceptible to erosion, McCool *et al.* (1989) proposed that

$$\beta_{\text{mod}} = \frac{11.16 \sin\theta}{3.0(\sin\theta)^{0.8} + 0.56}, \qquad (8.45)$$

where θ is the slope angle. Thus, the slope exponent is a function of the slope angle θ.

Soils in the RUSLE are classed as having low, moderate, or high susceptibility to rill erosion. Equation (8.45) is for soils that are moderately susceptible to erosion. Conversions for soils that have low or high susceptibility to erosion are given in Table 8.6. Values in Table 8.6 are based on the assumption that moderately erodible soils have a β defined by Eq. (8.45), soils highly susceptible to rilling have a β that is twice that given by Eq. (8.45), and soils with low susceptibility to rilling have a β that is defined by half that given by Eq. (8.45).

For soils in the Pacific Northwest, or other soils that are exposed to runoff during thawing without sufficient rainfall energy to cause interrill erosion, the values in Table 8.6 should not be used. Instead, McCool *et al.* (1989) recommend that a slope length exponent of 0.5 be used for all slopes. When runoff on thawing soils is exposed to rainfall sufficient to cause significant interrill erosion, the slope length exponent for the low rill to interrill erosion ratio should be used (column 1 in Table 8.6). For rangeland soils, the use of a low rill to interrill erosion ratio is proposed. Selection of the appropriate column to use in Table 8.6 requires professional judgement. The assistance of a soil scientist may be helpful.

Combined Length and Slope Factors

Combined slope length and slope steepness factors were calculated using the factors from Eqs. (8.39) to (8.43). These combination factors are given in Fig. 8.13 for all susceptibilities and for thawing soils.

Irregular and Segmented Slopes

Soil loss is strongly impacted by slope shape (Foster and Huggins, 1979). A convex shape will have greater erosion than a uniform slope by as much as 30%. A concave slope will have less erosion than a uniform slope. Foster and Wischmeier (1974) developed a procedure for evaluating the impact of irregular slopes by dividing the slope into segments. The soil loss per unit area from the ith segment is

$$A_i = RK_iC_iP_iS_i\left[\frac{\lambda_i^{m+1} - \lambda_{i-1}^{m+1}}{(\lambda_i - \lambda_{i-1})72.6^m}\right], \qquad (8.46)$$

where λ_i and λ_{i-1} are the slope lengths at the start and end of segment i, and K_i, C_i, P_i, and S_i are USLE factors for segment i. Equation (8.46) can be used for each segment i. The total erosion from each segment

Table 8.6 Slope Length Exponent m in Eq. (8.43) (after McCool *et al.*, 1993)[a]

Percentage slope	Rill/interrill ratio		
	Low[b]	Moderate[c]	High[d]
0.2	0.02	0.04	0.07
0.5	0.04	0.08	0.16
1.0	0.08	0.15	0.26
2.0	0.14	0.24	0.39
3.0	0.18	0.31	0.47
4.0	0.22	0.36	0.53
5.0	0.25	0.40	0.57
6.0	0.28	0.43	0.60
8.0	0.32	0.48	0.65
10.0	0.35	0.52	0.68
12.0	0.37	0.55	0.71
14.0	0.40	0.57	0.72
16.0	0.41	0.59	0.74
20.0	0.44	0.61	0.76
25.0	0.47	0.64	0.78
30.0	0.49	0.66	0.79
40.0	0.52	0.68	0.81
50.0	0.54	0.70	0.82
60.0	0.55	0.71	0.83

[a]Values in table are not applicable to thawing soils. See text for explanation.
[b]$\beta = 1/2$ value from Eq. (8.45) in Eq. (8.44).
[c]$\beta = 1 \times$ value from Eq. (8.45) in Eq. (8.44).
[d]$\beta = 2 \times$ value from Eq. (8.45) in Eq. (8.44).

would be $A_i(\lambda_i - \lambda_{i-1})$, and the average erosion per unit area over the entire slope length would be

$$A = R \sum_{i=1}^{n} K_i C_i P_i S_i \frac{\left[\lambda_i^{m+1} - \lambda_{i-1}^{m+1}\right]}{\lambda_e 72.6^m}, \qquad (8.47)$$

where λ_e is the total slope length. Equation (8.47) can also be used to evaluate the effects of variation in K, C, and P over the slope length.

An alternate method for evaluating irregular slopes is the use of a slope length adjustment factor (SAF). If the slope is divided into n increments of equal length ΔX, then

$$A = R \sum_{i=1}^{n} K_i C_i P_i S_i \frac{\left[(i\,\Delta X)^{m+1} - ([i-1]\,\Delta X)^{m+1}\right]}{n\,\Delta X 72.6^m}. \qquad (8.48)$$

Dividing by n times the soil loss from a uniform slope of equal length and assuming constant values of K_i C_i P_i along the slope, a slope adjustment factor can be developed for each segment, or

$$\mathrm{SAF}_i = \frac{A_i}{A} = \frac{i^{m+1} - (i-1)^{m+1}}{n^m}, \qquad (8.49)$$

where n is the number of segments and SAF is the slope adjustment factor. The sum of the SAF_i for a given slope is equal to the number of segments n; thus the average erosion over the slope is

$$A = \frac{R}{n} \sum_{i=1}^{n} K_i C_i P_i S_i L_i (\mathrm{SAF})_i. \qquad (8.50a)$$

where L_i is the slope length factor calculated from Eq. (8.43) using the m value corresponding to the segment steepness. In the development of a SAF relationship, R, K, C, and P remain constant over all segments; thus Eq. (8.50a) can be solved for an equivalent LS factor

$$LS = \frac{1}{n} \sum_{i=1}^{n} S_i L_i (\mathrm{SAF})_i. \qquad (8.50b)$$

Factors calculated from Eq. (8.50b) are given in Table 8.7. An example of its use is given in Example Problem 8.5.

Example Problem 8.5. Estimating *LS* factors

A soil that is very susceptible to rilling has a slope length of 210 ft and an average slope of 15%. Estimate the LS factor if:

(1) the slope is uniform
(2) the slope is convex with slopes of 10, 15, and 20% on segments 1, 2, and 3
(3) the slope is concave with slopes of 20, 15, and 10% on segments 1, 2, and 3.

Assume that the soil is not freezing and thawing.

Solution:

1. *Uniform slope.* The slope angle is

$$\theta = \tan^{-1} 0.15 = 8.53^\circ.$$

From Eq. (8.45) for soils moderately susceptible to rilling,

$$\beta = \frac{11.16 \sin 8.53}{3.0(\sin 8.53)^{0.8} + 0.56} = 1.37.$$

DETAIL DRAINAGE CALCULATIONS - North Channel

Made By:	CMF
Checked by:	JLY
Reviewed by:	JBF
Date:	5/2/2019

1.0 OBJECTIVE

Golder has designed the final cover system for the North Disposal Area (NDA) at the closed Exide Frisco Recycling Center in Frisco, Texas. A drainage channel to the north that drains to the east before turning back north has been proposed. This drainage channel will extend 403 feet to the east before extending 302 feet back to the north and discharge into the north tributary of Stewart Creek.

2.0 METHOD

The rational method is used to calculate discharge flows in small areas. The estimated flows are used to size the drainage channel using the Manning's equation.

3.0 CALCULATION

3.1 Discharge Flows

The rational method equation is used to calculate the peak discharge for facilities serving a drainage area less than 200 acres.

Q = ciA

c = Rational runoff coefficient

i = rainfall intensity (in/hour)

A = drainage area (acres)

Q = Peak discharge (cfs)

The runoff coefficient of 0.7 was used for a steep grassed slope, and 0.25 for the areas containing flatter terrain. The rainfall intensity is 4.6 in/hr based on the TxDOT intensity-duration-frequency chart. The time of concentration was calculated using TR-55 methodology. The 100-year storm event is used to analyze the peak discharge. The drainage area of 5.85 acres is based on the final site conditions draining to the proposed ditch.

Drainage Channel		
c=	Varies	
i =	4.6	in/hr
Total A =	5.85	ac
Composite c*A=	1.98	
Q =	**9**	**cfs**

3.2 Channel Sizing

The drainage channel is measured at 10 ft wide x approximately 0.5 ft deep. According to Manning's Equation, this channel is capable of containing up to approximately 14 cfs.

4.0 CONCLUSION

The drainage channel is within capabilities to handle drainage from the completed RCA cap and north drainage areas.

5.0 REFERENCES

1) Hydraulic Design Manual, Texas Department of Transportation. July 2016

2) Rainfall Intensity Duration Frequency Coefficients for Texas Counties, Texas Department of Transprotation.

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TEXAS REGISTRATION F-2578

TABLE 1
BASIN TIME OF CONCENTRATION CALCULATIONS

EXIDE RECYCLING CENTER - NDA
EXIDE TECHNOLOGIES
Project Number: 130208606

Date:	5/3/19
By:	CMF
Chkd:	JLY
Apprvd:	JBF

			Flow Segment 1							Flow Segment 2							Flow Segment 3						
Subbasin ID	Subbasin Area (sq mile)	Total Travel Time (min)	Type of Flow	Length (ft)	Slope (ft/ft)	Roughness Condition[(1)]		Typical Hydraulic Radius (Channel Only) (ft)	Travel Time (min)	Type of Flow	Length (ft)	Slope (ft/ft)	Roughness Condition[(1)]		Typical Hydraulic Radius (Channel Only) (ft)	Travel Time (min)	Type of Flow	Length (ft)	Slope (ft/ft)	Roughness Condition[(1)]		Typical Hydraulic Radius (Channel Only) (ft)	Travel Time (min)
LANDFILL AREA																							
1	0.0055	69.8	Sheet	300	0.008	F	Dense Grass		62.8	Shallow	422.6	0.008	U	Unpaved		5.0	Channel	316.39	0.024	G	Grass-lined	0.27	1.9

Table 2
Channel Hydraulic Calculations

Exide Recycling Center - NDA
Exide Technologies
Collin County, Texas
PROJECT NO.: 130208606

Date:	5/3/19
By:	CMF
Chkd:	JLY
Apprvd:	JBF

			Channel Design Geometry						Channel Roughness Parameters				Hydraulic Calculations							Channel Evaluations	
Reach Designation	Q (cfs)	Storm Event	Approximate Channel Length (ft)	Bed Slope (ft/ft)	Left Side Slope (H:1V)	Right Side Slope (H:1V)	Bottom Width (ft)	Minimum Channel Depth (ft)	Design Channel Lining		Mannings 'n' for Capacity (Depth Calculation)	Mannings 'n' for Stability (Velocity Calculation)	Maximum Velocity (ft/sec)	Maximum Normal Flow Depth (ft)	Froude Number	Normal Depth Shear Stress (lb/ft^2)	Stream Power (W/m^2)	Top Width of Flow (ft)	Top Width of Channel (ft)	Available Freeboard (ft)	
Perimeter Channels																					
Channel	9.0	100-year	705	0.0130	4.0	4.0	10	0.5	GL	Grass-lined	0.035	0.030	2.5	0.35	0.81	0.29	10.26	12.8	14.0	0.15	< 1.0 ft

(1) Note: Comments and Warnings:
< 1.0 ft indicates freeboard is less than 1 foot.
< 1/2 Vel. Head indicates that the remaining freeboard is less than 1/2 the velocity head ($V^2/2g$) suggesting water may splash out.
Warning: VxD>9 indicates that the velocity times the depth is greater than 9 ft^2/sec, which is undesirable and may be unsafe.
Unstable V indicates that calculated velocity exceeds the recommended maximum for the lining material.
Unstable T indicates that calculated shear stress exceeds the recommended maximum for the lining material.

TABLE 2A
COMPOSITE CURVE NUMBER CALCULATIONS

EXIDE RECYCLING CENTER - NDA
EXIDE TECHNOLOGIES
Project Number: 130208606

Date:	5/3/19
By:	CMF
Chkd:	JLY
Apprvd:	JBF

Design Storm **100** **-Year Reoccurance Interval**

Storm Duration (hours)	2-Year Depth (inches)	100 -Year Depth (inches)	Storm Distribution
1	2.1	4.6	II

Subbasin ID	Subbasin Area (ft^2)	Subbasin Area (acres)	Subbasin Area (sq mile)	CN = 98 CONCRETE - PAVED AREAS OR POND AREAS (acres)	CN = 92 DIRT ROADS - UNPAVED AREAS -- HERBACEOUS GRASS/BRUSH (acres)	CN = 85 LANDFILL FINAL COVER AREAS (acres)	Composite SCS Curve No.	$S = \frac{1000}{CN} - 10$	Unit Runoff Q (in)	Runoff Volume (ac-ft)	Runoff Volume (ft^3)
LANDFILL AREA											
1	153,767	3.53	0.0055			3.53	CN = 85	1.76	3.00	0.88	38,446
Total:	153,767	3.53	0.01							0.88	38,446

Rainfall Intensity-Duration-Frequency Coefficients for Texas Counties

1. Select your county. 2. Enter the time of concentration

County	Coefficient	2-year	5-year	10-year	25-year	50-year	100-year
Collin	e (in)	0.790	0.781	0.778	0.779	0.776	0.764
	b	54	67	79	92	102	106
	d (mins)	8.2	8.8	8.8	8.8	8.8	8.2
	Intensity (in/hr)*	2.1	2.7	3.2	3.8	4.2	4.6

Clay
Cochran
Coke
Coleman
Collin
Collingsworth
Colorado
Comal
Comanche

Coefficient	2-year	5-year	10-year	25-year	50-year	100-year
e (mm)	0.790	0.781	0.778	0.779	0.776	0.764
b	1372	1702	2007	2337	2591	2692
d (mins)	8.2	8.8	8.8	8.8	8.8	8.2
Intensity (mm/hr)*	54.1	69.1	82.5	95.6	107.3	118.1

* for time of Concentration = **51.7** mins

DETAIL DRAINAGE CALCULATIONS - South Channel

Made By:	CMF
Checked by:	JLY
Reviewed by:	JBF
Date:	5/2/2019

1.0 OBJECTIVE

Golder has designed the final cover system for the Remediation Consolidation Area (RCA) at the closed Exide Frisco Recycling Center in Frisco, Texas. With this proposed design there is a need for drainage features. A perimeter drainage channel on the south that drains to the west has been proposed. This drainage channel will extend 847 feet to the west and discharge into an existing pipe that leads to an evaporation pond west of the RCA.

2.0 METHOD

The rational method is used to calculate discharge flows in small areas. The estimated flows are used to size the drainage channel using the Manning's equation.

3.0 CALCULATION

3.1 Discharge Flows

The rational method equation is used to calculate the peak discharge for facilities serving a drainage area less than 200 acres.

Q = ciA
c = Rational runoff coefficient
i = rainfall intensity (in/hour)
A = drainage area (acres)
Q = Peak discharge (cfs)

The runoff coefficient of 0.7 was used for a steep grassed slope. The rainfall intensity is 4.5 in/hr based on the TxDOT intensity-duration-frequency chart. The time of concentration was calculated using TR-55 methodology. The 100-year storm event is used to analyze the peak discharge. The drainage area of 3.53 acres is based on the final site conditions draining to the proposed ditch.

Perimeter Ditch		
c =	0.7	
i =	4.5	in/hr
A =	3.53	ac
Q =	**11**	**cfs**

3.2 Channel Sizing

The Manning equation is used to size the perimeter channel. Table 1, Channel Hydraulic Calculation, shows the channel design geometry, velocity, and freeboard calculation.

4.0 CONCLUSION

The ditch is designed to be grassed lined with a geometry of 2 feet deep and 3 feet wide with 6H:1V and 4H:1V sideslopes.

5.0 REFERENCES

1) Hydraulic Design Manual, Texas Department of Transportation. July 2016
2) Rainfall Intensity Duration Frequency Coefficients for Texas Counties, Texas Department of Transprotation.

STATE OF TEXAS
5/30/19
JEFFREY B. FASSETT
85675
LICENSED
PROFESSIONAL ENGINEER

GOLDER ASSOCIATES INC.
TEXAS REGISTRATION F-2578

TABLE 1
BASIN TIME OF CONCENTRATION CALCULATIONS

EXIDE RECYCLING CENTER - RCA
EXIDE TECHNOLOGIES
Project Number: 130208606

Date:	5/2/19
By:	CMF
Chkd:	JLY
Apprvd:	JBF

			Flow Segment 1							Flow Segment 2							Flow Segment 3						
Subbasin ID	Subbasin Area (sq mile)	Total Travel Time (min)	Type of Flow	Length (ft)	Slope (ft/ft)	Roughness Condition(1)		Typical Hydraulic Radius (Channel Only) (ft)	Travel Time (min)	Type of Flow	Length (ft)	Slope (ft/ft)	Roughness Condition(1)		Typical Hydraulic Radius (Channel Only) (ft)	Travel Time (min)	Type of Flow	Length (ft)	Slope (ft/ft)	Roughness Condition(1)		Typical Hydraulic Radius (Channel Only) (ft)	Travel Time (min)
LANDFILL AREA																							
1	0.0055	72.1	Sheet	155	0.003	F	Dense Grass		56.2	Sheet	38.7	0.250	F	Dense Grass		3.1	Channel	786.68	0.006	G	Grass-lined	0.17	12.9

Table 2
Channel Hydraulic Calculations

Exide Technologies
Exide Recycling Center - RCA
Collin County, Texas
PROJECT NO.: 130208606

Date:	5/2/19
By:	CMF
Chkd:	JLY
Apprvd:	JBF

			Channel Design Geometry						Channel Roughness Parameters				Hydraulic Calculations							Channel Evaluations	
Reach Designation	Q (cfs)	Storm Event	Approximate Channel Length (ft)	Bed Slope (ft/ft)	Left Side Slope (H:1V)	Right Side Slope (H:1V)	Bottom Width (ft)	Minimum Channel Depth (ft)	Design Channel Lining		Mannings 'n' for Capacity (Depth Calculation)	Mannings 'n' for Stability (Velocity Calculation)	Maximum Velocity (ft/sec)	Maximum Normal Flow Depth (ft)	Froude Number	Normal Depth Shear Stress (lb/ft^2)	Stream Power (W/m^2)	Top Width of Flow (ft)	Top Width of Channel (ft)	Available Freeboard (ft)	
Perimeter Channels																					
Channel	11.0	100-year	847	0.0061	6.0	4.0	3	2.0	GL	Grass-lined	0.035	0.030	2.3	0.78	0.59	0.30	9.89	10.8	23.0	1.22	

(1) Note: Comments and Warnings:
< 1.0 ft indicates freeboard is less than 1 foot.
< 1/2 Vel. Head indicates that the remaining freeboard is less than 1/2 the velocity head ($V^2/2g$) suggesting water may splash out.
Warning: VxD>9 indicates that the velocity times the depth is greater than 9 ft^2/sec, which is undesirable and may be unsafe.
Unstable V indicates that calculated velocity exceeds the recommended maximum for the lining material.
Unstable T indicates that calculated shear stress exceeds the recommended maximum for the lining material.

TABLE 2A
COMPOSITE CURVE NUMBER CALCULATIONS

EXIDE RECYCLING CENTER - RCA
EXIDE TECHNOLOGIES
Project Number: 130208606

Date:	5/2/19
By:	CMF
Chkd:	JLY
Apprvd:	JBF

Design Storm 100 -Year Reoccurance Interval

Storm Duration (hours)	2-Year Depth (inches)	100 -Year Depth (inches)	Storm Distributio n
1	2.0	4.5	II

Subbasin ID	Subbasin Area (ft^2)	Subbasin Area (acres)	Subbasin Area (sq mile)	CN = 98 CONCRETE - PAVED AREAS OR POND AREAS (acres)	CN = 92 DIRT ROADS - UNPAVED AREAS -- HERBACEOUS GRASS/BRUSH (acres)	CN = 85 LANDFILL FINAL COVER AREAS (acres)	Composite SCS Curve No.	$S = \frac{1000}{CN} - 10$	Unit Runoff Q (in)	Runoff Volume (ac-ft)	Runoff Volume (ft^3)
LANDFILL AREA											
1	153,767	3.53	0.0055			3.53	CN = 85	1.76	2.91	0.86	37,277
Total:	153,767	3.53	0.01							0.86	37,277

Rainfall Intensity-Duration-Frequency Coefficients for Texas Counties

1. Select your county. 2. Enter the time of concentration

County	Coefficient	2-year	5-year	10-year	25-year	50-year	100-year
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	b	54	67	79	92	102	106
	d (mins)	8.2	8.8	8.8	8.8	8.8	8.2
	Intensity (in/hr)*	2.0	2.6	3.1	3.6	4.1	4.5

Clay
Cochran
Coke
Coleman
Collin
Collingsworth
Colorado
Comal
Comanche

Coefficient	2-year	5-year	10-year	25-year	50-year	100-year
e (mm)	0.790	0.781	0.778	0.779	0.776	0.764
b	1372	1702	2007	2337	2591	2692
d (mins)	8.2	8.8	8.8	8.8	8.8	8.2
Intensity (mm/hr)*	52.0	66.4	79.3	92.0	103.3	113.6

* for time of Concentration = **54.8** mins

APPENDIX P

FOP AIR MONITORING PLAN

FOP AIR MONITORING PLAN

for

Former Operating Plant Remediation Activities and
Remediation Consolidation Area Operation and Closure Activities

at

Exide Technologies Frisco Recycling Center
Frisco, Texas

Prepared by

Golder Associates Inc.

May 2019

Table of Contents

1.0 INTRODUCTION **2**

2.0 ORGANIZATION OF PLAN **2**

3.0 PARTICULATE Matter MONITORING **3**

3.1 Equipment 3

3.2 Monitoring Locations 3

3.3 Take Action and Stop Work Levels Using Particulates as a Surrogate for Lead and Cadmium 3

3.3.1 Establishing Particulate Take Action and Stop Action Levels for Lead 3

3.3.2 Establishing Particulate Matter Take Action and Stop Work Levels for Cadmium 4

3.3.3 Take Action and Stop Work Levels for PM_{10} as Surrogate 5

3.4 Stop Work Level for Wind 5

3.5 Particulate Monitors and Wind Data Monitoring and Notifications 5

3.5.1 Particulate Monitors 5

3.5.2 Wind Speed and Direction Data Monitoring 5

3.5.3 Notifications 6

3.5.4 Stop Work Criteria for Monitors 6

3.6 Dust Suppression Measures 6

3.6.1 Particulate Matter Take Action Levels 6

3.6.2 Particulate Stop Work Levels 6

3.6.3 Visible Dust 6

4.0 AIR SAMPLES COLLECTED FOR LABORATORY ANALYSES **7**

4.1 Metals Analyses 7

4.2 Metals Concentrations Take Action Levels 8

4.3 Metals Concentrations Stop Work Levels 8

5.0 REPORTS **9**

6.0 QUALITY ASSURANCE / QUALITY CONTROL **10**

6.1 Particulate Monitors 11

6.1.1 Quality Control 11

6.2 Air Samplers 12

6.2.1 Quality Control 12

6.2.2 Quality Assurance 12

6.3 Met Station 13

6.4 Laboratory Validation 13

6.5 Dust Concentration, Wind Speed and Direction Report Validation 13

6.6 Sample Information Management 14

7.0 POINTS OF CONTACT **14**

ATTACHMENTS

1. Descriptive Literature on E-BAM Particulate Monitors
2. NIOSH Method 7303

1.0 INTRODUCTION

The purpose of the air monitoring and dust control plans is to identify the measures that will be taken to monitor and minimize emissions associated with remediation activities at the Former Operating Plant portion of the Exide Technologies Frisco Recycling Center in Frisco, Collin County, Texas (FOP), including operation and closure activities at the Remediation Consolidation Area (RCA). Specifically, this Air Monitoring Plan specifies the requirements and methods for monitoring ambient air quality for particulate matter (dust), lead, and cadmium during excavation, consolidation, and closure activities. This plan works in conjunction with the FOP/RCA Dust Control Plan, which describes operational controls to reduce dust emissions during these activities.

Remediation and closure activities are described in detail in other components of the Final Closure Plan, to which this Perimeter Air Monitoring Plan and the FOP/RCA Dust Control Plan are appendices. Excavation of soils at the FOP and sediment/soils in Stewart Creek and placement of the soils/sediment in the RCA are considered dust-generating activities for the purposes of this plan as well as any additional demolition activities that may be needed prior to placement of waste within the RCA.

Air monitoring is not required during the following activities:

- Initial construction of perimeter berms constructed of clean soil
- Placement of the cap once contaminated soil or waste is covered
- Backfill of excavation areas with clean soil.

Air quality monitoring will consist of ambient air monitoring using NIOSH Method 7303 to evaluate lead and cadmium concentrations in dust. E-BAM mass monitors will be used to evaluate dust concentrations. Monitoring will be conducted to ensure that potential off-site impacts are mitigated. Air quality will be monitored by the contractor during the remediation activities.

The primary objectives of the air monitoring are to

- Monitor the relationship between particulate matter (i.e., dust) levels and concentrations of lead and cadmium so that the particulate matter 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 FOP; and
- Ensure that engineering controls and work practices help minimize potential off-site impacts. The Plan will help ensure that the contractor 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 FOP remediation, RCA operation, and RCA closure activities in accordance with this Plan.

2.0 ORGANIZATION OF PLAN

This plan addresses the air monitoring to be performed during dust-generating activities involving excavation and consolidation of contaminated soil or sediment and placement of soil or sediment (or other approved waste as described in the Final Closure Plan) at the FOP and ancillary demolition needed prior to placement of wastes in the RCA (the "dust generating activities"). This Plan addresses continuous perimeter monitoring for particulate matter (PM_{10}) during the times that such dust generating activities are performed; explains how the relationship between particulate matter, lead, and cadmium will be established and monitored; and describes how the Take Action and Stop Work Levels will be identified and implemented for particulate matter. In addition, it describes how samples will be collected to directly measure lead and cadmium and how that data will be used. The dust control procedures to be used during excavation and placement of waste are described in the Dust Control Plan.

3.0 PARTICULATE MATTER MONITORING

3.1 Equipment

Real-time particulate matter air monitors (e.g., E-BAM mass monitor or equivalent) equipped with omni-directional air intake devices and PM_{10} impactor heads will be used at the FOP to monitor dust levels at or near the Exide property boundaries during dust generating activities. Real-time data from the downwind particulate matter monitors will be evaluated in 30-minute and 60-minute averaged blocks to provide immediate comparison to Take Action and Stop Work Level criteria. If there is a calm wind condition (i.e. 1 mile per hour or less averaged over a 30-minute period) the upwind monitor will be treated as a downwind monitor. The data collection and reporting system which utilizes data generated by this equipment is described further in Section 3.5. Attachment 1 provides specific information regarding the E-BAM mass monitors that will be utilized at the FOP.

3.2 Monitoring Locations

One upwind and up to six downwind monitoring locations will be established each day dust-generating activities involving contaminated soil or sediment are to be performed (so that there are at least one upwind and three downwind monitoring locations for the RCA activities that may be occurring at the FOP). Monitors will be placed near the FOP boundary to ensure adequate downwind coverage of both the remediation areas and the RCA to minimize the potential for impacts to property beyond the FOP. If multiple activities are being conducted concurrently (i.e., multiple remediation areas, RCA activities, etc.) the downwind monitoring network will be used to monitor all activities to the extent practicable. One monitor may be used to monitor both RCA activities and remediation activities, depending on wind direction. If wind direction and remediation activity locations warrant it, additional monitors will be added to ensure adequate downwind coverage. If Take Action or Stop Work criteria are exceeded, dust mitigation procedures applicable to each activity will be implemented. The contractor will utilize National Weather Service forecasts and review current conditions and recent trends from an on-site meteorological station, located near the North Corrective Action Management Unit, to position the monitors each morning prior to start of work. The locations of the monitors will be determined by GPS and recorded. Wind speed and direction will be recorded and the data sent to on-site personnel as described in Section 3.5. If there is a 90-degree change in the prevailing wind direction averaged over a 30-minute period during the work day, the initial placement of the downwind monitors will be appropriately relocated and dust-generating activities involving waste 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, and the Texas Effects Screening Level (ESL) for cadmium have been utilized to establish “Take Action” and “Stop Work” levels for real-time particulate monitoring that will minimize off-site migration of dust associated with the remediation and RCA closure activities. The lead and cadmium-based PM_{10} surrogate levels will be calculated based upon correlations derived from project monitoring data and the more stringent of the two surrogate levels (i.e., lead or cadmium) will be used to establish the ongoing “Take Action” and “Stop Work” levels for PM_{10}.

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 a three-month rolling average. The lead action level (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 (TAL^{PM-30}). The particulate Stop Work Level will be set on 30-minute (SWL^{PM-30}) and 60-minute (SWL^{PM-60}) downwind block averages.

According to Appendix D, "Averaging Period Concentration Estimates," of EPA-454/R-92-024 "Workbook of Screening Techniques for Assessing Impacts of Toxic Air Pollutants (Revised)" dated 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. Until the AL^{Pb} is established as described below, the default TAL^{PM-30} will be 0.1 mg/m^3, and the SWL^{PM-30} will be 0.2 mg/m^3 (two times the default TAL^{PM-30}). The default SWL^{PM-60} will be 0.1 mg/m^3. Work completed to date on other portions of the FOP have shown that this is an appropriate default level.

The AL^{Pb} will be calculated by the following method:

The lead content fraction (FPb), taking into account downwind air sampling stations, will be determined from project-collected particulate matter and lead concentration data based upon the following relationship in the measured downwind particulate matter monitoring 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 half of the reported detection limit rather than as zero. The calculation of FPb will be completed for the averaged data from each of the downwind particulate monitors and air sampler pairs.

$$\frac{Pb\ (mg/m^3)}{PM_{10}\ (mg/m^3)} = FPb\ (unitless)$$

The highest of the calculated values from the downwind particulate monitor and air sampler pairs will be the FPb. The AL^{Pb} for the particulate matter monitors for the action levels described above will then be calculated as follows:

$$\frac{TPb\ (0.0015\ mg/m^3)}{FPb\ (unitless)} = AL^{Pb}\ (mg/m^3\ as\ particulates, PM_{10})$$

The lowest correlated particulate matter Take Action Levels for lead calculated from the averaged data for each day from each of the downwind particulate matter monitor and air sampler pairs will be used to calculate a two-week rolling average that will be utilized for the dust monitors' AL^{Pb} until the next correlation is performed.

3.3.2 Establishing Particulate Matter 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. Until the AL^{Cd} is established as described below, the default TAL^{PM-30} will be 0.1 mg/m^3, and the default SWL^{PM-30} will be 0.2 mg/m^3 (two times the default TAL^{PM-30}). The default SWL^{PM-60} will be 0.1 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 matter 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 half of the reported detection limit rather than as zero. The calculation of FCd will be completed for the averaged data from each of the downwind particulate monitors and air sampler pairs.

$$\frac{Cd\ (mg/m^3)}{PM_{10}\ (mg/m^3)} = FCd\ (unitless)$$

The highest of the calculated values from the downwind particulate matter monitors and air sampler pairs will be the FCd. The AL^{Cd} for the dust monitors for the action levels described above will then be calculated as follows:

$$\frac{ESL\ Cd\ (0.0001\ mg/m^3)}{FCd\ (unitless)} = AL^{Cd}\ (mg/m^3\ as\ particulates, PM_{10})$$

The lowest correlated particulate matter Take Action Levels for cadmium calculated from the averaged data for each day from each of the downwind particulate matter monitor and air sampler pairs will be used to calculate a two-week rolling average that will be utilized for the dust monitors' AL^{Cd} until the next correlation is performed.

3.3.3 Take Action and Stop Work Levels for PM_{10} as Surrogate

The TAL^{PM-30} (i.e., 30-minute block average Take Action Level) and SWL^{PM-60} (i.e., 60-minute block average Stop Work Level) for PM_{10} will be the LOWER of the calculated AL^{Pb} and AL^{Cd}. In no event will the TAL^{PM-30} and the SWL^{PM-60} be greater than 0.15 mg/m^3. The SWL^{PM-30} (i.e., 30-minute block average Stop Work Level) will be two times the TAL^{PM-30}.

The lowest correlated particulate matter Take Action Levels for cadmium and lead calculated from the averaged data for each day from each of the downwind particulate matter monitor and air sampler pairs will be used to calculate a two-week rolling average that will be utilized for the dust monitors' AL^{PM} until the next correlation is performed.

3.4 Stop Work Level for Wind

A wind speed Stop Work Level notification will be set on a ten-minute block average using data from an on-Site meteorological station located near the North Corrective Action Management Unit. If the sustained wind speed (the wind speed obtained by averaging the measured values over a ten minute period) exceeds 20 miles per hour, all active soil excavation, stockpiling, and loading must cease until the sustained wind speed declines to 20 miles per hour or lower for at least 10 consecutive minutes. Non-dust producing activities (equipment maintenance, etc.) may still be conducted during these periods.

3.5 Particulate Monitors and Wind Data Monitoring and Notifications

3.5.1 Particulate Monitors

The data obtained from 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 to transmit data. Cellular communication gateways will be installed at the FOP to act as central communication hubs.

3.5.2 Wind Speed and Direction Data Monitoring

Wind speed and direction will be monitored using data from an on-Site meteorological station located near the North Corrective Action Management Unit. The data will be transmitted to FDS directly via telemetry. This data will be integrated with the FDS monitoring 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 direction.

3.5.3 Notifications

Notifications of exceedances of the particulate or wind speed Take Action or Stop Work Levels at the downwind monitors will be sent via text message to field personnel. Notifications to the field office will be sent via email. The notifications will be sent to the contractor's on-site Project Manager and Air Monitoring Technician. The notifications will be sent as a Take Action Level notification or a Stop Work Level notification. The Air Monitoring Technician will be the primary individual responsible for monitoring the notifications and ordering implementation of dust mitigation procedures. However, both of these individuals will have the authority to order implementation of dust mitigation procedures, if needed.

3.5.4 Stop Work Criteria for Monitors

If the signal from either the downwind particulate monitors or the on-Site meteorological station located near the North Corrective Action Management Unit is lost for five minutes or more, all dust generating activities involving contaminated soil or waste will be suspended until the downwind particulate monitors and the meteorological station are operational and the signal to the FDS system is re-established.

3.6 Dust Suppression Measures

3.6.1 Particulate Matter Take Action Levels

If the 30-minute average PM_{10} concentration at a downwind monitor exceeds or is equal to the Take Action Levels presented in Table 1 (TAL^{PM-30}), the contractor will immediately implement increased dust suppression activities as described in the FOP/RCA Dust Control Plan.

3.6.2 Particulate Stop Work Levels

If the one-hour (60-minute) average or thirty-minute (30-minute) average PM_{10} concentration at a downwind monitor exceeds or is equal to the applicable Stop Work Level (SWL^{PM-60} or SWL^{PM-30}) presented in Table 1, the contractor will immediately stop all dust-generating activities involving contaminated soil or waste. 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 matter. The dust suppression adjustments are described in the FOP/RCA Dust Control Plan.

After dust suppression adjustments have been implemented (minimum 15-minute period), the work may resume. 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 on-site computer to ensure the dust suppression adjustments are effective. Adjustments to dust suppression activities will be made if needed. If particulate matter Stop Work Levels are exceeded at a downwind particulate matter monitor 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, equipment maintenance and other non-dust-producing activities may be performed.

3.6.3 Visible Dust

If visible dust is present in the active work zone, increased wetting of the area using water trucks or spray misters will be implemented. If visible dust is observed leaving the active work zone, work will stop until additional dust control measures are implemented as described in the FOP/RCA Dust Control Plan. This criteria also applies to excavation of sediment in Stewart Creek, although it is unlikely to occur because it is naturally wetted and therefore unlikely to generate dust. In addition, stockpiles of sediment will be covered when they are not actively being added to or loaded and trucks transporting sediment will be covered during transport.

4.0 AIR SAMPLES COLLECTED FOR LABORATORY ANALYSES

4.1 Metals Analyses

Air samples will be collected upwind and downwind of remediation activities and the RCA for laboratory analyses of both lead and cadmium during activities involving contaminated soil or waste using high volume (10 liters per minute) particulate matter air samplers. The samples will be collected approximately 2-3 feet away from the E-BAMs to mitigate any air-flow disturbances that may be caused by the E-BAM enclosure.

This analytical data will be correlated with the real-time particulate matter concentration data collected by the E-BAM monitors on a weekly basis, provided validated sampling results are received in a timely manner, and at a minimum every two weeks. Two weeks of analytical data will be correlated with the corresponding real-time particulate matter concentration data collected by the E-BAM monitors to establish a two-week rolling average.

The lowest correlated particulate matter Take Action Levels for cadmium and lead calculated from the averaged data for each day from each of the downwind particulate matter monitor and air sampler pairs will be used to calculate a two-week rolling average that will be utilized for the dust monitors' AL^{PM} until the next correlation is performed.

Air samples for these metals analyses will be collected by the contractor on the first work day of every week and every other day through the week during remediation activities involving contaminated soil or waste. Samples will not be collected on days when remediation activities are not occurring.

Air samples for metals analyses will be collected over a full working shift (typically eight to ten hours) using sampling pumps capable of operating at 10 liters per minute. The intakes of the filter cassettes will be positioned adjacent to the inlet of the collocated E-BAM air inlet. The inlet port of the filter will be in a downward position. 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 or rain which stop the work activities). Air samples will be collected by attaching laboratory-provided air sample filter cartridges (0.8-µm mixed cellulose ester membrane filter cartridges) to the pump and setting the air sample filter cartridges approximately five feet above ground level at the E-BAM monitor locations. When the downwind air samplers are relocated with the E-BAM monitors due to a 90-degree change in the prevailing wind direction, averaged over a 30-minute period, the air 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 ten liters per minute, thereby resulting in an air sample volume of approximately 4,800-6,000 liters per air sample.

Following air sample collection, the air sample cartridges will be securely capped, labeled, and delivered with chain of custody documentation to ALS Laboratory Group, in Salt Lake City, Utah, for analysis of lead and cadmium. ALS is accredited by the TCEQ for analysis of environmental samples and is accredited by the American Industrial Hygiene Association (AIHA) for analysis of air samples and lead in soil, dust, paint and air. Laboratory analyses on an expedited 72-hour turnaround will be requested. Metals will be analyzed using NIOSH Method 7303. Test method details are provided in Attachment 2. This method is specifically accredited by the AIHA.

Laboratory data will be validated by Exide's consultant (Golder Associates, Inc.) 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 the data to TCEQ as described above.

4.2 <u>Metals Concentrations Take Action Levels</u>

Following receipt of the lead and cadmium analytical laboratory reports, the analytical data from the downwind air samplers will be compared to the lead and cadmium Take Action Levels shown on Table 1. If either concentration in the downwind samples exceeds the relevant Take Action Level, the contractor will immediately implement increased dust suppression activities as described in the FOP/RCA Dust Control Plan.

4.3 <u>Metals Concentrations Stop Work Levels</u>

Following receipt of the lead and cadmium analytical laboratory reports, the analytical data from the downwind air samplers 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 lead, 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)" dated 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 1.07 $\mu g/m^3$ 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 dust-generating activities involving contaminated soil or waste and design and implement a more effective dust control program prior to resuming work. The additional dust suppression activities are described in the FOP/RCA Dust Control Plan.

Table 1 provides, in chart form, the default action levels and responses for particulate matter, lead, and cadmium. When sufficient site data has been collected following the start of the remediation activities, the action and stop work levels for particulate matter will be updated based upon the relationship between 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. Take Action and Stop Work levels will be updated weekly, provided timely sampling results are received, and at least every two weeks based upon the relationship between dust and measured metals concentrations. Work performed to date on other portions of the FOP have shown that the current concentrations used for stop work levels are an appropriate default.

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 Placement Zone perimeter – Stop Work. Implement additional dust control measures.
	PM_{10} Downwind Particulate Monitors	30-minute block average	PM_{10} > or equal $TAL^{PM\text{-}30}$ Default $TAL^{PM\text{-}30}$ - 0.1 mg/m^3 average 30-minute concentration – Implement additional dust control measures.	PM_{10} > or equal $SWL^{PM\text{-}30}$ Default $SWL^{PM\text{-}30}$ (two times $TAL^{PM\text{-}30}$) - 0.2 mg/m^3 average 30-minute concentration Stop Work. Implement additional dust control measures.
	PM_{10} Downwind Particulate Monitors	60-minute block average		PM_{10} > or equal $SWL^{PM\text{-}60}$ Default $SWL^{PM\text{-}60}$- 0.1 mg/m^3 average hourly concentration Stop Work. Implement additional dust control measures.
Lead	High Volume Particulate Samplers	Three days per week	0.8 µg/m^3 – Implement additional dust control measures.	1.07 µg/m^3 average concentration.
Cadmium	High Volume Particulate Samplers	Three days per week	0.075 µg/m^3 – Implement additional dust control measures.	0.1 µg/m^3 average concentration (TCEQ short term Cd ESL).

5.0 REPORTS

Daily Dust Concentration (PM_{10}) and Wind Speed and Direction summary reports will be prepared by FDS. These summary reports will include the average 30-minute net block average PM_{10} results for each downwind 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 receipt of analytical data for the monitoring day being reported. The data will be validated by Golder Associates, Inc. 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 are received that are 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 Golder Associates, Inc., followed by validation. The summary report with validated data will then be submitted to TCEQ as described above.

6.0 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 subsections describe the QC, calibration, and auditing procedures to be used during this project.

Table 2 Schedule of Audits, Calibrations, and Quality Control Checks		
Frequency	**Activity**	**Acceptable Limits**
Prior to delivery, prior to start of the project	Calibration of E-BAM monitors	
Prior to the start of work each week	Routine checks of E-BAM Monitors (tape checks, zero checks, leak check; clean size selective inlets; verify clock settings; housekeeping) and air samplers	Leak check >1.0 L/min requires nozzle and vane cleaning Leak check >1.5 L/min invalidates data to previous leak check
Every three weeks	Flow rate calibration (perform barometric pressure sensor audit, temperature sensor audit prior to flow test), membrane test and pump test of E-BAM monitors	Flow rate $\pm$0.1 L/min of traceable reference standard audit device Barometric pressure audit – calibrate E-Bam Temperature audit – calibrate E-Bam Membrane test – pass/fail Pump test – pass/fail Membrane check pass/fail
Every tape change and at least monthly	Cleaning nozzle and vane of E-BAM monitors (leak check is required anytime detector tape is removed or a new tape is installed)	Leak check >1.0 L/min requires nozzle and vane cleaning Leak check >1.5 L/min invalidates data to previous leak check
Weekly	Field blanks collected for air samplers	See 6.4 below
Monthly	Trip blanks collected for air samplers	See 6.4 below
Yearly	Calibration for on-site meteorological station, including zero calibration for wind speed	See 6.3 below

6.1 Particulate Monitors

6.1.1 Quality Control

The E-BAM beta detectors are calibrated at the factory. The beta detector 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 manually performed prior to the start of the project and at least every three weeks (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 project, and prior to the start of work each week.

QC flow checks will be performed by the contractor every three weeks to ensure that the correct sample flow rate is being maintained to provide proper particle size separation. The flow rate calibration is performed using a traceable reference standard flow audit device (BGI deltaCal® or equivalent). The barometric pressure and ambient temperature must be audited and calibrated, if necessary, prior to the flow check. The ambient temperature and barometric pressure indicated on the traceable reference standard flow audit device is compared to the ambient temperature and barometric pressure indicated on the E-BAM. If necessary, the ambient temperature and barometric pressure indicated on the traceable standard flow audit device is entered into the E-BAM to correct the E-BAM internal ambient temperature and/or barometric pressure sensor reading. The flow rate calibration can then be performed. The E-BAM internal flow rate is audited based upon the flow rate indicated by the traceable reference standard flow audit device. If necessary, the E-BAM flow rate indicated on the traceable standard flow audit device is entered into the E-BAM to correct the E-BAM internal flow sensor reading. A pump test will also be performed every three weeks.

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. Cleaning of the size selective inlets on the particulate monitors will be conducted prior to the start of each work week. 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 weekly and when the tape is removed or a new tape is installed. 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.

6.2 Air Samplers

6.2.1 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 air 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.

6.2.2 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 air 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.

Preventive maintenance will be part of the air 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 air samplers includes inspection and cleaning of the inlets.

6.3 Meteorological Station

The on-Site meteorological station will be zero checked once per year (or more often if values do not appear reasonable based on experience or comparison to a local weather source). The check for wind speed will include placing a small container over the sensor to zero check the wind measurement. The check for other meteorological data will be done by comparing readings to a local weather source. Once every two years the meteorological station will be calibrated by the manufacturer (the unit will be removed from service and shipped off-Site).

6.4 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 the EPA's *National Functional Guidelines for Inorganic Superfund Data Review* (2010).

The Laboratory will submit the analytical data and supporting quality assurance/quality control data to Exide's consultant, Golder Associates, 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.

- 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.

6.5 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, Golder Associates, Inc., for validation. The review will include review of error reports, previous instrument flow and leak check information, and review of the data received to insure the data being reported is from the instruments being used at the site.

6.6 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 with which the sample is associated.

The sample ID will be structured as follows:

FOPR-YYMMDD-LOC-XXX[-QQ], where

FOPR = Project (FOP Remediation)

YYMMDD = Sampling date (e.g., 11/01/2012 = 121101)
LOC = Sample Location (e.g. 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 November 1, 2017, would be identified as FOPR 171101 DW 123.

7.0 POINTS OF CONTACT

Concerns regarding activities conducted at the Exide Technologies Frisco Recycling Center should be addressed to the following points of contact:

Exide:
Eduardo Salazar
P.O. Box 250
Frisco, Texas 75034
Ph: 972-335-2121
Cell: 972-786-5404
eduardo.salazar@exide.com

Texas Commission on Environmental Quality:
Margaret Ligarde
Office of Legal Services
MC-173
P.O. Box 13087
Austin, Texas 78711
Ph: 512-239-3426
Fax: 512-239-0330
margaret.ligarde@tceq.texas.gov

City of Frisco:
Mack Borchardt
City of Frisco
6101 Frisco Square Blvd.
Frisco, Texas 75034
Ph: 972-292-5127
Fax: 972-292-6319
mborchardt@friscotexas.gov

ATTACHMENTS

ATTACHMENT 1

E-Bam Particulate Monitors

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

Met One Instruments, Inc.
Corporate Sales & Service: 1600 Washington Blvd., Grants Pass, Oregon 97526 • Tel (541) 471-7111 • Fax (541) 471-7116
Regional Sales & Service: 3206 Main Street, Suite 106, Rowlett, Texas 75088 • Tel (972) 412-4747 • Fax (972) 412-4716
http://www.metone.com • metone@metone.com

Rev. 08/09

E-BAM

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.

Met One Instruments, Inc.

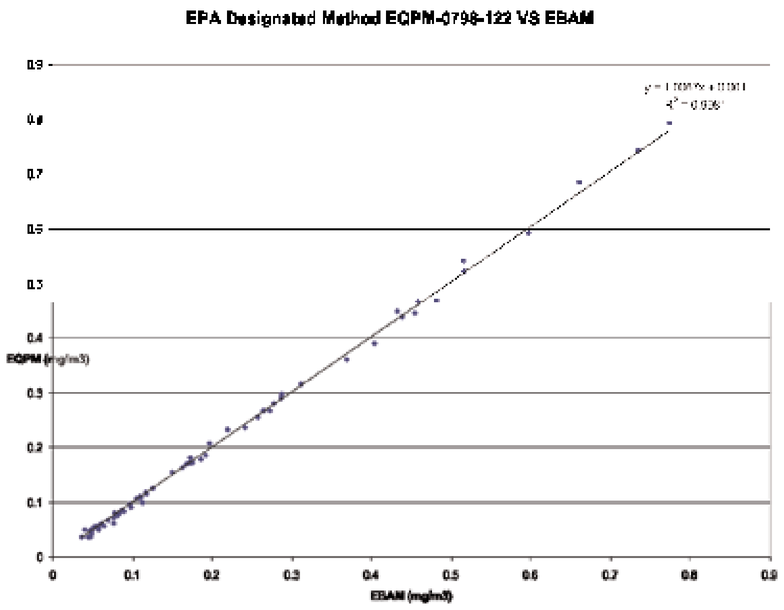
Continuous Monitoring

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.



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.

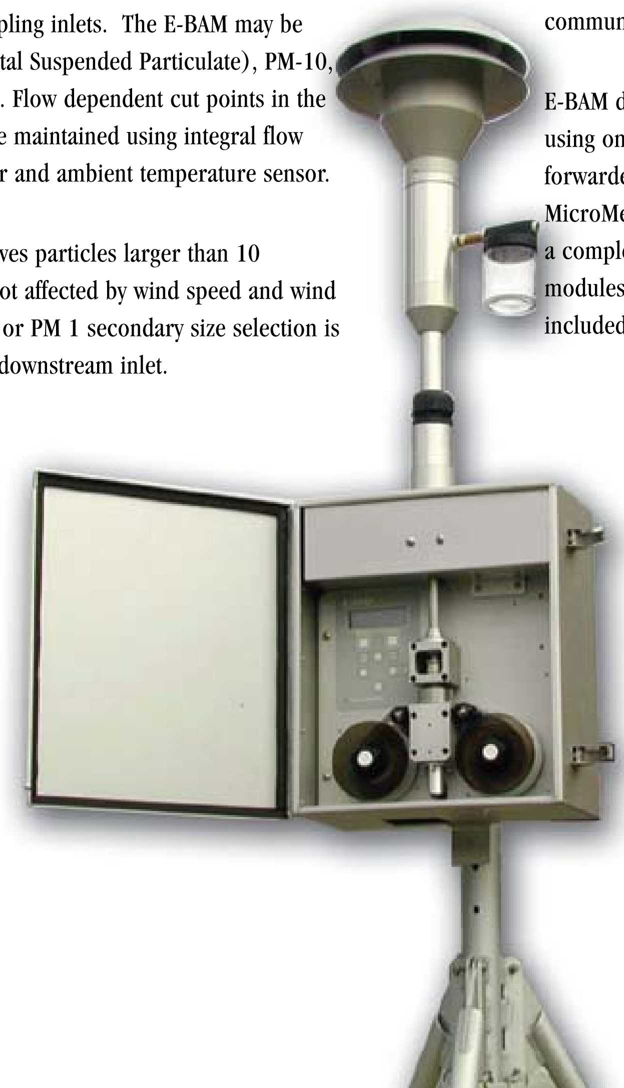
Set up

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 (Š): Not evaluated

APPLICABILITY: The working range of this method is up to 100 mg/m^3 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.

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[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:

Jason Loughrin, Lyle Reichmann, Doug Smieja, Shakker Amer, Curtis Hedman
Wisconsin Occupational Health Laboratory (WOHL).

TABLE 1: ANALYTE INFORMATION FOR VALID ELEMENTS AND COMPOUNDS

Analyte	Properties MW	MP (°C)	LOD (µg/mL)	LOQ (µg/mL)	Estimated LOQ (µg/sample)*	Minimum** air vol. (L)	Maximum*** air vol. (L)
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 under certain conditions (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.

APPENDIX Q

FOP DUST CONTROL PLAN

FOP/RCA DUST CONTROL PLAN

for

Former Operating Plant Remediation Activities and

Remediation Consolidation Area Operation and Closure Activities

at

Exide Technologies Frisco Recycling Center

Frisco, Texas

Prepared by

Golder Associates Inc.

August 2018

Updated May 2019

Table of Contents

1.0 INTRODUCTION ... 1
1.1 Project Overview ... 1
1.2 Air Monitoring and Dust Prevention Team ... 1
2.0 DUST CONTROL ... 2
2.1 Training of Personnel ... 3
2.2 Inspection and Maintenance ... 3
3.0 POTENTIAL DUST GENERATION ACTIVITIES AND PROPOSED CONTROLS ... 3
3.1 Dust Suppression Measures ... 4
3.1.1 Particulate Matter Take Action Levels ... 4
3.1.2 Particulate Matter and Metals Concentration Take Action Levels ... 4
3.1.3 Particulate Matter and Metals Concentration Stop Work Levels ... 4
3.2 Excavation Activities ... 5
3.3 On-Site Transportation ... 5
3.4 Soil Stockpiles ... 5
3.5 Soil Loading and On-Site Transportation ... 5
3.6 Waste Placement ... 6
3.7 Equipment Decontamination ... 6
4.0 POINTS OF CONTACT ... 6

TABLES

ATTACHMENTS

1. Descriptive Literature on Misting Equipment
2. Additional Dust Suppression Materials

1.0 INTRODUCTION

The purpose of this Dust Control Plan is to identify the measures that will be taken to minimize emissions associated with remediation activities at the Former Operating Plant portion of the Exide Technologies Frisco Recycling Center in Frisco, Collin County, Texas, including operation and closure activities at the Remediation Consolidation Area (RCA). Specifically, this Dust Control Plan specifies the requirements and methods for minimizing dust generation during excavation, consolidation, and closure activities. This plan works in conjunction with the FOP/RCA Air Monitoring Plan, which describes the air monitoring activities that will be performed during the work. This plan addresses the dust control measures to be implemented during the "dust-generating activities" involving excavation, transport and placement of contaminated soil from the FOP and excavation, transport and placement of sediment (or other approved waste as described in the Final Closure Plan) in the RCA and limited demolition work.

Air monitoring is not required during the following activities:

- Initial construction of perimeter berms constructed of clean soil
- Placement of the soil cap once contaminated soil or waste is covered
- Backfill of excavation areas with clean soil.

The purpose of this Dust Control Plan is to identify steps that will be taken to reduce particulate matter, lead, and cadmium emissions during demolition, excavation, consolidation, and closure activities. It provides specific information about the generation and control of dust emissions during these activities. This plan also includes site-specific dust suppression procedures. Best management practices (BMPs) will be implemented throughout the project. BMPs will include wetting active work areas, minimizing or ceasing activity during periods of high wind (i.e., greater than 20 miles per hour), wetting paved areas and unpaved areas in the FOP, and application of dust suppressant materials. This Dust Control Plan is to be used in conjunction with the FOP/RCA Air Monitoring Plan. The following sections detail potential dust sources and dust control means and methods.

1.1 Project Overview

The overall project consists of excavation of contaminated soil and sediment from affected properties at and downstream of the FOP, consolidation of these wastes and other approved wastes in the RCA, and closure activities at the RCA. Limited demolition of specified above grade concrete walls and the wastewater treatment plant may also be performed prior to or during the course of the remediation and closure activities. Waste placed in the RCA will be waste generated during the ongoing demolition and remediation activities at the FOP and downstream Stewart Creek. Dust control is a high priority during the project.

1.2 Air Monitoring and Dust Prevention Team

These points of contact have the authority to implement additional dust control provisions and stop work provisions based on the FOP/RCA Air Monitoring Plan. These team members are also responsible for maintenance and revisions of the Dust Control Plan.

Employee Name	Employee Title	Designated Dust Control Responsibility
To Be Determined	Project Manager	On-site project manager responsible to insure Dust Control Plan is followed by all project team members.
To be Determined	Principal in Charge or Equivalent Role	Senior management authority; provide corporate support to ensure availability of necessary resources to maintain compliance with the Dust Control Plan.
To be Determined	Project Manager or Equivalent Role	Qualified Individual; review and modify the Dust Control Plan to keep it current; ensure proper record keeping. Review of laboratory reports and field data sheets prepare correlation between dust monitors and laboratory data and review air monitoring locations
To Be Determined	Air Monitoring Technician	Responsible for air monitoring required by these plans; responsible for maintenance of monitoring equipment; responsible for preparation of daily reports.

2.0 DUST CONTROL

Dust control is a high priority during remediation, demolition and soil placement activities. The main dust control method to be used during remediation activities at the FOP will be the application of water using fine water mist to the area being actively excavated using an airborne dust suppression system (e.g., Buffalo Turbine BT-MDC2 or Dust Boss DB 60 with oscillation or current manufacturer's replacement model). The airborne dust wet suppression system resembles a snow making machine and can cover a large area with a fine mist of water, effectively controlling dust. A water truck or tank will be staged with the airborne dust suppression system to provide water to the system. A water truck will be used to fill the tank and provide additional dust suppression as needed. Soil excavation will not proceed unless the airborne dust suppression system or a water truck is available for use.

Given the damp conditions of the soil due to wetting at the excavation area, and based upon our previous experience during remediation of the former undeveloped buffer property it is anticipated that spraying fine water mists using the airborne dust suppression system will be sufficient to control dust during the placement activities. Descriptive literature on the Dust Boss DB 60 and the Buffalo Turbine BT-MDC2 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 FOP activities, including enforcement of low speed limits for onsite vehicular traffic, stopping dust-generating activity during high wind conditions, decontamination of trucks leaving the Site, and height limits for soil stock piles. The size of stockpiles will be limited to 250 cubic yards with an area of approximately 30 by 30 feet and height of approximately 8 feet. The length and width of the stockpiles may vary, but the height will not exceed 8 feet. When not actively being worked, stockpiles will be covered with plastic sheeting to reduce dust emissions and prevent infiltration/runoff during rain events. Plastic sheeting will be secured in place with pin anchors, sand bags, or other devices to reduce the potential for displacement due to weather.

If enhanced dust suppression is required by ambient conditions, paper mulch mixed with a tackifier may be applied to areas where waste is not being actively placed. Section 3.0 describes the additional dust control measures to be used. Information on the paper mulch material and tackifier is provided in Attachment 2.

If the sustained wind speed (the wind speed obtained by averaging the measured values over a ten minute period) exceeds 20 miles per hour, it is a "high wind condition." When there is a high wind condition, all excavation and RCA operation and closure activities must cease until the sustained wind speed declines to 20 miles per hour or lower for at least 10 consecutive minutes. Non-dust producing activities (equipment maintenance, etc.) may still be conducted during these periods.

2.1 Training of Personnel

The contractor 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 order to minimize dust generation 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

Excavation and RCA operation and closure 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 soil excavation and consolidation activities which have the potential to generate dust and the respective dust control measures for each activity.

Table 3-1
Potential Dust Generation Activities and Proposed Control

Activity	Proposed Controls
General Dust Suppression – All Dust-Generating Activities involving potentially contaminated materials	Use of airborne dust wet suppression system during operating hours for all material handling activities and otherwise as needed. Water spray/mist to wet work areas prior to beginning work and as a supplemental system. Adjust the waste placement rate. Suspend work under high wind conditions until sustained wind speed is below 20 mph for at least 10 consecutive minutes.
Truck Traffic	Wetting unpaved and paved onsite haul roads prior to the start of activities each morning and as needed during working hours. Lower speed limits for onsite vehicular traffic to reduce dust generation. Remove loose material before truck exits work area.
Excavation	Water spray/mist to wet excavation areas and/or use of airborne dust wet suppression system as needed for dust generating activities. Adjust excavation activities. Suspend work under high wind conditions.
Soil or Sediment Stockpiling	Ensure soil or sediment is damp prior to stockpiling. Water spray/mist work area prior to beginning work and as a supplemental system. Cover stockpiles at the end of each day and when not in active use and secure cover.
Waste Placement	Use of airborne dust wet suppression system. Water spray/mist the work area prior to placement and as a supplemental system.

Table 3-1 Potential Dust Generation Activities and Proposed Control	
Activity	**Proposed Controls**
Demolition	Use of airborne dust wet suppression system. Water spray/mist to wet work areas prior to beginning work and as a supplemental system. Adjust demolition activities. Suspend work under high wind conditions.

3.1 Dust Suppression Measures

3.1.1 Particulate Matter Take Action Levels

If visible dust is present in the work area, increased wetting of the area using water sprays from perimeter hoses, water trucks, and/or spray misters will be implemented. Airborne dust suppression will be achieved by use of oscillating spray misters that provide dust suppression within a 100-200 ft. range of the mister units. (The range is dependent upon wind speed and direction.) Additional details regarding the airborne dust suppression system are provided in Attachment 1. If visible dust is observed leaving the RCA or soil excavation area, work will stop and additional dust control measures will be implemented. These additional dust control measures may include:

- Increased wetting/misting of work area(s) and/or roadways
- Adjusting the rate/speed and/or quantity of equipment in the excavation areas
- Adjusting the rate/speed and of equipment in the RCA
- Applying temporary cover (paper mulch with tackifier, plastic sheeting or a similar cover) to placement areas not being actively worked

3.1.2 Particulate Matter and Metals Concentration Take Action Levels

If the 30-minute average PM_{10} concentration from the downwind monitors or the downwind sampler analytical data for metals exceeds the applicable Take Action Levels set forth in Table 1 of the FOP/RCA Air Monitoring Plan, then the contractor will immediately implement increased dust suppression activities. Airborne dust suppression will be achieved by use of oscillating spray misters that provide dust suppression within a 100-200 ft. range of the mister units. These increased dust suppression activities may include, but are not limited to, the following:

- Increased wetting/misting of work area(s) and/or roadways
- Adjusting the rate/speed and/or quantity of equipment in the excavation area(s)
- Adjusting the rate/speed and of equipment in the RCA
- Applying temporary cover (paper mulch with tackifier) to placement areas not being actively worked

3.1.3 Particulate Matter and Metals Concentration Stop Work Levels

If the one-hour (60-minute) average or 30-minute average PM_{10} concentration from the downwind monitors exceeds the applicable Stop Work Level set forth in Table 1 of the FOP/RCA Air Monitoring Plan, the contractor will immediately stop all excavation and soil loading and placement work. The dust suppression activities may include, but are not limited to, the following:

- Mobilize and make operational an additional Airborne Dust Suppression System
- Increased wetting/misting of placement areas and/or roadways
- Applying temporary cover (paper mulch with tackifier) to excavation areas not being actively worked
- Adjusting the rate/speed of equipment in the RCA or excavation area

- Stopping specific dust-generating activities until wind directions and/or wind speeds are more conducive to reduced dust levels

3.2 Excavation Activities

Dust control measures will include water spraying/misting prior to excavation activities to control dust during excavation activities and during excavation as a supplemental system. Water to be utilized for dust suppression will be potable municipal water supplied by a hydrant located on the Exide property. Water to the hydrant is supplied through the City of Frisco Municipal Water System.

Water trucks will be filled at the water loading area at the Exide facility and sent to active excavation work areas for dust suppression as needed. The airborne dust wet suppression system will be operated during excavation to control dust. Excavation activities that are capable of generating dust associated with contaminated soil are not permitted to continue when dust suppression capabilities are unavailable.

If there is a high wind condition, all excavation work will cease until the sustained wind speed decreases to less than 20 miles per hour for at least 10 consecutive minutes.

3.3 On-Site Transportation

All employee vehicles will enter the site from the east entrance. Employees will park in the designated parking area at the facility. No private vehicles will be allowed into the work areas.

Vehicle travel on unpaved access roads will be limited to 10 miles per hour. Project personnel are required to obey 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 and paved roads will be wetted using a water truck prior to the start of activities each morning and during working hours, as appropriate to minimize dust formation without creating runoff or tracking issues.

3.4 Soil or Sediment Stockpiles

Fugitive dust emissions from soil or sediment stockpiles at the FOP or along Stewart Creek will be controlled using temporary covers and water sprays. Controls for dust mitigation during soil/sediment stockpiling include a water spray/mist from a water truck prior to work beginning and during work as a supplemental system, operation of the airborne dust wet suppression system as a supplemental control as needed, and covering stockpiles. The height of stockpiles will be kept to approximately 8 feet with a maximum volume of 250 cubic yards each. The lateral extent of each stock pile will be no greater than approximately 30 feet by 30 feet. The length and width of the stockpiles may vary, but the height will not exceed 8 feet. Each stockpile will be covered with 6 mil (or thicker) poly sheeting and weighted down by sandbags (or other appropriate weights) at the end of each day and when the stockpile is not in active use.

3.5 Soil/Sediment Loading and On-Site Transportation

Soil/sediment will be loaded into haul trucks using an excavator or front end loader. For areas where waste classification has previously been determined, the loading will be completed concurrently with excavation or will be stockpiled per the requirements of Section 3.4 concerning Soil Stockpiles. If loading is being conducted in areas that are considered “clean”, polyethylene sheeting will be placed on the ground in the loading area to allow any spillage that occurs during the truck loading operations to be easily cleaned up. Each truck will be inspected and soil adhering to the outside of the bed will be removed. The load will be tarped or the surface of the load will be wetted prior to exiting the load out area.

Loaded trucks will proceed directly from the load-out area of the excavation area to the RCA. A clean haul road and bulkhead will be constructed to allow the waste hauling trucks to dump their loads without traveling over waste material. A truck tire decontamination area will be established at the egress from the RCA. The tires of each truck will be brushed or washed as needed in this area prior to return to the excavation area. Truck tire decontamination fluids will be processed through the on-site waste water treatment plant.

3.6 Waste Placement

Large area misters will be mobilized to the RCA to wet work areas prior to the beginning of work and during waste placement. Waste placement activities are not permitted to continue when dust suppression capabilities are unavailable. Only potable water will be used for dust control purposes.

Material placed in the RCA may be covered with paper mulch and tackifier to prevent the generation of dust on an as needed basis. As the waste material is not expected to attract birds or animals nor to generate dust once placed during the relatively brief periods between additional placement of misted / moistened material, daily cover of the active areas will not be required in accordance with the Final Closure Plan.

3.7 Equipment Decontamination

The excavation equipment will be decontaminated between each excavation area and upon completion of the excavation activities. The decontamination between each excavation area is expected to be minimal and should only include the tracks or tires and/or ground-engaging parts of the equipment. The decontamination will consist of dry decontamination followed by washing with potable water, if needed. The decontamination will be completed immediately adjacent to the excavation on a prefabricated decontamination pad. The decontamination solids and liquids generated from each area will be incorporated into the waste materials from the area that was excavated. If more liquids are generated during the decontamination process than will soak into the excavated soil, they will be placed into containers and transported to the on-site wastewater treatment plant for processing or transported off-site in accordance with applicable regulations.

Equipment used in the RCA will be decontaminated prior to leaving the RCA area. The decontamination will consist of dry decontamination followed by washing with potable water, if needed. The decontamination will be completed immediately adjacent to the RCA on a prefabricated decontamination pad. The decontamination solids and liquids generated from the RCA will be incorporated into the waste materials in the RCA. If more liquids are generated during the decontamination process than will soak into the excavated soil, they will be placed into containers and transported to the on-site wastewater treatment plant for processing or transported off-site in accordance with applicable regulations.

4.0 POINTS OF CONTACT

Concerns regarding activities conducted at the Exide Technologies Frisco Recycling Center should be addressed to the following points of contact:

Exide:
Eduardo Salazar
P.O. Box 250
Frisco, Texas 75034
Ph: 972-335-2121
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MC-173
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Austin, Texas 78711
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Margaret.ligarde@tceq.texas.gov

City of Frisco:
Mack Borchardt
City of Frisco
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Frisco, Texas 75034
Ph: 972-292-5127
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mborchardt@friscotexas.gov

ATTACHMENTS

ATTACHMENT 1

Descriptive Literature on Misting Equipment

Monsoon

DUST CONTROLLER-
DIESEL COMPLETE

BUFFALO TURBINE

Made in America

180 Zoar Valley Road, Springville, NY 14141 | ph 716.592.2700 | www.buffaloturbine.com | *Dealer Inquiries Welcome*

MONSOON **DUST CONTROLLER W/OSCILLATION - *DIESEL***

Applications

Demolition Sites | Landfills | Wood Recycling
Scrap Metal Recycling | Aggregate Processing
Waste Transfer

TOP BENEFITS

- Extended engine life when compared to traditional gas models
- Powerful and versatile
- Easy to operate and maintain
- Self contained

TOP FEATURES

- High speed oscillation up to 270°
- Dual 6 gallon fuel tanks for additional run time
- Low oil shut-off feature
- Low intake airflow shut-off
- 3 wheel off-road trailer package for ease of transport

***Optional** Lifting Bracket

ENGINE SPECS

- Kohler 3-cylinder diesel engine
- Liquid cooled, tier-4 compliant
- 3 year engine warranty
- 12 gallon fuel capacity

PHYSICAL SPECS

- Length w/wheels & handle removed: 88”
- Overall length w/nozzle & tow handle: 136”
- Width: 55”
- Max height w/nozzle in upright position: 54”
- Weight: 975 lbs.

***Optional** Fork Lift Pockets

GENERAL INFO

- Hand held wireless transmitter (water resistant) with push button control (manual control option available)
- Gyratory atomizing nozzle system
- Hose input: 3/4” utility / garden hose
- Min/Max water pressure: 40psi - 120psi
- Min/Max water volume: 1/3 gallon - 20 gallons per minute
- Throw distance (neutral wind conditions): Vertical: up to 50 ft, Horizontal: up to 125 ft
- Input RPM: Up to 3600 rpm
- Outlet size: 12”
- Droplet size: 50 - 200 microns

GSA Contractor: GS-21F-080AA GSA Advantage! www.gsaAdvantage.gov | ISRI Institute of Scrap Recycling Industries, Inc. | NATIONAL DEMOLITION ASSOCIATION | Made in the USA | SWANA 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	14.6	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

Descriptive Literature on Dust Suppression Material

Conwed Fibers®

Family of Hydraulic Mulch Products

Setting the Standards for Erosion Control Since 1965

▪ 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® Hydro Mulching Solutions 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

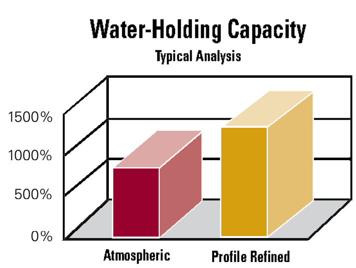
Nothing illustrates Conwed Fibers superior quality than a comparison of our wood fibers to those of our competitors.

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.

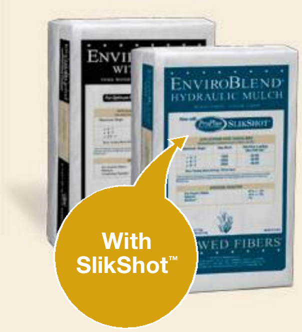
Conwed Fibers® 1000 with SlikShot™

- 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
- 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 for more water holding capacity and a stronger bond
- 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

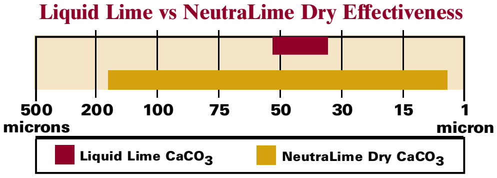
- **NeutraLime™ Dry –** Nothing balances soil pH faster – within 6-10 days of application – with the added plus of longer control – up to 18 weeks. Contains 50% more active ingredients than liquid lime.

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

APPENDIX R

INSPECTION AND MAINTENANCE FORMS

INSPECTION FORM
EXIDE TECHNOLOGIES FRISCO RECYCLING CENTER

Date:__________ Type of Inspection (Storm, Monthly, Quarterly or Semi-Annual):______________________

Inspector(s):____

Signature(s):____

Instructions: For any items that require maintenance, submit this form and notify the Exide representative of any recommended actions. Schedule remedial actions complete the **REPAIR REPORT FORM** when complete.

Facility Component	Inspection Item	Inspection Frequency				Condition		Notes or Recommended Repairs
		Storm	Monthly	Quarterly	Semi-Annually	Acceptable	Maintenance Needed	
General FOP Conditions	Signs, security fences, and gates							
	Access Roads							
	Safety and Emergency Equipment							
	Benchmarks							
	Exterior berm slopes and surface water control systems							

Golder Associates

Facility Component	Inspection Item	Inspection Frequency				Condition		Notes or Recommended Repairs
		Storm	Monthly	Quarterly	Semi-Annually	Acceptable	Maintenance Needed	
North CAMU Final Cover	including ditches and culverts							
	Access road on berm							
	Surface erosion, rills, gullies, and crevasses; minor cover settling or subsidence							
	Major cover settlement							
	Water on unit surface							
	Sparse or eroded vegetation							
	Invasive vegetation							
	Cover disturbance by burrowing animals							
	Grass							
North CAMU Surface Water Management	Ditches							
	Erosion and sediment control devices							

Facility Component	Inspection Item	Inspection Frequency				Condition		Notes or Recommended Repairs
		Storm	Monthly	Quarterly	Semi-Annually	Acceptable	Maintenance Needed	
	Culverts and conveyance pipes							
	Grass							
	Surface water drainage							
North CAMU Leachate Collection Conveyance System	Pumps and pump house							
	Collection sumps							
	Exposed piping, conduit, and appurtenances							
	Riser cracked							
	Alarm system and auto-dialer system							
RCA Final Cover	Access road conditions							
	Surface erosion, rills, gullies, and crevasses; minor cover settling or subsidence							

Facility Component	Inspection Item	Inspection Frequency				Condition		Notes or Recommended Repairs
		Storm	Monthly	Quarterly	Semi-Annually	Acceptable	Maintenance Needed	
	Major cover settlement							
	Water on unit surface							
	Sparse or eroded vegetation							
	Invasive vegetation							
	Cover disturbance by burrowing animals							
	Grass							
RCA Surface Water Management	Ditches							
	Storm Water Pond							
	Erosion and sediment control devices							
	Culverts and conveyance pipes							
	Grass							

Facility Component	Inspection Item	Inspection Frequency				Condition		Notes or Recommended Repairs
		Storm	Monthly	Quarterly	Semi-Annually	Acceptable	Maintenance Needed	
	Surface water drainage							
RCA Flood Wall	Flood wall waterstop and joint filters							
	Seepage, settlement, sand boils, saturated soil areas, cracks, or other damage to flood wall							
	Vegetation (no trees or high vegetation along flood wall)							
	No trash or debris accumulation along flood wall							
	No bank erosion/caving observed that would endanger wall stability							
North Disposal Area Final Cover	Access road conditions							
	Surface erosion, rills, gullies, and crevasses; minor cover settling or subsidence							

Facility Component	Inspection Item	Inspection Frequency				Condition		Notes or Recommended Repairs
		Storm	Monthly	Quarterly	Semi-Annually	Acceptable	Maintenance Needed	
	Major cover settlement							
	Water on unit surface							
	Sparse or eroded vegetation							
	Invasive vegetation							
	Cover disturbance by burrowing animals							
	Grass							
North Disposal Area Surface Water Management	Ditches							
	Erosion and sediment control devices							
	Grass							
	Surface water drainage							
South Disposal Area Final	Access road conditions							

Facility Component	Inspection Item	Inspection Frequency				Condition		Notes or Recommended Repairs
		Storm	Monthly	Quarterly	Semi-Annually	Acceptable	Maintenance Needed	
Cover	Surface erosion, rills, gullies, and crevasses; minor cover settling or subsidence							
	Major cover settlement							
	Water on unit surface							
	Sparse or eroded vegetation							
	Invasive vegetation							
	Cover disturbance by burrowing animals							
	Grass							
South Disposal Area Surface Water Management	Ditches							
	Erosion and sediment control devices							
	Grass							

Facility Component	Inspection Item	Inspection Frequency				Condition		Notes or Recommended Repairs
		Storm	Monthly	Quarterly	Semi-Annually	Acceptable	Maintenance Needed	
	Surface water drainage							
Slag Landfill Final Cover	Access road conditions							
	Surface erosion, rills, gullies, and crevasses; minor cover settling or subsidence							
	Major cover settlement							
	Water on unit surface							
	Sparse or eroded vegetation							
	Invasive vegetation							
	Cover disturbance by burrowing animals							
	Grass							
Slag Landfill Surface Water Management	Ditches							
	Erosion and sediment control							

Facility Component	Inspection Item	Inspection Frequency				Condition		Notes or Recommended Repairs
		Storm	Monthly	Quarterly	Semi-Annually	Acceptable	Maintenance Needed	
	devices							
	Grass							
	Surface water drainage							
Groundwater Monitoring System	Protective casing							
	Locks							
	Ground surface seal							
	Accumulation of surface water							
	Concrete pad and bollards							

REPAIR REPORT FORM
EXIDE TECHNOLOGIES FRISCO FRISCO RECYCLING CENTER

Inspector(s):____

Signature(s):____

Instructions: Note the problem(s) identified during the inspection, date the problem(s) was identified, actions performed to address the problem(s), date the problem(s) was addressed, and date the problem(s) was fully addressed.

Deficiency	Date Identified	Action Taken	Date Addressed	Date Completed

Golder Associates

APPENDIX S

SIGNED EMERGENCY COORDINATION AGREEMENTS

SIGNED EMERGENCY COORDINATION AGREEMENTS
TO BE PROVIDED TO THE TCEQ UPON RECEIPT

Established in 1960, Golder Associates is a global, employee-owned organization that helps clients find sustainable solutions to the challenges of finite resources, energy and water supply and management, waste management, urbanization, and climate change. We provide a wide range of independent consulting, design, and construction services in our specialist areas of earth, environment, and energy. By building strong relationships and meeting the needs of clients, our people have created one of the most trusted professional services organizations in the world.

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