

**Excavation Plan  
for Phase B Soil Remediation of RZ-D  
Addendum to the Removal Action Work Plan  
Tronox LLC  
Henderson, Nevada**

~~July 26, 2010~~ August 31, 2010

*Prepared For:*

Tronox LLC  
560 West Lake Mead Parkway  
Henderson, Nevada 89015

*Prepared By:*

Northgate Environmental Management, Inc.  
300 Frank H. Ogawa Plaza, Suite 510  
Oakland, California 94612



---

Deni Chambers, CEM  
Principal-in-Charge



---

Derrick Willis  
Project Manager



---

Ted Splitter, P.E., CEM  
Principal Engineer



**Excavation Plan**  
**For Phase B Soil Remediation of Remediation Zone RZ-D**  
**Addendum to the Removal Action Work Plan**  
**Tronox LLC**  
**Henderson, Nevada**

**Responsible Certified Environmental Manager (CEM) for this project**

I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and, to the best of my knowledge, comply with all applicable federal, state and local statutes, regulations and ordinances.



---

Susan M. Crowley, CEM 1428 Exp.:03/08/11  
Crowley Environmental LLC



## TABLE OF CONTENTS

<b>1.0</b>	<b>INTRODUCTION .....</b>	<b>1</b>
1.1	Site Description.....	<del>321</del>
1.2	Background.....	<del>321</del>
1.3	Data Evaluation.....	<del>421</del>
1.4	RZ-D Site Conditions .....	<del>641</del>
<b>2.0</b>	<b>SCOPE OF WORK .....</b>	<b><del>861</del></b>
2.1.1	Buffer Strip Ponds GW-11 and WC-West and WC-East .....	<del>971</del>
2.1.2	Property Lines.....	<del>971</del>
2.1.3	Trade Effluent Pond Berms .....	<del>1071</del>
2.1.4	Railroad Embankments.....	<del>1081</del>
2.1.5	Asphalt Pavement .....	<del>1081</del>
2.1.6	Veolia Facilities .....	<del>1181</del>
2.1.7	Infiltration Trenches.....	<del>1181</del>
2.1.8	Field Observations .....	<del>1181</del>
2.1.9	Utility Lines .....	<del>1291</del>
2.2	Depth Constraints Driven by Arsenic.....	<del>1291</del>
<b>3.0</b>	<b>REMEDIATION.....</b>	<b><del>13101</del></b>
3.1	Work Area Preparation .....	<del>13101</del>
3.2	Well Abandonment .....	<del>14111</del>
3.3	Excavation.....	<del>14111</del>
3.4	Post-Excavation Backfilling .....	<del>16121</del>
3.5	Air Monitoring.....	<del>16131</del>
<b>4.0</b>	<b>INSTITUTIONAL AND ENGINEERING CONTROLS.....</b>	<b><del>18141</del></b>
<b>5.0</b>	<b>REFERENCES .....</b>	<b><del>20161</del></b>

## TABLES

- 1 Excavation Area Summary
- ~~2 ...NDEP modified table...Excavation Area Data~~

## FIGURES

- 1 RZ-D Excavation Areas and Nature and Extent of Contamination
- 2 Approximate Location of Utilities RZ-D
- ~~3 RZ-D Excavation Area Boundaries and Target Depths of Excavation~~
- ~~43 Location of Monitoring Wells and Proposed Engineering/Institutional Control Areas RZ-D~~
- ~~54 Typical Cross-Section Excavation Areas~~

## APPENDIX



A RZ-D Analytical Data



## 1.0 INTRODUCTION

Northgate Environmental Management, Inc. (Northgate) has prepared this Excavation Plan (EP) for Remediation Zone D (RZ-D) at the Tronox LLC (Tronox) facility located in Henderson, Nevada (the Site). This EP is an addendum to the *Removal Action Work Plan for Phase B Soil Remediation of Remediation Zones RZ-B through RZ-E* (RAW) that was issued on May 4, 2010 (Northgate, 2010a) and approved by the Nevada Division of Environmental Protection (NDEP) on May 12, 2010. This EP presents the methods and procedures to be used to implement the remedial alternative approved by NDEP for RZ-D to address contaminated soil at the Site. The scope of work presented in this EP is based on the NDEP-approved scope of work contained in the RAW and incorporates the results of a pre-confirmation sampling program performed to identify the limits of the cleanup actions (described in Section 1.2). Soil remediation work will be performed in accordance with this EP, including the Standard Operating Procedures (SOPs) established by Basic Remediation Company (BRC, 2009a-j) for the Black Mountain Industrial (BMI) complex and the *Quality Assurance Project Plan* (QAPP; AECOM and Northgate, 2009). A human health risk assessment will be conducted for RZ-D in accordance with the *Health Risk Assessment Work Plan* (HRA; Northgate, 2010b).

The objective of this EP is to present a cleanup strategy that complies with the NDEP Order issued to Tronox on December 14, 2009 ([NDEP, 2009](#)) to remove impacted soil from RZ-D by the end of 2010. For purposes of the EP and designation of potential remediation areas, “contaminated soil” is generally defined as concentrations exceeding NDEP worker [Basic Comparison Levels \(BCLs\)](#), or the modified Site-specific risk-based concentration (RBRC) for dioxin/furans (in terms of a 2,3,7,8-TCDD) of 2,700 ng/kg (ppt). For arsenic, the target remediation goal of 7.2 mg/kg will be used for surface soil as it represents a regionally accepted background concentration. There are no NDEP BCLs for asbestos; therefore, “contaminated” soil is defined as one or more long fibers (amphibole) and/or [greater than](#) five ~~or more~~ long fibers (chrysotile). Remediation is focused on removing impacted soils exceeding the [above](#) criteria ([Comparison Criteria](#)) ~~indicated above~~ within the 0-10 feet below the ground surface (bgs) soil column for protection of human health. The final soil cleanup goals will achieve a cumulative theoretical upper-bound incremental carcinogen risk level point of departure of  $1 \times 10^{-6}$  and a target organ specific non-cancer hazard index of 1 for each decision unit at the Site. If needed, NDEP may re-evaluate these goals in accordance with U.S. Environmental Protection Agency (USEPA) guidance.

The final excavation areas will also address elevated concentrations of contaminants [deeper than 10 feet](#) and the leaching to groundwater pathway. A ~~site~~-wide evaluation to address leaching to



groundwater has been conducted. As the evaluation is finalized, an errata to this report will be submitted to address this pathway.

~~1.1 — Northgate Environmental Management, Inc. (Northgate) has prepared this Excavation Plan (EP) for Remediation Zone D (RZ-D) at the Tronox LLC (Tronox) facility located in Henderson, Nevada (the Site). This EP is an addendum to the Removal Action Work Plan for Phase B Soil Remediation of Remediation Zones RZ-B through RZ-E (RAW) issued May 4, 2010 and approved by the Nevada Division of Environmental Protection (NDEP) May 12, 2010. The EP presents the methods and procedures to be used to implement the remedial alternative approved by NDEP for RZ-D to address contaminated soil within 10 feet below ground surface (bgs) at the Site. The scope of work presented in this EP is based on the NDEP-approved scope of work contained in the RAW and incorporates the results of a pre-confirmation sampling program (described in Section 1.2) performed to identify the limits of the cleanup actions. Soil remediation work will be performed in accordance with this EP, including the Standard Operating Procedures (SOPs) established by Basic Remediation Company (BRC, 2009a-j) for the Black Mountain Industrial (BMI) complex and the Quality Assurance Project Plan (QAPP; AECOM and Northgate, 2009). A human health risk assessment will be conducted for RZ-D in accordance with the Health Risk Assessment Work Plan (HRA WP; Northgate, 2010a).~~

~~1.2 — The objective of this EP is to present a cleanup strategy that complies with the NDEP Order issued to Tronox on December 14, 2009 to remove impacted soil from RZ-D by the end of 2010.~~

~~1.3 — The remediation limits presented in this excavation plan have been developed based on human health criteria including commercial worker and construction worker BCLs, modified risk-based goals for dioxins/furans and background concentrations for metals in soil. This EP currently does not address the soil-to-groundwater pathway. A separate site-wide leaching evaluation has been conducted and received by NDEP on June 12, 2010. As the evaluation is finalized, errata to this plan will be provided to address this pathway.~~

~~1.4 — For purposes of the EP and designation of potential remediation areas, “contaminated soil” is generally defined as soil containing chemicals of potential concern (COPCs) at concentrations exceeding NDEP worker Basic~~



~~Comparison Levels (BCLs), or modified risk-based goals for dioxins/furans agreed upon by NDEP<sup>1</sup>. For metals in which the background concentrations that exceed BCLs, “contaminated soil” is defined as concentrations that exceed the maximum concentration of the background data set (i.e., 7.2 mg/kg for arsenic). There are no NDEP BCLs for asbestos. Therefore, asbestos-related “contaminated soil” is defined as one or more long fibers (amphibole) and/or more than five long fibers (chrysotile) per sample. The final soil cleanup goals will achieve a cumulative theoretical upper-bound incremental carcinogen risk level point of departure of  $1 \times 10^{-6}$  and a target organ-specific non-cancer hazard index of 1 for each decision unit at the Site. If needed, NDEP may re-evaluate these goals in accordance with United States Environmental Protection Agency (USEPA) guidance.~~

### 1.51.1 Site Description

The Tronox Site is a portion of a larger complex that was first developed by the U.S. government in 1942 as a magnesium plant for World War II operations. The active portion of the Tronox LLC facility currently produces electrolytic manganese dioxide, used in the manufacturing of alkaline batteries; elemental boron, a component of automotive airbag igniters; and boron trichloride, used in the pharmaceutical and semiconductor industries and in the manufacturing of high-strength boron fibers for products including sporting equipment and aircraft parts. RZ-D consists of approximately 130 acres primarily occupied by active, existing groundwater and process water holding pond areas, including GW-11, ~~and~~ WC-West, and WC-East (see Figure 1). Several buildings are present in RZ-D, including the active Veolia facilities that are used for groundwater treatment and several older ~~storage~~-historic storage buildings. A closed hazardous waste landfill is present in the northwest corner of RZ-D. Other features include active soil/bentonite groundwater cutoff trench and infiltration trenches. A complete description of the Site, history of its use, and historical environmental investigations are presented in the RAW.

### 1.61.2 Background

At the completion of the Phase A and B Investigations and the Area I and II supplemental soil sampling, a pre-confirmation sampling program was developed in concert with NDEP to refine remediation planning and establish the vertical and horizontal extent (“cutlines”) of the proposed excavations ~~in shallow soils (0 to 10 feet bgs)~~. The cutlines were developed in accordance with NDEP direction as described below:



- The depths of the excavation polygons were ~~ere~~ determined by the depth to the non-contaminated (i.e. less than ~~BCLs or background~~the eComparison eCriteria) sample in the contaminated sampling locations; and
- The lateral limits of excavation for the Voronoi diagrams/Thiessen polygons were generated by determining the half-way point between defining contaminated sampling location(s) and adjacent non-contaminated sampling locations or adjacent contaminated sampling locations with a different depth of excavation determination.

The cutline identification also allowsed final risk assessment calculations to be prepared in parallel with the excavation of contaminated soils, further facilitating completion of remedial excavation by the end of 2010 as required by the NDEP Order dated December 14, 2009 (NDEP, 2009).

### 1.71.3 Data Evaluation

Chemical analyses of soil samples collected in RZ-D during the Phase A and B Investigations show that there are locations ~~within the upper 10 feet of soil~~ where dioxins/furans, hexachlorobenzene (HCB), other semi-volatile organic compounds (SVOCs), asbestos, metals, pesticides, and/or perchlorate exceed the ~~various BCL criteria~~Comparison Criteria. Remedial excavation areas for RZ-D have been developed using the Phase A and B soil analytical data supplemented by the pre-confirmation sampling. The excavation areas define portions of the site where soil exceeds ~~BCL or other comparison criteria~~the Comparison Criteria, as specified on Figure 1. Figure 1 shows the excavation area boundaries and the chemical data upon which they are based.

A CD containing the soil sample analytical data from borings advanced during the Soil Investigation Programs is included in Appendix A. Appendix A also contains a set of summary tables presenting the sampling data for those chemicals identified to be remediated in RZ-D: dioxins/furans, ~~hexachlorobenzene (HCB)~~, other ~~semi-volatile organic compounds (SVOCs)~~, asbestos, metals, pesticides, and/or perchlorate.

The Appendix A tables provide the following information:

- All data for all chemicals to be remediated for each soil boring in RZ-D (Table A). Cells highlighted in orange indicate soil concentrations for one or more of the constituents exceeding ~~defined the eComparison Criteria criteria~~ and soil will be excavated. These data will not be retained in the post-remediation health risk assessment (HRA). Cells highlighted in green indicate soil concentrations not exceeding ~~defined eComparison eCriteria~~. These data will be retained in the post-remediation HRA. Cells highlighted in





yellow indicate data still pending. Cells highlighted in purple indicate soil concentrations to remain above their respective cleanup criteria based on one of the following: (1) concentration of the chemical in soil is located ~~at depth at or~~ below a depth of 10 feet bgs ~~and no further remediation will occur as area will be backfilled to original grade and alternative insitu remediation methods are proposed to remediate the soil (soil flushing and/or bioremediation); excavations may be deepened for source removal or to reduce leaching potential as detailed in a future errata to this EP), or~~ (2) soil is located in an engineering and institutional control area and will be isolated from contact by an engineering control measure and will not be excavated until the facility use ceases; or 3) the exceedance of arsenic is below 10 feet bgs and does not exceed the deep background concentration.

- Separate tables are also provided for each RZ-excavation area (Tables A-1 through A-31) that include data from the defining (def) and bordering (bor) soil borings. These tables provide the post-confirmation data, as well as original data that will be used in the HRA following excavation.

There are two instances in which arsenic concentrations above 7.2 mg/kg are located at located at depth and are not proposed for excavation (RSAK8 at 12.3 mg/kg at 10 to 11.5 feet; and SA206 at 7.8 mg/kg and 13.4 mg/kg at 9 to 10.5 feet and 10 to 11.5 feet, respectively) and one instance in which a perchlorate concentration of 1,320 mg/kg is located at 10 to 11 feet bgs (SA72).

As noted above, fFor RZ-D, dioxins/furans, HCB, and asbestos concentrations will remain in some areas above BCI-Comparison Criteria as soil is located in engineering and institutional control areas such as the trade effluent pond berms and buffer strips. and these areas will have Tronox proposes to construct engineering controls including an asphalt-based cap in these areas (See Section 22.1.1). Tronox--proposed engineering and institutional control areas and/or any controls on limitations on excavation have not yet been approved by NDEP. Additionally, there are locations in which dioxin and HCB are located at depths greater than 10 feet bgs and no further remediation will occur as the area will be backfilled to original grade. There are two instances in which arsenic concentrations above 7.2 mg/kg are located at 10 feet bgs to 11 feet bgs and will not be excavated (SSK7-02 at 9.2 mg/kg and RSAK8 at 12.3 mg/kg) and one instance in which a perchlorate concentration of 1320 mg/kg is located at 10 to 11 feet bgs (SA72).

In instances where chemicals are not risk drivers, but excavation is occurring due to other chemicals (i.e., SVOCs and metals that are not being remediated as concentrations are below their respective cleanup criteria), the existing data for those chemicals will be used in the risk assessment. For example, as shown in Appendix A tables, if an excavation is based on arsenic, the pre-confirmation data (green cell) for arsenic will replace the elevated arsenic concentrations (orange cells), but the existing data for the other remaining chemicals that are not above



eComparison eCriteria (highlighted in green) will be retained in the HRA. With regard to Beta-BHC and 4,4-DDE, if either one of these two constituents isare above the BCL, data for both will be replaced with pre-confirmation data as the entire suite of data is available. The same is true for asbestos in that if either amphiboles or chrysotile fibers exceed eComparison eCriteria, both data points will be replaced with confirmation data. Additionally, there are instances when all depths within a soil column are highlighted in orange even though there are some shallow results that are below the BCLComparison Criteria (i.e., excavation to 3 feet based on 2-3 feet bgs result when 1-2 feet bgs result does not exceed BCL)Comparison Criteria. Therefore, Appendix A tables will include instances in which some cells are highlighted orange even though the soil concentrations are below their respective comparison criteria.

Finally, in instances of excavation in which backfill will be used, it is anticipated that chemical concentrations representing backfill soil will be generated and all existing data within the backfill depth zone will be replaced with representative backfill concentrations. The representative backfill concentrations will be discussed and agreed upon with NDEP prior to use in the HRA. As part of the RZ-D risk assessment, an evaluation of all validated data will be conducted to document soil concentrations removed from further evaluation due to soil removal activities and remaining chemical concentrations. The risk assessment will discuss the sufficiency of the data to identify the Chemicals of Potential Concern (COPCs) and select an Exposure Point Concentration (EPC) for the exposure scenarios evaluated in the HRA. The EPC for use in the risk assessment is likely to be the maximum COPC concentration within the entire RZ area (i.e., RZs -B, -C and -D) following polygon excavations. In some instances, a 95 % upper confidence limit may be used to evaluate an in which sufficient vertical and lateral data have been collected.

As pending data become available, errata to this report will be prepared presenting the data and any changes in excavation areas or depths of excavations.

#### **1.81.4 RZ-D Site Conditions**

RZ-D is a four-sided polygon in shape, with the long axis running roughly east-/west. The southern boundary of RZ-D is the northern side of the Beta Ditch, as shown on Figure 1. In general the land surface in RZ-D slopes northward at a gradient of approximately 0.023 feet per foot. However, Northgate understands that the soil used to construct the embankments for the ponds was generated by excavation of soil from the northern portion of RZ-D. Therefore, the ground slope is steeper in this area. The developed portions of RZ-D have also been modified by grading to accommodate plant facility buildings, access roads, and other features.



The Site is crossed by asphaltic concrete roads and dirt roads. A network of active and inactive underground utility lines is present under the roads and some open areas at the Site. Figure 2 presents the approximate locations and types of utilities that are present in RZ-D, and it represents the summation of the information provided by Tronox on known utility lines. The locations of the lines have been field-checked by Northgate where surface expressions of the utilities are present. It is likely that unknown utilities, both active and inactive, also exist on the Site and may be encountered during remediation. Field procedures to address the possibility of encountering unknown utilities will be included in the contractor plans and specifications. It is Northgate's and Tronox's intent that the contractor be responsible for locating, avoiding, and protecting underground and aboveground utilities during remedial activities.



## 2.0 SCOPE OF WORK

The remediation program at RZ-D will consist of soil excavation and off-Site disposal. The proposed excavation areas were generated using information gathered during the Soil Investigation Programs, a conceptual site model (CSM) review, and a field check of the existing Site conditions.

Based on NDEP guidance and the results of the Soil Investigation Programs, Tronox will excavate contaminated soil to the excavation boundaries and depths shown on Figure 1 and presented in Table 1, with ~~a~~ several exceptions as discussed in this section. Table 1 also shows the chemical group(s) driving the target excavation depths for each excavation area. Table 2 is being presented to further detail the contaminated sampling locations, adjacent sampling locations, and exceptions used to define the excavation areas. Table 2 was originally prepared by NDEP and was modified slightly by Northgate/Tronox Tronox to reflect minor changes in a few excavation depths based on the confirmation data. Tronox utilized the NDEP numbering of excavation areas for consistency. Justifications for ~~to~~ changes to the table are provided in the ~~the~~ Table 2 for NDEP review.

Excavated soil will be transported for permanent off-Site disposal at the Republic Landfill in Apex, Nevada or other approved landfills in accordance with sampling results and landfill acceptance criteria.

All work conducted as part of this EP will be performed in accordance with the following plans:

- Dust Mitigation Plan and Clark County Dust Permit (to be submitted by the Remediation Contractor);
- *Perimeter Air Monitoring Plan* (PAMP; Approved by NDEP on May 12, 2010);
- *Stormwater Pollution Prevention Plan* (Approved by NDEP on May 12, 2010) ;
- Contractor's Site-Specific Health and Safety Plan (HSP; to be submitted by the Remediation Contractor); and
- *Transportation Plan* (Approved by NDEP on May 12, 2010).

These plans are part of the RAW (Northgate, 2010a), with the exception of the contractor's Dust Mitigation Plan, Clark County Dust Permit, and ~~the~~ Site-Specific Health and Safety Plan.



## **2.1 Excavation Boundary Constraints**

### **2.1 Excavation Boundary Constraints**

RZ-D ~~contains~~ ~~has been subdivided into~~ 300 main excavation areas, some of which have been subdivided, for a total of ~~32~~ 4446 excavation areas identified as RZ-D-01A through RZ-D-31 and ~~RZ-D-1A~~, as listed in Table 1 and shown on Figure 1. ~~Several of the areas are subdivided.~~ Many of the excavation areas identified for RZ-D are constrained by various site features. This section describes in detail, on an excavation area-specific basis, the constraints for the proposed excavations. These constraints are also listed in Table 1 under “Excavation Boundary Modifications,” and in Table 2 as “Exceptions.”

#### **2.1.1 Buffer Strip for Ponds GW-11, ~~and~~ WC-West, and WC-East**

A ~~5035-~~ to 40-foot wide buffer strip has been proposed by Tronox based on a geotechnical engineering analysis of the stability of the embankments around active Ponds GW-11, WC-West and WC-East. The purpose of the buffer strip is to protect the ponds currently in use by Tronox from potential slope instability potentially caused by undercutting the toe of embankments. The proposed buffer strip extends from the toe ~~of slope of the existing embankments to the top-of-~~ slope of proposed cut slopes. ~~of the exterior slopes to 50 feet outside the toe of slope; see-~~ The proposed buffer strip has not yet been approved by NDEP. NDEP has directed Tronox to show the excavation areas ending at the existing toe of the embankment. Although Tronox has complied with this directive, Tronox intends to provide a buffer strip to protect the embankments from slope failure for reasons of maintaining Tronox operations and for worker and the public safety. It is Tronox’s intent to come to agreement with NDEP regarding the details of the buffer strip. Figure 1 for location of the proposed engineering and institutional control area including the buffer strips. The purpose of the buffer strip is to protect the ponds currently in use by Tronox from slope instability potentially caused by undercutting the toe of embankments. The toe of slope of excavation areas abutting the buffer strip will coincide with the buffer strip boundary. Buffer strips are discussed further in Section 4, Institutional and Engineering ~~and Institutional~~ Controls. The engineering controls described in Section 4 will be constructed in accordance with the Project Plans and Specifications at the end of the remediation phase of work in RZ-D. A report presenting the findings of the geotechnical analysis is being prepared by Tronox and will be submitted as a stand-alone report.

#### **2.1.2 Property Lines**

~~Five~~ Some of the proposed excavations are constrained by the Tronox Site property lines. Because soil sampling has only been performed in areas owned by Tronox, no data exists in adjacent areas. Prior to excavation, confirmation samples at the limits of the proposed excavation



areas that border the property line will be collected at a minimum of one sample per property line boundary excavation or one sample per 150 lineal feet, whichever is greater. Samples will be collected near the proposed excavation sidewall at a height coinciding with the maximum concentration in the nearest sample. Samples will be analyzed for the chemical(s) driving the excavation in the vicinity of the boring as shown in Table 1 and the chemical drivers from adjacent borings. Chemical drivers include any chemical greater than or equal to the eComparison levelsCriteria established for this Site.~~chemical(s) driving the excavation as shown in Table 1.~~

### 2.1.3 Trade Effluent Pond Berms

~~Seven of the~~Currently none of the proposed excavation areas are constrained by the ~~abut~~ the former Trade Effluent Pond berms. An additional boring is being drilled and sampled in the ~~in~~ the northeast corner and in the north-east corner of RZ-D (RZ-D-01, RZ-D-02, RZ-D-03 through RZ-D-05, RZ-D-23, and RZ-D-24) of the Site to further refine the excavation area limits for RZ-D-23A. Tronox would like to retain the former Trade Effluent Pond berm in this area if possible for storm water retention. In these locations, the limits of the excavation have been shown at the toe of slope. Pre-confirmation sampling indicate that the berms are clean (analytical results from soil samples collected are below BCLs) to the depth of sampling; however, no sampling has been done in the deep portion of the berms or below the berms. Tronox proposes that the berm soil in the northwest corner of the Site ~~will~~ be used as backfill, provided it is clean and suitable for reuse and will perform additional sampling in ~~those~~ these areas not previously sampled to verify that the deeper berm soil and the soil below the berms meets the cleanup-Comparison eCriteria.

### 2.1.4 Railroad Embankments

Proposed Excavation areas RZ-D-11A, RZ-D-13 and RZ-D-14 include the inactive curving rail alignment in the southwest portion of RZ-D. This inactive portion of tracks and appurtenant subsurface soil and ballast material will be removed in proposed excavation areas, as shown on Figure 1.

### 2.1.5 Asphalt Pavement

Currently there are no pavement areas that are limiting excavations areas.

~~Excavation areas RZ-D-30 and RZ-D-31 are separated by 9th Street. Tronox is not proposing to remove 9th Street in this area. Ninth Street is heavily used and is one of the oldest historic roads on the Project Site. It is Tronox's opinion that this historic pavement area preceded the event(s) that resulted in asbestos contamination. In addition, the thickness of the pavement section~~



(asphalt concrete and aggregate base at least 1-foot in thickness) is equal to or exceeds the proposed 0.5-foot thickness of soil requiring removal. ~~Currently there are no pavement areas that are limiting excavations areas.~~

#### **2.1.52.1.6 Veolia Facilities**

The Veolia facility is in operation 24 hours-per-day, 7 days a week treating contaminated groundwater and cannot be taken off-line for extended periods of time. Proposed excavation area RZ-D-26 has been truncated to the north ~~west~~ by the presence of the Veolia facilities. The contamination in this area appears to be relatively shallow, approximately 0.5 feet. Excavation will be performed as close to the facilities as is possible and is considered structurally sound by Tronox's engineers. ~~Figure 1 depicts the planned excavation limits for RZ-D-26. In the north central portion of RZ-D, Excavation Areas RZ-D-15 and RZ-D-18 are truncated to the west by the Veolia equalization tanks and other equipment pads. As described above and in Section 3.3 of this excavation plan, the excavation will be performed as close to the facilities as is possible and measures will be taken to maximize the amount of soil removed. Figure 1 depicts the planned excavation limits for RZ-D-26, RZ-D-15, and RZ-D-18.~~

#### **2.1.62.1.7 Infiltration Trenches**

The excavation areas ~~north in the area~~ of the infiltrations trenches (RZ-D-16-17A, -17B, -19, and -21 ~~and RZ-D-19 through RZ-D-21~~) ~~have been partially truncated to avoid impacting the trenches.~~ ~~ares shown to cross over the infiltration trenches. These excavations will be performed in accordance with an NDEP--approved memorandum.~~ The trenches are used to infiltrate clean Lake Mead water to replace the contaminated groundwater that is extracted south of the soil bentonite barrier wall.

#### **2.1.8 Field Observations**

~~The analytical data, although limited, for soil between and south of the trenches suggest that the soil meets the cleanup goals. Tronox is proposing to verify these conditions by collecting additional samples between the trenches at the locations shown on Figure 1 as purple hexagons.~~

##### *Field Observations*

The eastern boundaries of excavation areas RZ-D-~~06 06 and 07~~ ~~have~~ ~~has~~ been established based on based on topographic maps and visual field observations of the limits of contaminated historic fills. The observations suggest that fill materials were the source of the contamination. Therefore, the limits of the fill were selected as the limits of excavation. ~~Two~~ ~~An~~ additional soil



~~borings or boring is~~ proposed at the estimated eastern limits of RZ-D- ~~06 06 and RZ-D-07~~ to verify the extent of the excavations.

### **2.1.72.1.9 Utility Lines**

Currently, no excavation boundary modifications are proposed for existing utilities except for a limited restriction around the high-voltage power line foundations in the areas of RZ-D-01~~2~~, RZ-D-3, ~~and and RZ-D-12-02~~. However, as shown on Figure 2, a number of overhead and buried utilities are present in proposed excavation areas. It is Tronox's intent to meet with NDEP to discuss any known areas where excavation extent and depth may be altered from the plan due to interference with utility lines as soon as they are identified. ~~excavate to the boundaries and depths shown on Figure 1.~~ As the work proceeds, depending on the location and depth of active utilities, it may become necessary to keep some existing soil in place for support of utilities that cannot be moved or temporarily taken out of service. If and when these situations arise, Tronox will contact NDEP to discuss the situation and proposed measures.

## **2.2 Depth Constraints Driven by Arsenic**

A number of the proposed excavation areas are driven by arsenic. Based on NDEP input, Tronox has adjusted the proposed excavation areas to remove soil within ~~10~~<sup>ten</sup> feet of the ground surface where concentrations of arsenic exceed the background concentration of 7.2 mg/kg. ~~A previous issue centered on RZ-D-24 (now RZ-D-25). As requested by NDEP, the proposed excavation of RZ-D-25 is now 1 foot bgs.~~





## **3.0 REMEDIATION**

[The following sections describe the proposed remediation tasks at the Tronox Site.](#)

### **2.33.1 Work Area Preparation**

This section describes the preparation activities that will be performed prior to excavating and transporting soil from RZ-D excavation areas. As described in the RAW, the following remediation support features will be established/constructed prior to performing soil excavation activities, as delineated in Figure 5 of the RAW:

- Access routes for authorized visitor and contractor Site ingress and egress;
- Haul roads to the public access roads;
- Clearing and disposal of vegetation in excavation areas, access and haul roads;
- Dust-control water source(s);
- Visitor area;
- Management/engineering trailers;
- Parking areas for workers, vehicles, and heavy equipment;
- Debris storage area; and
- Vehicular and personnel decontamination areas.

Portions of RZ-D contain excess soil materials and debris. Prior to beginning soil excavation in the excavation areas, debris will be sampled in place and tested for contaminants. A Sampling and Analysis Plan will be prepared and submitted to NDEP for approval that will present Tronox's proposed procedures to sample the debris. Based on test results, the debris will either be left on site or disposed of at an appropriate landfill. Uncontaminated debris may be moved from the work area and disposed or stockpiled in non-working areas. It is also possible that this uncontaminated debris may be recycled and used as fill.

Remnants of asbestos pipe insulation were observed on the ground surface in a number of locations in the northwestern corner of RZ-D. A portion of asbestos-wrapped pipe, still buried, was observed in the north-south trending Trade Effluent Pond embankment between the GW-11 pond and the western property line. Site preparation in this area will require that the insulation remnants be removed from the ground surface prior to remedial excavation. Northgate expects that the north-south berm will also be excavated and the soil reused, provided analytical testing shows the materials are suitable. When the berm is removed, an asbestos removal contractor will be retained to remove the asbestos-wrapped pipe.



### 2.43.2 Well Abandonment

Eighty-five-nine active wells are located within RZ-D, as shown approximately on Figure 3. Based on the location of planned excavation areas, 1718 of ~~the~~ ~~them~~ wells (AA-MW-16, I-C, M-70, M-83, M-22A, M-84, M-85, M-86, M-87, M-88, M-18, M-74, M-132, M-133, M-37, I-A-R, and I-K) ~~will~~ ~~are~~ ~~in~~ ~~excavation~~ ~~areas~~ ~~and~~ ~~may~~ be impacted during remediation activities. ~~Eight~~ ~~Ten~~ of these wells ~~are~~ ~~in~~ ~~areas~~ ~~where~~ ~~excavations~~ ~~depths~~ ~~are~~ ~~expected~~ ~~to~~ ~~be~~ ~~less~~ ~~than~~ ~~2~~ ~~feet~~. Tronox ~~does~~ ~~not~~ ~~expect~~ ~~that~~ ~~these~~ ~~wells~~ ~~will~~ ~~need~~ ~~to~~ ~~be~~ ~~removed~~. ~~Three~~ ~~of~~ ~~the~~ ~~wells~~ ~~are~~ ~~in~~ ~~an~~ ~~area~~ ~~where~~ ~~excavation~~ ~~is~~ ~~planned~~ ~~for~~ ~~a~~ ~~depth~~ ~~of~~ ~~10~~ ~~feet~~. Tronox ~~will~~ ~~discuss~~ ~~the~~ ~~disposition~~ ~~of~~ ~~these~~ ~~wells~~ ~~with~~ ~~NDEP~~ ~~prior~~ ~~to~~ ~~excavation~~ ~~to~~ ~~determine~~ ~~if~~ ~~specific~~ ~~wells~~ ~~will~~ ~~require~~ ~~replacement~~ ~~or~~ ~~if~~ ~~sufficient~~ ~~coverage~~ ~~exists~~ ~~such~~ ~~that~~ ~~replacement~~ ~~is~~ ~~not~~ ~~required~~. ~~(I-A-R, I-C, I-K, M-22A, M-37, M-74, M-83, M-132, M-133, and MW-16)~~ ~~are~~ ~~recommended~~ ~~for~~ ~~maintaining~~ ~~and~~ ~~protecting~~. ~~If~~ ~~replacement~~ ~~is~~ ~~required~~, ~~†~~ These wells could be protected during excavation and backfilling by marking and placing barricades and caution tape, ~~and~~ ~~hand~~ ~~(or~~ ~~using~~ ~~of~~ ~~small~~ ~~equipment~~ ~~for)~~ ~~excavating~~ ~~on~~, or they could be properly abandoned prior to excavation. If wells become damaged beyond repair, they will be properly abandoned ~~and~~ ~~if~~ ~~replacement~~ ~~is~~ ~~required~~, ~~and~~ similar wells will be reinstalled after the remediation work is completed. ~~Six~~ ~~Seven~~ wells (M-18, M-84, M-85, M-86, M-87, M-88, and M-102 ~~are~~ ~~recommended~~ ~~for~~ ~~a~~ ~~Abandonment~~. Well abandonment procedures will be performed in accordance with Nevada Division of Water Resources (NDWR) requirements.

### 2.53.3 Excavation

This section describes the excavation of contaminated soil from RZ-D. The excavation areas are shown on Figures 1 through 3, with areas impacted by asbestos shown in blue and the remainder of excavation areas shaded in tan. The target depths of excavation areas are shown on Figure 1 and summarized in Table 1.

In general, the cutlines represent the lateral limit of the bottom of the excavation area. The limits and depths selected for the excavation areas are based on the soil data collected and the ~~NDEP~~ ~~worker~~ ~~BCLs~~, ~~background~~ ~~for~~ ~~arsenic~~, ~~and~~ ~~risk~~ ~~based~~ ~~cleanup~~ ~~goals~~ Comparison Criteria. The criteria used for the selection is presented in Table 2.

The excavations will generally be sloped or benched outward and upward from the cutline at a slope of 1:1 slope (horizontal to vertical). ~~In~~ ~~cases~~ ~~where~~ ~~the~~ ~~excavation~~ ~~abuts~~ ~~a~~ ~~structure~~, ~~feature~~ ~~or~~ ~~property~~ ~~line~~ ~~that~~ ~~cannot~~ ~~be~~ ~~removed~~, ~~the~~ ~~cutline~~ ~~represents~~ ~~the~~ ~~top~~ ~~of~~ ~~slope~~. Temporary fencing will be placed along the perimeter of excavations 5 feet or more in depth and in areas where the excavations represent a potential traffic or safety hazard. If excavations are to be left



un-backfilled, the side slopes will be flattened to 3:1 (horizontal to vertical). During construction, portions of the excavation sidewalls may also be flattened or the excavation partially backfilled to facilitate vehicle traffic or soil handling activities.

If a proposed excavation abuts a structure that has a basement or buried foundation as deep as or deeper than the proposed excavation, the excavation will be dug to the full depth at the obstruction boundary. NDEP has requested that steps be taken to minimize the amount of contaminated soil left behind against obstructions and property lines (Obstructions). In order to accomplish this objective, Tronox proposes to attempt to excavate against obstructions in relatively narrow slots perpendicular to the obstruction/property line. Slots would be excavated as steep as possible and be backfilled immediately upon removal of the contaminated soil. Workers would not be allowed in the slots until the excavation height reaches a safe level. The intent is to maintain support for the obstructions and at the same time protect workers.

At locations where excavation areas abut each other, the deeper excavation will be excavated to the full depth to the limits shown on the plan figure then sloped upward at 1:1 horizontal to vertical toward the shallower excavation to avoid leaving any contaminated soil, (See Figure 4 for a typical cross-section illustrating this condition).

The target excavation depths may be revised based on visual staining, ~~vapor~~~~odor~~-s-monitoring instrumentation readings or other indications. Depths may also be modified in the field as utilities and other buried structures are encountered. Northgate will obtain NDEP approval of any changes to the excavation depths shown in Table 1 and Figure 1 as field work progresses and if special cases are encountered.

It is anticipated that excavations deeper than 1 foot will be performed with heavy earth-moving excavators. Excavations less than 1 foot deep will be performed either with an excavator or motor grader (blade). The contractor may elect to stockpile soil in the excavation area or may load the soil directly into trucks for off-Site disposal.

A pipe rack utility corridor trends north and south and is located along the northern extension of 9<sup>th</sup> Street (see Figure 2). The corridor passes through an excavation area before reaching the WC-East Pond area. The pipe corridor is elevated in this location. ~~The An~~ excavation is planned for a depth of 10 feet in this area, and Northgate anticipates that the excavation can be performed in the in this area areas planned. The pipe rack will need to be supported during the excavation. This could be accomplished through underpinning or replacing the existing piers (by carrying loads to soil below the excavation depth) or the pipe could be rerouted temporarily around the work area. Tronox will determine the best method to address the pipe rack and will describe the method in plans and specifications for RZ-D remediation.



#### **2.63.4 Post-Excavation Backfilling**

Tronox will backfill some of the excavations in RZ-D with clean material. Backfill will be required to maintain vehicle access in excavation areas where roadways exist. Tronox also intends to backfill all excavations that are 10 feet or more in depth. The areas proposed for backfilling and the extent of the proposed backfill is summarized in Table 1. If backfilling to the previous surface grades is not proposed, Tronox will discuss these areas with NDEP.

Backfilling will be performed by the contractor in accordance with the remediation plans and specifications. Backfill materials will be tested by Northgate for geotechnical engineering and environmental compliance requirements. Test results will be provided to NDEP before the material is accepted for use in backfilling. It is anticipated that imported soil backfill borrow sources will be from ~~clean areas on the project Site. "Clean areas" are defined as areas with soil concentrations meeting the NDEP worker BCLs, background for arsenic and modified risk based cleanup goals for dioxins/furans, off-site quarry areas. In addition, other off-Site sources are being investigated.~~

Analytical test results indicate that the existing upper portion of the north-south Trade Effluent Pond berm in the north-west corner of RZ-D is soil meeting the ~~BCLs and other e~~Comparison eCriteria and is suitable for use as backfill. Further testing of the lower portion of the berm is currently underway. Tronox plans to utilize the clean soils from the berm for backfill of the ~~When the remediation contractor excavates the hazardous waste landfill area, the berm material could be placed and compacted in the landfill area and minimize hauling distances.~~

#### **2.73.5 Air Monitoring**

Air monitoring will be performed for fugitive dust emissions, chemicals of concern and volatile chemical emissions in accordance with the PAMP (Appendix B of the RAW) and the Contractor's HSP. The RZ-D specific ~~list~~lists of constituents that will be monitored are presented in Table 1 of the PAMP. Because of the relatively small size of the excavation area in comparison to the overall Site, it is Northgate's opinion that perimeter monitoring at the edges of individual excavation areas is not necessary to demonstrate that the dust control measures are adequate. Tronox proposes to perform the perimeter air monitoring at the Site perimeter as described in the PAMP. In addition, particulate matter with a diameter of 10 micrometers or less (PM10) real-time monitoring will be performed on selected workers in the work area. Perimeter and worker air monitoring will be used to evaluate the effectiveness of dust control measures in mitigating emissions. If emissions exceed the action levels outlined in the PAMP, actions will be taken to bring the emissions into conformance with the plan. Mitigation actions include



additional soil wetting, covering exposed soil stockpiles, use of dust palliatives, ceasing operations if the wind velocity exceeds the value set in the PAMP, and ceasing operations until effective measures are implemented.



### 3.04.0 INSTITUTIONAL AND ENGINEERING CONTROLS

It is Tronox's intent to excavate contaminated soils in RZ-D excavation areas to the lateral extent and ~~to the~~ depths ~~provided~~ described in Table 1 and shown on Figure 1. Currently there are 19 ~~two location~~ excavation areas where institutional or engineering controls are proposed within RZ-D. These areas are shown on the figures and include:

- The embankments, pond areas, and the areas of the buffer strips around Ponds GW-11, WC-West and WC-East, ~~and~~
- The Veolia groundwater treatment building and facilities; and
- The Veolia equalizations tanks and equipment area.-

Analytical data collected from soils in the pond embankment around GW-11, WC-West, WC-East and the buffer zone areas indicate that there is some contaminated soil in these areas. However, the ponds and embankments are in an integral part of the operating Tronox and Veolia facilities and cannot be removed and remediated at this time. Additionally, a buffer zone is needed to allow the planned remedial excavations to remove contaminated soil from the areas near the ponds and maintain embankment stability. In order to protect Tronox workers, Site visitors and the public, engineering controls are proposed for the exposed-soil portions of embankments (there are portions of the embankments that are covered with an existing membrane liner which currently serves as an engineering control) and the buffer strip. The proposed engineering controls will be an asphaltic-based cover: either asphalt concrete pavement and an aggregate base layer or a double chip seal layer over aggregate base, or equivalent. These covers should be capable of sustaining light truck traffic without damage and should provide a reasonably long life with a low level of required maintenance.

The Veolia water treatment building and facilities are located in two areas of RZ-D. The main water treatment area is in the central portion of RZ-D just north of RZ-D-26. Another facility (the equalization tank area) is located in the area east of GW-11 Pond and west of RZ-D-15 and RZ-D-18. The building and facilities operate 24 hours a day treating recovered groundwater for perchlorate and hexavalent chromium. The building and facilities cannot be taken off line for extensive periods of time; therefore, remediation of soil beneath the building or the operating facilities is unfeasible at this time. The proposed RZ-D-26 excavation area has been extended to the north and is now adjacent to the building and facilities. The impacted area in the vicinity of the facility will be excavated to a depth of 0.5 ft bgs, as shown on Figure 1. A confirmation sample will be collected next to the facility to assess if asbestos-contaminated soil is adjacent to the building and facilities. The proposed excavations for RZ-D-15 and RZ-D-18 will be



extended as far west as possible to excavate the maximum amount of soil without detrimental impact to the facilities.

If a decision is made to ~~institute~~implement institutional or engineering controls, the procedures will be in accordance with *Revised Environmental Covenants, Institutional and Engineering Control Plan* submitted by Tronox on June 9, 2010 and delivered on June 10, 2010 for NDEP review and comment.



#### 4.05.0 REFERENCES

~~AECOM, 2009. *Quality Assurance Project Plan, Tronox LLC Facility, Henderson, Nevada.* May 2009.~~

~~AECOM, 2008. *Revised Phase B Site Investigation Work Plan, Text, Tables and Figures. Tronox LLC Facility. Henderson, Nevada.* December 2008.~~

AECOM and Northgate Environmental Management, Inc., 2009. *Quality Assurance Project Plan, Tronox LLC Facility, Henderson, Nevada.* Revised June 18, 2009.

~~Basic Environmental Company, 2008. *Removal Action Work Plan for Soil, Tronox Parcels “C”, “D”, “F”, “G”, and “H” Sites, Henderson, Nevada.* July 1, 2008.~~

Basic Remediation Company (BRC), 2009a. *BRC Standard Operating Procedure (SOP) 06. Sample Management and Shipping.* Revision 4. December 2009.

BRC, 2009b. *BRC Standard Operating Procedure (SOP) 07, Soil Sampling.* Revision 4. December 2009.

BRC, 2009c. *BRC Standard Operating Procedure (SOP) 12. Asbestos Soil Sampling.* Revision 4. December 2009.

BRC, 2009d. *BRC Standard Operating Procedure (SOP) 14. Field Documentation.* Revision 4. December 2009.

BRC, 2009e. *BRC Standard Operating Procedure (SOP) 17. Soil Logging.* Revision 4. December 2009.

BRC, 2009f. *BRC Standard Operating Procedure (SOP) 19. Borehole Abandonment.* Revision 4. December 2009.

BRC, 2009g. *BRC Standard Operating Procedure (SOP) 23. Split Spoon Sampling.* Revision 4. December 2009.

BRC, 2009h. *BRC Standard Operating Procedure (SOP) 31. Equipment Drilling Decon.* Revision 4. December 2009.

BRC, 2009i. *BRC Standard Operating Procedure (SOP) 34. Investigative Derived Waste (IDW) Management.* Revision 4. December 2009.

BRC, 2009j. *BRC Standard Operating Procedure (SOP) 42. Soil Sampling by Geoprobe™ Methods.* Revision 4. December 2009.





~~Northgate Environmental Management, Inc. (Northgate), 2010a. *Removal Action Work Plan for Phase B Soil Remediation of Remediation Zones RZ-B through RZ-E, Tronox LLC, Henderson, Nevada.* May 4, 2010.~~

~~ENSR Corporation (ENSR), 2005, *Conceptual Site Model, Kerr-McGee Facility.* Henderson, Nevada. February 2005~~

~~ENSR, 2006. *Phase A Site Source Area Investigation Work Plan.* Tronox LLC Facility. Henderson, Nevada. September 2006.~~

~~ENSR, 2008. *Phase B Site Source Area Investigation Work Plan.* Tronox LLC Facility. Henderson, Nevada. December 2008.~~

~~Nevada Division of Environmental Protection (NDEP), *1 Phase II Letter of Understanding between NDEP and Kerr McGee,* August 15, 1994.~~

~~North American Vertical Datum of 1988 (NAV 88). Established in 1991 to replace the National Geodetic Vertical Datum of 1929 (NGVD 29).~~

~~Northgate Environmental Management, Inc. (Northgate), 2010<sub>ba</sub>. *Health Risk Assessment Work Plan, Tronox Facility, Henderson, Nevada.* March 2010.~~

~~Northgate, 2010b. *Revised Pre-Confirmation Sampling Work Plan, Remediation Zones RZ-A through RZ-E, Phase B Investigation, Tronox Facility, Henderson, Nevada.* March 2010.~~

~~Northgate, 2010c. *Removal Action Work Plan for Phase B Soil Remediation of Remediation Zones RZ-B through RZ-E, Tronox LLC, Henderson, Nevada.* May 4, 2010.~~

~~United States Department of Labor, Occupational Health & Safety Administration (OSHA). CFR Part 1926, Safety & Health for Construction.~~





**APPENDIX A  
RZ-D ANALYTICAL DATA**

**Remediated Soil Data  
Tables A-1 through A-46**

**Analytical Data  
(Provided on CD)**

