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Work-in-Progress

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

June 21, 2010

Prepared For:

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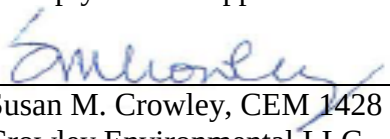
Responsible Certified Environmental Manager (CEM) for this project

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

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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) 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).

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. For purposes of the EP and designation of potential remediation areas, "contaminated soil" is generally defined as soil containing chemicals of potential concern at concentrations exceeding NDEP worker Basic Comparison Levels (BCLs), or modified risk-based goals agreed upon by NDEP. For metals with background concentrations exceeding BCLs (e.g., arsenic), "contaminated soil" is defined as concentrations that exceed the background for the RZ as a whole. There are no NDEP BCLs for asbestos. Therefore, asbestos-related "contaminated soil" is defined as one or more long fibers (amphibole) and/or five or more long fibers (chrysotile). The final soil cleanup goals will achieve a cumulative theoretical upper-bound incremental carcinogen risk level point of departure of 1×10^{-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.

1.1 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 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 existing groundwater treatment holding pond areas, including GW-11 and WC-West and WC-East (see Figure 1). Several buildings are present in RZ-D, including Veolia facilities that are used for groundwater treatment and several older storage buildings. A historical hazardous waste landfill is present in the northwest corner of RZ-D. Other features include the 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.

1.2 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 cutline identification also allowed 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).

Chemical analyses of soil samples collected in RZ-D during the Phase A and B Investigations showed that there are locations within the upper 10 feet of soil where dioxin, hexachlorobenzene (HCB), other semi-volatile organic compounds (SVOCs), asbestos, metals, pesticides, and/or perchlorate exceed the various BCL criteria. Remedial excavation areas for RZ-D have been developed using the data generated from Phase A and B soil investigations, the Area I and II supplemental soil sampling, and the pre-confirmation sampling (herein referred to as Soil Investigation Programs). The excavation areas define portions of land with BCL exceedances or other criteria, as specified on Figure 1. Excavation area boundaries and the chemical data upon which they are based are also shown on Figure 1.

The analytical data for the samples collected from the Soil Investigation Programs are included in a CD as part of Appendix A. The CD contains a set of summary tables of the above-described information segregated by analytical method. In addition, five additional chemical data tables are presented in Appendix tables A-1 through A-5. These tables present the sampling data for those chemicals identified to be remediated in RZ-D (arsenic, perchlorate, dioxin/furans, Polynuclear aromatic hydrocarbons [PAHs], and HCB). Although asbestos will be remediated, it is not included at this time, as electronic data deliverables are still pending. The Appendix data highlighted in yellow are soil concentrations that will be eliminated from risk evaluation based

on soil removal. As part of the RZ-D risk assessment, a complete evaluation of all validated data for all chemicals will be conducted to document soil concentrations removed from further evaluation due to soil removal activities. Northgate has not yet received all of the step-out data and asbestos data from the pre-confirmation sampling program. When these data become available, errata to this report will be prepared presenting the data and any changes in excavation areas or depths of excavations.

1.3 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 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 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 3 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. 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;
- Perimeter Air Monitoring plan;
- Stormwater Pollution Prevention Plan;
- Contractor's Site Specific Health and Safety Plan (HSP); and
- Transportation Plan

These plans are part of the RAW (Northgate, 2010), with the exception of the contractor's Site Specific Health and Safety Plan.

2.1 Excavation Boundary Constraints

RZ-D has been subdivided into 27 excavation areas identified as RZ-D-1 through RZ-D-27, as listed in Table 1 and shown on Figure 3. 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 Modification."

2.1.1 Buffer Strip Ponds GW-11 and WC-West and WC-East

A 50-foot wide buffer strip has been established around active Ponds GW-11, WC-West and WC-East. The buffer strip extends from the toe-of-slope of the exterior slopes to 50 feet outside the toe-of-slope; see 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 top-of-slope of excavation areas abutting the buffer strip will coincide with the buffer strip boundary. Buffer strips are discussed further in Section 4, 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.

2.1.2 Property Lines

Four of the proposed excavation areas (RZ-D-1, RZ-D-6, RZ-D-7 and RZ-D-22) 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. 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 as shown in Table 1.

2.1.3 Trade Effluent Pond Berms

Five of the proposed excavation areas abut the former Trade Effluent Pond berms in the northeast corner and in the north east corner of RZ-D (RZ-D-01, RZ-D-03 through RZ-D-05, and RZ-D-21). 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 will be used as backfill provided it is clean and suitable for reuse and will perform additional sampling in those areas not previously sampled to verify that the deeper berm soil and the soil below the berms meets the cleanup criteria.

2.1.4 Railroad Embankments

Proposed Excavation areas RZ-D-13 and RZ-D-14 have been truncated slightly to avoid the curving rail alignment in the southwest portion of RZ-D. The subsurface soil preparation and placement of ballast below the tracks is considered to have removed the relatively shallow soil contamination, if present, at the time of railroad construction.

2.1.5 Asphalt Pavement

Excavation boundaries for proposed excavation areas RZ-D-23, RZ-D-26 and RZ-D-27 that are impacted with asbestos have been restricted to unpaved areas only. It is Tronox's opinion that the historic pavement areas preceded the event(s) that resulted in asbestos contamination. In addition, the thickness of the pavement section (asphalt concrete and aggregate base approximately 1-foot in thickness) are equal to or exceed the thickness of soil requiring removal. Because the elevation of the top of the pavement is approximately the same as the elevation of the adjacent unpaved soil surface, the impacted soil, if present during the time of pavement installation, would have been removed.

2.1.6 Veolia Facilities

Proposed excavation area RZ-D-23 has been truncated to the north by the presence of the Veolia facilities. The contamination in this area appears to be relatively shallow, approximately 0.5 feet. If the contamination did extend into the Veolia facility, it would have been removed to construct the facilities. Typical excavation depths for this type of construction typically exceed 3 feet below adjacent grade. In addition, 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.

2.1.7 Infiltration Trenches

The excavation areas north of the infiltrations trenches (RZ-D-6 through RZ-D-19) have been truncated to avoid impacting the trenches. 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. 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.

2.1.8 Field Observations

The eastern boundaries of excavation areas RZ-D- 06 and 07 have 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.

2.1.9 Utility Lines

Currently, no excavation boundary modifications are proposed for existing utilities. 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 excavate to the boundaries and depths shown on Figure 3. 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 and discuss the situation and proposed measures.

2.2 Depth Constraints Driven by Arsenic

Excavation area RZ-D-13 is driven by arsenic and the results of analytic testing on samples from boring RSAK8. The results indicate that there are two exceedances of arsenic at depths of 0.5 to 2 feet, concentration of 8.65 mg/kg and 10 to 11.5 feet, concentration of 12.3. The three additional samples within this range had concentrations of 4.1, 5 and 5.8. Northgate has evaluated two similar cases in RZ-B (with slightly higher concentrations) and presented our findings in a Memorandum entitled: *Relative Risk Reduction Associated with Arsenic Removal in RZ-B-9 and RZ-B-6 at the Tronox LLC Site, Henderson, Nevada*, dated June 21, 2010. The conclusions of that analysis also appear applicable to this location. Therefore the excavation area has been shown for clarity but 0.0 depth is proposed for excavation area RZ-D-22.

3.0 REMEDIATION

3.1 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 moved from the work area and disposed or stockpiled in non-working areas. Provided that the final product shows free of contaminates, it is also possible that this debris could 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-B. 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.

3.2 Well Abandonment

Eighty-five active wells are located within RZ-D, as shown approximately on Figure 4. Based on the location of planned excavation areas, eleven of the wells (AA-MW-16, M-14A, M-22A, M-84, M-85, M-86, M-87, M-74, M-132, M-133 and 1-K) will be impacted during remediation

activities. Eight 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. These wells could be protected during excavation and backfilling by marking and placing barricades and caution tape, or they could be properly abandoned prior to excavation. If wells become damaged beyond repair, they will be properly abandoned and similar wells will be reinstalled after the remediation work is completed in order to continue groundwater characterization and remediation activities, if appropriate. Well abandonment procedures will be performed in accordance with Nevada Division of Water Resources (NDWR) requirements.

3.3 Excavation

This section describes the excavation of contaminated soil from RZ-D. The excavation areas are shown on Figures 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 3 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. 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 2:1 (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.

The target excavation depths may be revised based on visual staining, odors 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 3 as field work progresses and if special cases are encountered.

It is anticipated the 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 9th 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 excavation is planned for a depth of 10 feet, and Northgate anticipates that the excavation can be performed in this area. The pipe rack will need to be supported during the excavation. This could be accomplished through underpinning 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.

3.4 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. Such 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. The test results will be provided to NDEP for approval before the material is accepted for use in backfilling. It is anticipated that soil backfill borrow sources will be from clean areas(s) 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.

Analytical test results indicate that the existing upper portion of the north-south Trade Effluent Pond berm in the north-west corner of RZ-B is clean soil and suitable for use as backfill. When the remediation contractor excavates the hazardous waste landfill, the berm material could be placed and compacted in the landfill area and minimize hauling.

The areas that Tronox anticipates will be backfilled are noted on Table 1.

3.5 Air Monitoring

Air monitoring will be performed for fugitive dust emissions, chemicals of concern and volatile chemical emissions in accordance with the *Perimeter Air Monitoring Plan* (PAMP; Appendix B of the RAW) and the Contractor's HSP. The RZ-D specific list 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, 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 in accordance with the PAMP 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.

4.0 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 described in Table 1 and shown on Figure 3. Currently there are two locations 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 and WC-West and WC-East; and
- The Veolia groundwater treatment building and facilities.

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 serve 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 in the central portion of RZ-D. 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 these areas is unfeasible at this time. Analytical soil testing in the building and facility area indicates that the near-surface soil in a portion of the area is contaminated with asbestos. It is also unlikely that any of the asbestos-containing soil is still present in the Veolia area. The area in question is currently paved with asphalt concrete; therefore, engineering controls are already in place.

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

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FIGURES

TABLE

APPENDIX A
RZ-D ANALYTICAL DATA

Remediated Soil Data
Tables A-1 through A-5

Analytical Data
(Provided on DVD)