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

November 3, 2010

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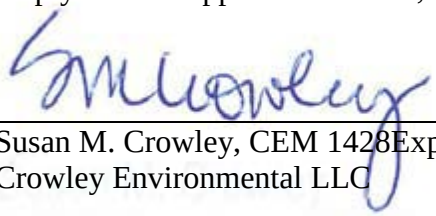
Responsible Certified Environmental Manager (CEM) for this project

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 1428Exp.: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 E (RZ-E) 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-E 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-E 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-E 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 (10 feet or less) 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 long fibers (chrysotile). Remediation is focused on removing impacted soils exceeding the above criteria (Comparison Criteria) for protection of human health and for source control. The final soil cleanup goals will achieve a cumulative theoretical upper-bound incremental carcinogen risk level point of departure of 1 x 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, errata to this report will be submitted to address this pathway.

1.1 Site Description

The Tronox Site is a portion of a larger historic complex that was first developed by the U.S. government in 1942 as a magnesium plant for World War II operations. The Tronox LLC active 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-E consists of an unlined historic conveyance ditch referred to as the Beta Ditch. The ditch extends roughly east-west across the entire Site, as shown on Figure 1. The Beta Ditch no longer serves as a waste conveyance ditch and is currently blocked by an earthen dam near the eastern end. Gravel filled bags were installed as part of the Stormwater Pollution Prevention Plan at the Tronox/Timet property boundary to minimize sediment movement off-Site during remedial activities. Complete descriptions of the Site, history of its use, and historical environmental investigations are presented in the RAW.

1.2 Background

The Beta Ditch was constructed at the same time as the magnesium plant (1941/1942). The original Beta Ditch terminated on the west end near the current Tronox AP Maintenance Shop (see Figure 1) and received various liquid and slurry wastes from historic property operations that flowed to the pond areas to the east of the Tronox property. In 1970, the ditch was extended westward to allow wastes from facilities to the west to be transmitted through the ditch.

Subsequent to 1976, effluent to the Beta Ditch was limited to stormwater runoff and non-contact cooling water. The Beta Ditch was the primary means to carry stormwater from the western property and from the Tronox Site through the Site until it was blocked near the east end in early 2010. Some limited stormwater continues to enter the Beta Ditch near the eastern end downstream of the blockage and flows onto the Timet Site. As noted above in Section 1.1, a gravel bag barrier is located at the property line.

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.

Tronox performed supplemental pre-confirmation sampling in the Beta Ditch along four transects to estimate the lateral extent of the contamination beyond the top-of-slope. The transect locations were selected based on the following criteria:

- Obtaining data throughout the length of the Beta Ditch;
- Sampling in a location where overflow may have occurred due to undefined bank slopes; and
- Placing transects through areas with known contamination (through existing borings with contamination).

The selected transect locations are shown on Figure 1 and the associated data for the excavation areas are presented in Table 1. Tronox also drilled four additional pre-confirmation borings in the main eastern ditch extension as shown on Figure 1. Tronox sampled for chemicals exceeding Comparison Criteria in the initial boring in the transect, as applicable, as well as chemicals with exceedances in adjacent areas.

Tronox has evaluated the chemical data and considered the conceptual site model (CSM) in developing the extent and depth of the excavation areas, as described below. Tronox proposes to vary the depths of the remediation as appropriate to reflect the depth of contamination at sampling locations. In selecting the depths, the areas were split a midpoints using the same procedures used for the remained of the Tronox facility excavation areas.. In the design of the lateral extent, the transect information was utilized to set the outer boundaries. In some instances, if the transect data were not considered applicable, the excavation area was carried to the RZ-E boundary. Boundaries between borings were divided at the midpoints. The width of the bottom of the excavation areas associated with the Beta Ditch is from the first transect sample on one side of the ditch to the first transect sample on the other side of the ditch (the width of the ditch plus 10 feet). A typical cross-section showing transect 2 is presented in Figure 1 for illustration and explanation of the plan view.

Adjacent excavation areas in RZ-C and D have been extended, as appropriate, into RZ-E in accordance with the polygon construction criteria until they are contiguous with the RZ-E excavation area boundaries, as shown in Figure 1. In addition, sampling locations with Comparison Criteria exceedances at or outside the top-of-bank were used to develop excavation areas in RZ-C and RZ-D as applicable.

The eastern-most ditch extension does not appear to be associated with historical facility operations nor is there any physical ditch present in the area. In addition, the sampling performed

indicates this ditch extension does not have exceedances of BCLs or other Comparison Criteria (see Figure 1, borings SA-92 and SA-158).

The excavation area boundary identification provides an opportunity for the 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-E during the Phase A and B Investigations showed that there are locations where dioxins/furans, semi-volatile organic compounds (SVOCs; hexachlorobenzene [HCB] and benzo[a]pyrene), asbestos, metals (arsenic, lead, magnesium, and manganese), pesticides (4,4-DDE, 4,4,-DDT, dieldrin, and alpha-BHC), perchlorate, and polychlorinated biphenyls (PCBs – Aroclor 1260), exceed the various Comparison Criteria. These are the constituents driving the excavation. Remedial excavation of RZ-E has 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 (hereafter referred to as Soil Investigation Programs). Chemical data, BCL exceedances, or other criteria, are shown on Figure 1 of this EP.

The analytical data for the samples collected from the Soil Investigation Programs are included in the Appendix A Table. The Table is a set of summary tables of the above-described information organized by sample number and constituents. The Appendix data highlighted in orange indicate soil concentrations for one or more of the highlighted constituents are above defined Comparison Criteria (see Target Remediation Concentrations table within Figure 1) and soil will be excavated. These data will not be retained in the post-remediation HRA. Data highlighted in green indicate soil concentrations not exceeding above-defined comparison criteria; however, there are some exceptions for arsenic and manganese based on CSM considerations. One data point, SA-129, highlighted in purple, indicates a soil perchlorate concentration above defined comparison criteria; however, that soil will not be excavated because it is deeper than the surrounding excavation and it will be remediated in situ using alternative remediation methods (e.g., soil flushing and bioremediation). As part of the RZ-E risk assessment, a complete evaluation of validated data for chemicals will be conducted to document soil concentrations removed from further evaluation due to soil removal activities.

1.3 RZ-E Site Conditions

The shape of RZ-E is defined by the historical path of the Beta Ditch, including ditch tributaries. The main part of RZ-E runs across the entire Site between the eastern and western property lines

(Figure 1). The southern boundary of RZ-E is the northern boundary of RZ-C, while the northern boundary of RZ-E is the southern boundary of RZ-D, as shown on Figure 1. In general, the land surface in RZ-E slopes east-northeast at a gradient of approximately 0.005 feet per foot.

There are seven road crossings of the Beta Ditch and one railroad crossing (not currently in use). The road crossings are earthen embankments underlain by metal culvert pipes.

Some underground and above-ground utilities cross RZ-E. Figure 2 presents the approximate locations and types of utilities that are present in RZ-E, as well as the summation of the information provided 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 in RZ-E 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 Tronox's intent that the contractor be responsible for locating, avoiding, and protecting underground and above-ground utilities during remediation.

Tronox is considering using the Beta Ditch as a feature in the final storm water control plan for the Site. As part of the plan, portions of the Beta Ditch will be at current grades; therefore, these areas will require backfill. The central portion of the Beta Ditch may be incorporated into a retention pond and would be at approximately the excavated grades.

2.0 SCOPE OF WORK

The remediation program at RZ-E will consist of soil excavation and off-Site disposal. The proposed excavation areas were generated using information gathered during the Soil Investigation Programs, a CSM review, and a field reconnaissance 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.

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 (submitted by the Remediation Contractor);
- Perimeter Air Monitoring Plan (PAMP; Approved by NDEP on May 12, 2010);
- Stormwater Pollution Prevention Plan (SWPPP; Approved by NDEP on May 12, 2010);
- Contractor's Site Specific Health and Safety Plan (HSP; submitted by the Remediation Contractor); and
- Transportation Plan (TP; Approved by NDEP on May 12, 2010).

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

3.0 EXCAVATION BOUNDARY CONSTRAINTS

The RZ-E footprint is defined by the extent of contamination as measured in the borings from the Soil Investigation Program. The transects were sampled every five feet beginning 5 feet from the top-of-slope to 20 feet from the top-of-slope, as shown on Figure 1. Some locations in RZ-E cannot be excavated because of physical and operational constraints. This section describes in detail the constraints for the proposed excavations in RZ-E.

3.1 Property Lines

At the eastern end, the excavation of RZ-E is constrained by the Tronox Site property line. On the west end, the proposed end of the remediation will be the headwall associated with the existing 4th Street where the culvert ends and the Beta Ditch begins. This location is near the property line. One confirmation sample was collected at the eastern end of RZ-E. A pre-confirmation sample could not be collected due to physical constraints at the western end of RZ-E. Tronox proposes to collect this sample at the time of remediation when the western end wall will be exposed. Samples will be collected near the proposed excavation end wall at a height coinciding with the maximum concentration in the nearest sample. Samples will be analyzed for the chemical(s) driving the excavation and the chemicals exceeding Comparison Criteria in adjacent excavation areas.

3.2 Utility Lines and Roads

Currently, no excavation boundary modifications are proposed for existing utilities or roads; however, as shown on Figure 2, a number of overhead and buried utilities are present in proposed excavation area. Existing utilities will be supported as necessary during excavation and until clean backfill is in place.

3.3 Equalization (BT) Tanks

Four tanks exist in the central portion of RZ-E adjacent to the southern boundary of RZ-E, as shown on Figure 1. Two of these tanks are currently in use by Veolia for their water treatment operations. These tanks are expected to continue to be in use for the foreseeable future. Special care will be used when excavating near these tanks and the tank containment area so as not to cause damage to the concrete walls, slabs, and foundations that support the tanks.

The plans indicate that the area is approximately 159 feet long and 82 feet wide. The tanks are contained within a depressed area with the edges supported by a concrete retaining wall approximately 4 feet high. The containment area is lined with a concrete slab approximately 6

inches thick underlain by 6 inches of Type II fill (imported). The total depth to native soil from the adjacent ground surface is approximately 5 feet. The tank foundations consist of a ring beam embedded approximately 1.5 feet below the top-of-slab. A thin topping slab is completes the foundation within the ring beam.

Tronox drilled one pre-confirmation sampling location adjacent to the perimeter containment wall and collected soil samples for analysis (SSAM5-04). The results received to date indicated that the soil adjacent to this tank area is not impacted with dioxin, HCB, arsenic, lead, or manganese. Perchlorate was detected above the Comparison Criteria in the 1 to 2 foot sample. It is proposed to excavate soil to the two foot depth adjacent to the tank containment. Tronox is proposing to remediate deeper perchlorate through methods other than excavation and disposal at nearby location SA-129 (see Section 1.2). Flushing will be extended to the SSAM5-04 boring location.

4.0 REMEDIATION

4.1 Work Area Preparation

This section describes the preparation activities that will be performed prior to excavating and transporting soil from the RZ excavation areas. As described in the RAW, the following remediation support features will be established and/or constructed prior to performing soil excavation activities in RZ-E, 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, and 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-E may contain debris. Prior to beginning soil excavation in the excavation areas, any debris will be moved from the work area and disposed or stockpiled in non-working areas.

4.2 Well Abandonment

Three active wells (M-89, M-34, and M-180) are located within RZ-E, as shown approximately on Figure 3. Tronox has submitted a memorandum to NDEP outlining the proposed disposition of these wells. NDEP has responded to Tronox's proposal for these wells and has directed Tronox to plug and abandon these wells and replace the wells within 30 days of completion of remediation work in order to continue groundwater characterization activities. Well abandonment and installation procedures will be performed in accordance with Nevada Division of Water Resources (NDWR) requirements.

4.3 Excavation

This section describes the excavation of contaminated soil from RZ-E. In general, the cutlines represent the lateral limit of the bottom of the excavation area. 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, a feature that cannot be removed, or a property line, Tronox will attempt to cut the excavation slope as near vertical as possible without endangering workers or property. These over-steepened excavations will be backfilled as soon as possible. If the excavation would undermine and reduce support for a structure or endanger site workers, a 1:1 cut slope would be constructed and the cutline would represent the top-of-slope. Temporary fencing will be placed along the perimeter of excavated areas until clean compacted backfill is placed. 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 are shown of Figure 1. The lateral limits are based on the chemical data for sampling locations measured as distance from the top-of-slope. The lateral extent and depth may be increased based on visual staining, odor monitoring instrumentation readings, or other indications. Depths may also be modified in the field if utilities and other buried structures are encountered. Northgate will obtain NDEP approval of any changes to the excavation depths as field work progresses and if special cases are encountered.

The volume of excavation is estimated at 49,834 cubic yards, as shown in Table 1. This is an approximate estimate due to the uneven nature of the surface of the Beta Ditch and the variable top-of-slope and variable width of the ditch.

RZ-E excavation will be accomplished using heavy earth-moving excavators and possibly scrapers. Equipment selection will be made by the contractor. The contractor may elect to stockpile soil in the excavation area or may load the soil directly into trucks for off-Site disposal.

4.4 Post-Excavation Backfilling

Tronox proposes to backfill the excavated RZ-E with clean material to return the ground surface to currently existing grades except in the central area where the final grading plan indicates the construction of retention ponds. Retention ponds in this area are proposed for retaining stormwater and to provide natural soil flushing to remove perchlorate up-gradient of the barrier wall and the interceptor wells. When the backfilling is complete, the shape of the Beta Ditch is expected to be similar to the existing conditions, except in the retention basin area where the bottom of the retention basin will be at the approximate grade of the current Beta Ditch (see Figure 4).

Backfilling will be performed by the contractor in accordance with the remediation plans and specifications. Backfill materials have been tested by Northgate for geotechnical engineering and

environmental compliance requirements. The test results were provided to NDEP for review on September 23, 2010.

4.5 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. A list of specific constituents that will be monitored is 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 Tronox's opinion that perimeter monitoring at the edges of the 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.

5.0 INSTITUTIONAL AND ENGINEERING CONTROLS

Currently, there are no locations where institutional or engineering controls are proposed within RZ-E. If a situation arises where engineering or institutional controls become necessary, NDEP will be contacted and a decision will be made in concert with NDEP. If a decision is made to institute institutional or engineering controls, the procedures will be in accordance with the *Environmental Covenants, Institutional and Engineering Control Plan* submitted by Tronox on October 6, 2010 for NDEP review and comment.

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TABLE

FIGURES

APPENDIX A
RZ-E ANALYTICAL DATA