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

July 15, 2010

Prepared For:

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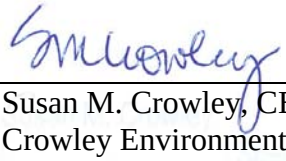
Responsible Certified Environmental Manager (CEM) for this project

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 B (RZ-B) 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. The EP presents the methods and procedures to be used to implement the remedial alternative approved by NDEP for RZ-B 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 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-B 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 to remove impacted soil from RZ-B 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 (COPs) at concentrations exceeding NDEP worker Basic Comparison Levels (BCLs), or modified risk-based goals agreed upon by NDEP.[1] For metals whose background concentrations exceed BCLs (e.g., arsenic), "contaminated soil" is defined as soil with 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 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 1×10^{-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]For purposes of this excavation plan, "contaminated soil" is not defined based on leaching potential to groundwater. A separate site-wide leaching evaluation has been conducted. As the evaluation is finalized, an errata to this plan will be provided to address this pathway.

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-B consists of approximately 42 acres of chemical manufacturing facility buildings, manufacturing facility structures, ponds and open space located between East Lake Mead Drive to the south and West Warm Springs Road to the north. 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, a pre-confirmation sampling program was developed in concert with NDEP and implemented in June-July 2010 to refine remediation planning and establish the vertical and horizontal extent ("cutlines") of the proposed excavations in shallow soils (0 to 10 feet bgs). These investigations are herein referred to as Soil Investigation Programs. 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).

1.3 Data Evaluation

Chemical analyses of soil samples collected in RZ-B during the Soil Investigation Programs indicated locations within the upper 10 feet of soil where dioxin, hexachlorobenzene (HCB) and other semi-volatile organic compounds (SVOCs); asbestos, metals, and/or perchlorate exceed their respective soil cleanup criteria. Remedial excavation areas for RZ-B 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, as specified on Figure 1 of the RAW and defined in Footnote 1 of the RAW. 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-B:

dioxin/furans, HCB, polynuclear aromatic hydrocarbons (PAHS), referred to as benzo(a) pyrene toxicity equivalency (TEQ), arsenic, perchlorate and asbestos.

The Appendix A tables provide the following information:

- All data for all chemicals to be remediated for each soil boring in RZ-B (Table A). Cells highlighted in orange indicate soil concentrations for one or more of the constituents exceeding defined comparison 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 comparison criteria. 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 one of the following: (1) for perchlorate, alternative remedial strategies are being evaluated, or (2) concentration is located at depth below 10 fbgs and no further remediation will occur as area will be backfilled.[2]
- Separate tables are also provided for each RZ-excavation area (Tables A-1 through A-24) 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.

In instances where chemicals are not risk drivers, but excavation is occurring due to other chemicals (i.e., organo phosphate pesticides [OPPs], 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 comparison criteria (highlighted in green) will be retained in the HRA. With regard to HCB and B(a)P TEQ, if either one of these two constituents are above the BCL, data for both will be replaced with pre-confirmation data as the entire EPA 8270 suite of data is available. The same is true for asbestos in that if either amphiboles or chrystotile fibers exceed comparison criteria, both data points will be replaced with confirmation data. Therefore, Appendix A tables will include instances in which some cells are highlighted orange for HCB,

[2] With regard to RZ-B, perchlorate concentrations will remain in some limited areas above BCL, as excavation will be impaired by utilities. Alternative remediation strategies are being evaluated (See Tables RZ-B-20 and RZ-B-21). Additionally, arsenic concentrations greater than 7.2 mg/kg will remain in some limited areas at depths below 10 feet bgs as no further remediation will occur greater than 10 feet bgs and area will be backfilled. Potential leaching of arsenic to groundwater at these locations and concentrations is being evaluated separately.

B(a)P TEQ, amphibole and chrysotile 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-B 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 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.

1.4 RZ-B Site Conditions

RZ-B is generally rectangular in shape, with the long axis running roughly east to west. A small peninsular portion of RZ-B extends northward to the southern boundary of RZ-C, and an approximate 20-foot-wide strip extends approximately 300 feet south in the southeast corner of the Site as shown on Figure 1. The general land surface in RZ-B slopes toward the north at a gradient of approximately 0.023 feet per foot. The developed portions of RZ-B have been modified by grading to accommodate plant facility buildings, surface impoundments, access roads, and other features.

The major buildings that exist within RZ-B consist of Unit Buildings 1 through 6. These were the main buildings during World War II magnesium production. Unit Building 3 is currently used by Tronox for offices and storage. Unit Buildings 5 and 6 are currently used by Tronox for production of manganese dioxide, with Unit 5 also used for storage. Unit Buildings 1, 2, and 4 are not currently used and have been partially demolished. Other buildings exist on RZ-B, including an administrative office building, a wash room building, and Tronox's boron production facility.

Historical information indicates that the central basement portion of Unit Buildings 1 and 2 have been used for disposal of demolition materials. The structural slabs that previously overlaid the basements and the east and west basement walls have been demolished and the concrete debris

dropped into the basements. Up to 10 percent of the demolition debris is estimated to contain asbestos. This asbestos containing material (ACM) is reportedly non-friable. The ACM reportedly consist of transite piping, transite barriers, insulation pads, transite siding, and Galbestos siding. Overlying the demolition debris is soil mixed with demolition debris and a thin cap of soil. The demolition debris and soil mix will be removed from these basements as part of the remediation of RZ-B. Demolition debris removed from RZ-B will be handled as ACM and disposed of at the Republic Landfill in Apex, Nevada.

The Site is crossed by asphalt concrete roads and dirt roads. An extensive network of active and inactive underground utility lines are 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-B. This figure 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. In addition Figure 2 shows an existing overhead chlorine transmission line near the Unit buildings; great care will be taken during remediation to protect this line. It is likely that unknown utilities, both active and inactive, also exist on the Site and may be encountered during the 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 and avoiding underground utilities during remedial activities.

2.0 SCOPE OF WORK

The remediation program at RZ-B 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 shown on Figure 1. Excavation areas in RZ-B will extend to the depths shown on Figure 1 and are presented in Table 1. At RZ-B -11 and -22 additional soil samples will be collected during remediation to refine the bottom of the excavation. Table 1 shows the chemical group(s) driving the target excavation depths for each excavation area except for the excavation areas RZ-B-15 and -18. These two excavations will extend to the bottom of the basements in Unit Buildings 1 and 2, respectively, at a depth of approximately 8 feet, to remove material above the concrete slab.

Soil sampling performed in the area between Unit Buildings 4 and 5 shows that the shallow soil is impacted with HCB in the northern portion (RZ-B-19), perchlorate and arsenic in the eastern portion (RZ-B-21), and perchlorate in the southern portion (RZ-B-20). Excavations to a depth of 1.5, 4 and 2 feet are proposed in these areas, respectively. Perchlorate was also detected above screening levels below these depths in RZ-B-20 and -21; however, to avoid damage to the utilities, these soils will be addressed with alternative remediation approaches. 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 (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 Site Specific HSP.

2.1 Excavation Boundary Constraints

RZ-B has been subdivided into 24 excavation areas identified as RZs -B-01 through -B-24, as listed in Table 1 and shown on Figure 1. Some of the excavation areas identified for RZ-B are constrained by site features. This section provides a detailed description, on an excavation area-specific basis, of the constraints for the proposed excavations. These constraints are also listed in Table 1 under "Excavation Boundary Modifications."

2.1.1 Property Lines

Five of the proposed excavation areas (RZ-B -11, -12, -13, -23 and -24) are constrained by the Site property lines, as shown on Figure 1. Because soil sampling has only been performed in areas owned by Tronox, no data exist in adjacent areas. Prior to excavation, confirmation samples for these five areas will be collected along the property line at a minimum of one sample per property line boundary excavation, or one sample per 150 lineal feet, whichever results in the greater number of samples. However, at RZ-B-24, each confirmation sample for asbestos will represent a 4-point composite sample. Each composite sample will be collected at the property line within a distance of 50 feet from the sampling location. In addition, three conformation samples for asbestos analysis will be collected at RZ-B-23, as shown on Figure 1. Confirmation samples will be collected near the proposed excavation sidewall at a depth coinciding with the maximum concentration in the nearest sample. Confirmation samples will be analyzed for the chemical(s) driving the excavation, as shown in Table 1.

2.1.2 Existing Buildings

The limits of 15 of the proposed excavation areas (RZ-B-01, -02, -04, -06, -09, -12, -13, -14, -15, -16, -17, -18, -19, -20 and -22) are constrained by the existing Unit Buildings 1 through 5. The central portion of each Unit Building is underlain by one basement level, approximately 10 feet below existing grade; the southern portion is underlain by two basement levels (approximately 20 feet below adjacent grade); and the northern portion is built on footings with slab-on-grade construction. The Unit Buildings were built in the early 1940s before the Site became contaminated. Therefore, shallow soil contamination adjacent to the buildings is not likely to be present beneath the buildings. However, soil borings will be advanced inside the building to collect soil samples and confirm that shallow soil contamination is not present beneath the buildings. Samples will be analyzed for the chemical(s) driving the excavation, as shown in Table 1.

2.1.3 Major Active Roads

The limits of four proposed excavation areas (RZ-B-01, -04, -09 and -14) are constrained by existing major active roads, including Avenue G and 5th Street, both currently in-use for the operation of the Tronox facility. Sampling is proposed beneath these active roads as shown on Figure 1.

2.1.4 Above Ground Storage Tanks

Two tanks, including a membrane-lined concrete containment basin (Letter of Understanding [LOU] #28), exist in the central portion of RZ-B, as shown on Figure 1. The historic hazardous waste storage pad was excavated to a depth of at least six feet prior to construction of the tanks. The two tanks are periodically used by Tronox for their process operations. These tanks are expected to continue to be in use for the foreseeable future. Excavation areas RZs -B-08, -09 and -B-10 have been modified to exclude the tanks.

2.1.5 Utility Lines

Currently, two excavation boundary modifications are proposed due to a bank of utility lines in RZ-B-21 and a potential electrical substation conflict in RZ-B-23. In addition, as shown on Figure 2, a number of buried utilities are present in proposed excavation areas. It is Tronox's intent to excavate to the boundaries and depths shown on Figure 1; however, as work proceeds, depending on the location and depth of active utilities encountered, it may become necessary to leave 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 Tronox's proposed measures.

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-B excavation areas. As described in the RAW (Northgate, 2010), the following remediation support features will be established/constructed prior to performing soil excavation activities. These features are 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.

3.2 Well Abandonment

Thirteen groundwater monitoring wells are currently located within RZ-B as shown approximately on Figure 3. Based on proposed excavation areas, three of the wells (M-13, -30 and -143) will be impacted during remediation activities. These wellheads will be protected during excavation by marking and placement of barricades and caution tape. The soil adjacent to the casings will be either hand-excavated or excavated using small excavation equipment. Tronox does not expect that these wells will need to be removed. If wells become damaged beyond repair, they will be properly abandoned and similar wells will be reinstalled after the excavation work is completed in order to continue groundwater characterization and remediation activities, as needed. 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-B. The excavation areas are shown on Figure 1, with the areas impacted only by asbestos shown in blue and the areas impacted by other COPCs shown in tan. The target depth of each excavation area is also summarized in Table 1.

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 1:1 slope (horizontal to vertical). In cases where the excavation abuts a structure or feature 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 a 2:1 slope (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 if utilities and/or other buried structures are encountered. Northgate will obtain NDEP approval of any changes to the excavation depths shown in Table 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 shallower than 1 foot will be performed with either an excavator or a 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.

Excavation boundaries for areas impacted with asbestos have been restricted to unpaved areas only. It is Northgate'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) is equal to or exceeds 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, impacted soil (if present during the time of pavement installation) would have already been removed.

Where trucks or other equipment will exit the excavation area onto clean active roadways, portable wheel-washing equipment will be required in accordance with the RAW.

3.4 Post-Excavation Backfilling

Tronox will backfill some of the excavations in RZ-B with clean material. Backfill will be required in instances where contaminated soil is left in place at 10 feet to provide a minimum 10- foot thickness of clean soil from the ground surface. Backfill will also 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 currently in development by

Tronox. Backfill materials will be tested by Northgate for geotechnical suitability and environmental compliance requirements. Test results will be provided to NDEP before the material is accepted for use in backfilling. It is anticipated that 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 levels for arsenic, and/or modified risk-based cleanup goals.

The backfill areas anticipated by Tronox are noted on Table 1. If backfilling to the previous surface grades is not proposed, Tronox will discuss these areas with NDEP.

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-B specific list of constituents that will be monitored is presented in Table 1 of the PAMP. Because of the relatively small size of the excavation areas 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. Northgate/Tronox proposes to perform the perimeter air monitoring at the Site perimeter as described in the PAMP. In addition, particular matter (PM10) real-time monitoring will be performed on selected workers in the work area. The 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 wetting of the soil, covering of 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-B excavation areas to the lateral extent and to the depths described in Table 1 and shown on Figure 1. Currently there are no planned locations where institutional or engineering controls are proposed within RZ-B. However, there are several areas of concern that could be proposed for engineering and institutional controls, including Avenue G and 5th Street. Avenue G and 5th Street contain a significant number of shallow active utility lines (see Figure 2). Tronox proposes to minimize these potential engineering and institutional control areas by performing additional sampling in strategic areas where, if samples are clean, controls become unnecessary.

If unforeseen conditions are encountered during remediation, Tronox will notify NDEP and provide input regarding the conditions encountered. If a decision is made to implement institutional or engineering controls, the procedures will be in accordance with the *Revised Environmental Covenants, Institutional and Engineering Control Plan*, submitted by Tronox June 9, 2010 for NDEP review and comment, once approved by NDEP.

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