northgate

environmental management, inc.

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Date: November 5, 2010

To: Shannon Harbour, P.E.
Nevada Division of Environmental Protection

RE: Response to Comments *on Revised Engineering Evaluation of Slope Stability, WC and GW-11 Pond Embankments*, *Phase B Soil Remediation of RZ-D*
Tronox LLC, Henderson, Nevada

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1. *Pages 1-2, Historical Geotechnical Data and Field Exploration, NDEP provides the following comments:*
   a. *Please provide a discussion on the method used for determining the soil parameters within the geometry of the profiles analyzed and how it relates to the CPT results.*
   b. *Please provide a discussion on the potential effects of the pore pressure results found in the CPT data and how they would affect slope stability.*
   c. *Page 2, according to the slope stability memorandum Mr. Umesh Bachu is the cone penetrometer testing (CPT) consultant that was retained to perform the testing and interpret the testing results. According to Mr. Bachu's recommendations, the maximum strength for granular soils should be limited to a phi angle of 35-degrees. Please discuss and provide justification for using a phi angle of 38-degrees in the submitted analyses.*

Response:

a. The soil layering in the profile was intended to relate directly to the CPT results. The bottom of the first layer is considered the bottom of the fill. The second layer is the upper native and the lower layer is the lower native. These layers coincide with relatively consistent CPT results for each layer. The layer thickness was taken directly from the CPT results.

b. The pore pressures are not expected to affect the soil strengths. In this case, drained conditions would be expected because of the granular nature of the soils and unsaturated conditions.

c. Northgate chose 38 degrees based on a statement made by Mr. Umesh Bachu that he applies a reduction factor of 10 degrees for very high results and a reduction factor of 5 degrees for moderate results. Because the phi angle results for these embankments were 48 degrees (high results), Northgate selected the 10 degree reduction to 38 degrees. 38 degrees is not an unusually high strength for dense granular soils and is likely an underestimation of plain strain strengths.

2. *Pages 2-4, Stability Analysis, NDEP provides the following comments:*
   a. *Please provide a discussion on the modeled geometry used in the cross-sections for the slope stability and verify that this is the as-built condition of the pond embankments and surrounding area.*
   b. *Page 2, TRX states that all of the cases were analyzed using Bishop's Modified method and several of the exact cases were also analyzed using Spencer's method. Please provide the results and parameters of all of the methods tested. Additionally, please provide evaluation of both circular and block failures surfaces.*
   c. *Page 3, NDEP provides the following comments:*
      i. *a pseudo-static coefficient of 0.15g is used to account for seismic loading in several of the eight cases analyzed. Please provide a discussion on the source of this value and how it was implemented into the slope stability analysis. Please also include the probability of exceedance for this value.*
      ii. *Based on the conclusion it is assumed that the maximum depth of excavation would be to 14-feet. Please verify this assumption.*

Response:

a. The cross-section locations were selected based on inspection of the topographic map for the areas. The locations represented the locations with the steepest and highest slopes for the GW-11 and WC Ponds. The sections were drawn from the topographic map and represent the as-built conditions.

b. The Spencer's Method analyses were analyzed for several cases; however, only one case was saved due to the various setback distances of the cases. Setbacks were eliminated by decreasing the excavation slope inclination to 3:1. The analyzed case is attached to this response memo. As requested, Northgate performed two analyses for block (wedge) failure for the WC pond embankment. This is the steepest slope analyzed at the Site and should have lower factors of safety compared to the GW-11 Pond embankments. Two cases were looked at: Case 1, with the failure surface intersecting the middle of the embankment, and Case 2, with the failure surface intersecting the inner top-of-slope of the embankment. Both cases intersected the toe of the slope and were investigated for both static and seismic conditions. The results indicate a factor of safety of 1.46 for static and 1.03 for seismic for Case 1, and a factor of safety of 1.58 for static and 1.06 for seismic for Case 2. These values are lower than the circular failure surfaces and are consistent with Northgate's understanding that static and seismic factors of safety decrease as the depth of the potential failure plane decreases (i.e., nearer to the slope surface). However, the impacts of potential failure are also fewer.

c.
   i. A pseudostatic force of 0.15 g is a commonly used value for screening level analyses to assess if more sophisticated seismic stability analyses are required. A seismic coefficient of 0.1 g represents an earthquake with a magnitude of 6.5 and a seismic coefficient of 0.15 represents a magnitude 8.25 earthquake. This assumes that a 1 meter displacement is acceptable. In this case a 1 meter displacement is probably not

acceptable, considering the processed-waste contents of the ponds. Therefore, erring on the conservative side is called for in this case.

Northgate is not aware of any correlation of the pseudostatic coefficient to probability of exceedances.

ii. The deepest planned excavation adjacent to the pond embankments is RZ-D-21E which has a design depth of 14 feet. Because the confirmation sampling has already been performed, the excavation will not be deeper than the design depth.

Attachments

1 Spencer and Bishop Study data

2 Block Slip Study data