

October 5, 2007

Susan Crowley  
Tronox LLC  
PO Box 55  
Henderson, Nevada 89009

Re: **Tronox LLC (TRX)**  
**NDEP Facility ID #H-000539**  
Nevada Division of Environmental Protection Response to:  
*Annual Remedial Performance Report for Chromium and Perchlorate, Tronox LLC,*  
*Henderson, Nevada*  
Dated August 29, 2007

Dear Ms. Crowley,

The NDEP has received and reviewed TRX's above-identified performance report and provides comments in Attachment A. These comments should be addressed in future performance report submittals (quarterly, semi-annual, and annual) as relevant. TRX should additionally provide an annotated response-to-comments letter as part of the next performance report submittal unless otherwise noted. Alternately, many of these issues could be discussed in a telephone conference or meeting. Please contact the undersigned with any questions at [sharbour@ndep.nv.gov](mailto:sharbour@ndep.nv.gov) or (702) 486-2850 x 240.

Sincerely,

Shannon Harbour, P.E.  
Staff Engineer III  
Bureau of Corrective Actions  
Special Projects Branch  
NDEP-Las Vegas Office

SH:bar:sh

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**Attachment A**

1. General comment, the NDEP requests that TRX report the flow and contaminant loading capacities of each of the groundwater treatment systems in future performance reports.
2. General comment, the NDEP has noted many instances of TRX using words like “clean”, “low”, and “significantly” without quantification. Please quantify statements using relative words, such as these, in future report submittals. The NDEP has noted some examples of this in the following comments.
3. Section 2.1, Interceptor Well Field Area, NDEP has the following comments:
  - a. TRX states that “clean Lake Mead water” is injected for artificial recharge to the area north of the barrier wall. Please quantify what is meant by “clean”. There is an incremental concentration of perchlorate in Lake Mead water which has varied over time. For clarity it would be helpful to understand this range of inputs.
  - b. TRX states the “mound” created by the injection of Lake Mead water into the infiltration trenches north of the barrier wall has been “dissipating”. Discuss how and/or why this is occurring.
  - c. TRX states that the formation contact at both ends of the barrier wall was remapped and confirmed the presence of “inter-channel Muddy Creek ridges at both ends of the barrier wall”. Please provide the information that was used for this remapping.
  - d. TRX proposed to use video techniques to investigate well inefficiencies suggested by the groundwater elevation data differences between the Interceptor wells and adjacent monitoring wells. Additionally, TRX proposes to rehabilitate well screens as necessary. Please provide a schedule for this investigation and rehabilitation **by November 5, 2007**.
4. Section 3.1, Chromium Plume Configuration, TRX states that the highest total chromium concentration reported north of the recharge trenches was 4.0 mg/L. Please state which well this concentration is associated with.
5. Section 3.1.1, On-Site Interceptor Well Field Area, NDEP has the following comments:
  - a. TRX states that the total chromium concentration from January 2002 to May 2007 has decreased 94.7% but in the follow sentence states that the decrease was 97.4%. It appears that one of these statements may be a typographic error; please clarify which percentage is correct.
  - b. TRX states that the concentration of perchlorate for groundwater monitoring well M-100 in January 2002 was 9.2 mg/L. Appendix A does not list any data for January 2002. Please clarify.
  - c. TRX calculated the percent decrease from January 2002 to May 2007 for total chromium in monitoring well M-100. TRX then used this percent decrease to determine that a maximum of 1.6 gpm of groundwater at 9.2 mg/L total chromium could be flowing around the barrier wall. This calculation assumes that the groundwater concentration for total chromium flowing around the barrier wall is 9.2 mg/L. Please discuss this assumption. As part of this discussion, TRX should consider the groundwater containing less than 0.1 mg/L that is traveling around the east and west ends of the barrier wall. This groundwater could contribute to the concentration reduction observed in M-100.
  - d. TRX states that “...leaking around the barrier wall to keep M-23 at 0.24 mg/L (total chromium)”. Appendix A and Plate 6 show M-23 with a total chromium

- concentration of 0.88 mg/L and M-100 with a total chromium concentration of 0.24 mg/L. Please clarify if the text should reference M-100 instead of M-23.
- e. TRX states that “the barrier wall also acts as an effective barrier to the downgradient flow of highly-impacted groundwater.” Please quantify what is meant “highly-impacted groundwater”.
  - f. TRX states that by using the well triplet M-74, CLD1-R, and CLD2-R near the eastern end of the barrier wall that a local groundwater flow direction of N20W, which flows from the east onto TRX property. TRX additionally states that there is “an unsaturated Muddy Creek fine-grained-facies bedrock high that separates the eastern end of the barrier wall from CLD2-R. Plate 3 illustrates this Muddy Creek ridge as extending between CLD2-R and M-74. Please explain how the flow direction calculated using these three wells is valid if they are separated by a subsurface feature.
  - g. Please provide the information indicating the locations of the “unsaturated Muddy Creek fine-grained-facies ridges” to the west and east sides of the barrier wall.
  - h. TRX states that “water levels have been dropping in M-68 – 14.4 feet of drawdown since 1987 (Table 2) – and in CLD2-R.” Please note and revise the text that drawdown information and calculations are provided in Table 1. Additionally, TRX does not provide the historical groundwater elevation data for CLD2-R. Please provide the historical data collected at CLD2-R in Appendix A in future performance reports. In addition, please note that the NDEP believes that statements regarding drawdown are of limited use. These statements taken out of context of regional groundwater level trends do not confirm capture. It is expected that this issue and all other capture related issues will be addressed via the capture zone analysis being conducted separately.
6. Section 3.2, On-Site Chromium Treatment System, the NDEP has the following comments:
- a. TRX reports the amount influent water to the Groundwater Treatment Plant (GWTP) is a million gallons in the month of May but predominantly uses gallons per minute (gpm) throughout the rest of the document. The NDEP requests that TRX report in consistent units throughout the document.
  - b. TRX discusses that it appears that total chromium, in the form of suspended solids, appears to be passing through the chromium treatment system but is being captured in the GAC vessels. NDEP notes that GAC is a very inefficient method to filter solids. In addition, if this was occurring, it would seem that the GAC vessels would eventually become filled with solids. Please explain TRX’s methodology for mitigating this situation.
  - c. TRX states that the “chromium impacted groundwater” is ultimately discharged as “clean effluent”. Please quantify what is meant by “clean effluent”.
  - d. TRX discusses that “all total and hexavalent chromium analyses, except two, have been non-detect”. It is suggested that these anomalies be discussed in future reporting,.
7. Section 3.3, Potential On-Site Interim Chromium Remediation, TRX states that they will discuss treatment alternatives with NDEP by October 1, 2007. To date, TRX has not initiated this discussion. Alternatively, TRX additionally proposed the pumping of groundwater wells M-70 and M-71 in the Revised Work Plan to Evaluate Effective Groundwater Capture at Tronox Extraction Systems (dated August 29, 2007). NDEP has

responded to this issue in a response to the above-referenced Work Plan in a letter dated October 3, 2007. Please address this issue as requested in the October 3, 2007 letter. It is suggested that TRX consider expansion of the clarification capacity and possibly adding filtration to the discharge of the chromium treatment unit.

8. Section 4.1.1, Interceptor Well Field Area, the NDEP has the following comments:
  - a. TRX states that the three components of this well field have “significantly” reduced the amount of perchlorate in the downgradient groundwater. Please quantify what is meant by “significantly”.
  - b. TRX uses “low” to describe the perchlorate concentrations in the area of the recharge trenches. Please quantify what is meant by “low”.
  - c. TRX calculated the percent decrease of the perchlorate concentration downgradient of the barrier wall from approximately 1,000 mg/L in July 1998 to less than 100 mg/L currently. TRX then used this percent decrease to determine that a maximum of 6 gpm of 1,000 mg/L perchlorate could be flowing around the barrier wall. This calculation assumes that the groundwater concentration for perchlorate flowing around the barrier wall is 1,000 mg/L. Please discuss this assumption. As part of this discussion, TRX should consider the groundwater containing less than 10 mg/l and 25 mg/l which is traveling around the east and west ends of the barrier wall, respectively. This groundwater could certainly contribute to the expansion of the less than 100 mg/l zone of perchlorate.
9. Section 4.1.2, Athens Road Well Field Area, TRX refers to the model completed by the NDEP’s contractor; however, TRX does not recognize all of the data gaps identified by the model. TRX should acknowledge these data gaps or discuss how these data gaps have been addressed in future performance reports.
10. Section 4.3, On-Site Perchlorate Remediation, please include an explanation of the transfer process from AP-5 pond to GW-11.
11. Figures, the NDEP has the following comments and suggestions:
  - a. Figure 2, West – East Hydrogeologic Cross Section A-A’ Interceptor Well Field May 2007, TRX illustrates a Tertiary Muddy Creek formation (TMCf) high on the west and east ends of the barrier wall. The text in Section 2.1 states that this area was “recently remapped”. Please provide the information used for the remapping of this area.
  - b. Figure 7, Tronox Henderson Groundwater Treatment Block Flow Diagram, in Section 3.2, TRX states that the influent to the GWTP includes “about 25 gpm from GW-11” but Figure 7 states that the influent to GWTP includes only “about 20 gpm” from GW-11. Please revise accordingly.
  - c. Figure 7, TRX states that the three activated carbon vessels “remove organics which could harm bacteria”. Please discuss this matter with the NDEP and provide analytical data to substantiate this statement. NDEP does not have sufficient assurance that TRX is monitoring the performance of the carbon vessels in a manner that will be protective of the FBR system.
  - d. Figure 7, please add a notation to indicate where the “FBR Influent” and “FBR Effluent” samples are taken.
12. Tables, the NDEP has the following comments and suggestions:
  - a. Table 2, Interceptor Well Discharge Rates (GPM), the NDEP has the following comments:

- i. TRX reports a total discharge rate for the Interceptor Wells listed in Table 2 of 64.2 gpm for June 2007. In Table 7, Groundwater Chromium Treatment Data July 2006 to June 2007 reports an average flow of 2.78 million gallons for June 2007 to the GWTP. Figure 7 shows that the inflow to the GWTP is the combination of the Interceptor Wells discharge plus approximately 20 gpm from pond GW-11. If the flow discharge rate from Table 2 is added to the approximately 20 gpm from pond GW-11, the inflow to the GWTP is 84.2 gpm (3.64 million gallons for June 2007). Please clarify this discrepancy.
    - ii. TRX lists a “NI = Not operational” as a footnote in this table but uses “NO” in the table. Please revise as necessary.
  - b. Table 6, Well PC-119 appears to have been turned off, please explain.
  - c. Table 7, Groundwater Chromium Treatment Data July 2006 to June 2007, the NDEP requests that this table be combined with Table 8 with the following column headings (units): Month, Average Influent Flow to GWTP (gpm), Average Total Cr Influent Concentration to GWTP (mg/L), Average CrVI Effluent Concentration from GWTP (mg/L), Average Total Cr Effluent Concentration from GWTP (mg/L), Average Influent Flow to FBR (gpm), Average CrVI Influent Concentration from FBR (mg/L), Average Total Cr Influent Concentration to FBR (mg/L), CrVI Effluent Concentration from FBR (mg/L), Average Total Cr Effluent Concentration to FBR (mg/L).
  - d. Table 8, July 2006 To June 2007 Weekly Chromium (mg/L) in FBR Influent and Effluent, please combine with Table 7 (please see above comment). Also note that the TRX does not need to have a column for detection limits if they report the concentrations as less than the numerical value of the detection limit (e.g. <0.0001).
  - e. Table 8, it appears that there is a mechanism that is removing chromium between the influent and effluent of the FBR. Please explain what this mechanism is.
  - f. Table 9, Perchlorate Removed from the Surface and Groundwater, please add total chromium removed to this table.
  - g. Table 10, July 2006 to June 2007 Weekly Perchlorate in FBR Influent and Effluent, the NDEP requests that this table be revised to have the following column headings (units): Month, Average Influent Flow (gpm), Average Perchlorate Influent Concentration (mg/L), and Average Perchlorate Effluent Concentration. Additionally, TRX does not need to have a column for detection limits if they report the concentrations as less than the numerical value of the detection limit (e.g. <0.0001).
13. Appendix A, the NDEP has requested that TRX provide all available data in an electronic format for each performance report. To date, the electronic data has not been complete; numerous wells and historic data have not been included.
14. Appendix D, the NDEP has the following comments:
  - a. TRX Response to March 29, 2007 NDEP comments of the Semiannual Performance Report Dated February 26, 2007, the NDEP has the following comments:
    - i. In response to comments (RTC) 14.a, TRX states that they will “review and set-up procedures for the graphical representations ... to unify scales and ranges where practical.” The NDEP did not observe any of the scales in Appendix B of the Annual Report to be unified. Please note that NDEP’s original comment

- was for all future performance reports that contain these graphs and not just future Semiannual Performance Reports.
- ii. RTC 17, TRX states that they will provide all parts of their database used for the development of the report. This information was not included.
- b. TRX RTC for NDEP's July 2, 2007 Comments on the Quarterly Performance Report dated May 29, 2007:
- i. RTC 4, no update on monitoring wells ARP-4, ARP-5, and ARP-6 was included in the text of the report.
  - ii. RTC 18, the NDEP originally requested that TRX submit a schedule for and clarification on the intended procedures for the recommended pump test on M-71 and M-72. In the Annual Performance Report, TRX has recommended pumping wells M-70 and M-71 but did not provide a schedule or recommended procedures. As previously stated above, the NDEP has responded to this issue in a response letter dated October 3, 2007. Please address this issue as requested in the October 3, 2007 letter.
15. Appendix F, NDEP has the following comments that should be addressed under separate cover (in a Sampling and Analysis Plan) and submitted by **November 16, 2007**:
- a. General comment, please note that the sampling plan is subject to change pending the submittal of additional data.
  - b. General comment, the issues outlined below would likely be addressed most effectively in a meeting.
  - c. The NDEP has noted on Plates 2, 6, 7, etc. that there are concentration and groundwater elevation data for wells not listed in Appendix F. Please add a table listing these wells that includes, at a minimum the owner of the wells, whether the respective owner of the well obtains and analyzes the sample and provides the data to TRX, and what analytical data TRX receives (or for what analytes does TRX sample).
  - d. Table F-4, NDEP requests the following:
    - i. The addition of total chromium analysis for the following wells: H-48, H-58A, MC53, and MC65.
    - ii. The addition of wells AA-01, LG025, BEC-1, POU3, and AA-11 to the annual sampling schedule.
    - iii. The rationale for limiting the number of samples collected for chlorate and nitrate analysis as compared to the number of samples collected for perchlorate.
    - iv. The rationale for the limited number of samples collected for Cr-VI analysis.
  - e. A separate table listing all wells required to be sampled by permits, AOC, etc., the required frequency of sampling, and the analytes required.
  - f. Figure F-2, TRX notes that PC-10 has been plugged and abandoned in Table F-4, please verify the status of the well and remove PC-10 from Figure F2 if not useable.
  - g. Figure F-4, please add the following wells to this figure: H-48, H-58A, MC53, and MC65.
  - h. TRX proposes weekly sampling from the pumping wells at the Seep and Athens Well Fields but only quarterly sampling from the pumping wells at the Interceptor Well Field. Please discuss the rationale for the difference in sampling frequency.
  - i. TRX proposes monthly sampling for several wells not associated with a well field. Please provide the rationale for this sampling frequency for these wells.

- j. TRX proposes monthly sampling for several wells associated with a well field but are not pumping wells. Please provide the rationale for this sampling frequency for these wells.