ATTACHMENT 2

BACKGROUND COMPARISON (Part I) AND Selection of SELECTION OF SCREENING FOR CHEMICALS OF POTENTIAL CONCERN FOR THE SOIL-TO-GROUNDWATER LEACHING EVALUATION PATHWAY (Part II)

This attachment presents the background comparison evaluation for metals in soil (Part I) and the selection of chemicals of potential concern for the soil-to-groundwater leaching evaluation (Part II).

PART I: Background Evaluation

Consistent with United States Environmental Protection Agency (USEPA) guidance (1989, 1992b, and 1992c), Site data for metals were evaluated relative to background concentrations to identify those metals that are not elevated above naturally occurring levels and can, therefore, be eliminated from further quantitative evaluation in the leaching evaluation and risk assessment. This evaluation was based on a combination of exploratory data analysis (EDA) and appropriate statistical methods (USEPA 2002c), each of which is discussed further below. When the weight-of-evidence of the EDA and results of the statistical analyses indicate that a particular chemical is within background levels, then these chemicals will not be evaluated further in the chemical of potential concern (COPC) selection process for the human health risk assessment and the soil-to- groundwater leaching evaluation.

a summary of the comparison of Phase A and Phase B soil concentrations with the background soil dataset selected in accordance with discussions and correspondence with the Nevada Division of Environmental Protection (NDEP). In a letter dated August 17, 2010, NDEP determined that the Remediation Zone A (RZ-A) dataset is appropriate for background comparisons at the Tronox Site (NDEP, 2010c).

Two phases of soil investigations have been performed at the Tronox facility in Henderson, Nevada (Site):

- Phase A soil investigations were conducted in November 2006 (AECOM, 2007);
- Phase B soil investigations were conducted from June 2008 to November 2009 (note that supplemental sampling and analyses are continuing to refine Phase B polygon results).

As discussed during conference calls on April 14 and 16, and presented in their April 30, 2010 memorandum (NDEP, 2010a), NDEP previously had determined that Phase B soil metal concentrations in RZ-A would be used as the background dataset for further evaluation of only Phase B soil concentration data in the remaining RZs (RZ-B through RZ-E) at the Tronox Henderson site (the Site), shown on Figure 1 of this memorandum. Accordingly, the results of the background comparisons for RZ-B through RZ-E, using only Phase B data, were previously presented in a technical memorandum submitted to NDEP on July 22, 2010 (Northgate, 2010b). Following NDEP's letter dated August 17, 2010 (NDEP, 2010c), which determined that the RZ-A dataset is appropriate for background comparisons with both Phase A and Phase B data for the remaining RZs, the background comparison tables have been revised in this Attachment to include both Phase A and Phase B soil concentration data .

~~This evaluation compares the data collected during the Phase A and Phase B investigations from RZs B through E to the Phase B data collected in RZ-A. The results of this evaluation will be incorporated into the health risk assessment reports for RZ-A through RZ-E, as well as the soil to groundwater leaching evaluation presented in the August 23, 2010 technical memorandum to which this summary is attached. The results presented for the leaching evaluation for the Quaternary alluvium (Qal) include background comparisons for various depth intervals (as discussed below under "Depth Interval Determination"), for which statistical comparisons were performed.~~

~~**Evaluation of Site Concentrations Relative to Background Conditions**~~

~~Consistent with United States Environmental Protection Agency (USEPA) guidance (1989, 1992b, and 1992c), Site data for metals were evaluated relative to background concentrations to identify those metals that are not elevated above naturally occurring levels and can, therefore, be eliminated from further quantitative evaluation in the leaching evaluation and risk assessments. This evaluation was based on a combination of exploratory data analysis (EDA) and appropriate statistical methods (USEPA 2002c), each of which is discussed further below. When the weight-of-evidence of the EDA and results of the statistical analyses indicate that a particular chemical is within background levels, then these chemicals will not be evaluated further in the chemical of potential concern (COPC) selection process.~~

RZ-A Background Dataset

NDEP has requested Tronox to use the Site soil concentrations from RZ-A as the background dataset (NDEP August 17 ~~April 30,~~ 2010). The RZ-A soil samples were collected as part of the Area IV investigation (i.e., a subset of the Phase B Area IV samples) and analyzed in accordance with the Revised Phase B Investigation Work Plan, Tronox LLC Facility, Henderson, Nevada, December 2008 (AECOM, 2008) and the Revised Phase B Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada, July 2009 (AECOM and Northgate 2009).

A review of the RZ-A dataset showed that one Phase A boring (SA02) and five Phase B borings (RSAU4, RSAU5, SA28, SA146, and SA147) are located in a boron source area (the former State Industries, Inc. site) in LOU 62 and contributed to elevated concentrations of boron. Table 1 presents statistical comparison of concentration data from these six borings to the remaining RZ-A data using Gilbert's Toolbox. As indicated in Table 1, in addition to boron, there are elevated concentrations of ~~and other metals, including~~ arsenic, chromium (total), cobalt, iron, molybdenum, nickel, platinum, and ~~sodium~~sodium. It is noted that for chemicals with a low frequency of detection (chromium VI, selenium, silver, and tin), the results of the statistical comparison tests may not be reliable. However, based on review of data, exclusion or inclusion of the LOU 62 data for these four chemicals will not materially impact the overall RZ-A background data-set. ~~Statistical comparison of concentration data from these six borings to the remaining RZ-A data using Gilbert's Toolbox showed differences between the two datasets for nearly all metals, with the sole exception of barium (Table 1; NDEP, 2009c). Therefore, the data associated with these six borings were excluded from the RZ-A dataset. The final "RZ-A background dataset" is composed of 17 borings with a total of 66 samples at various depths.~~ The following table identifies the chemicals identified as being greater than the remaining RZ-A dataset, along with comments as to how the elevated levels might be explained by the CSM.

Metals in LOU-62 Borings Greater than RZ-A Background	Relation to Conceptual Site Model
Arsenic	Slightly elevated concentrations detected in samples collected within LOU 62 (State Industries, Inc. site, including surface impoundments [SIs] and catch basin). Non-hazardous concentrations of arsenic were detected in a sludge sample collected from the eastern SI prior to closure.
Boron	Elevated concentrations detected in samples collected within LOU 62. Borax (hydrated sodium borate) was identified as a known constituent of the process waste stored in the SIs (ENSR 2008c).
Chromium (total)	Chromium was a detectable constituent of pickling process wastes discharged to the SIs at LOU 62.
Cobalt	Concentrations greater than maximum detected RZ-A background concentration in 4 borings (RSAU4, RSAU5, SA28, and SA146). No explicit relation to CSM for LOU 62.
Iron	Elevated concentrations detected in samples collected within LOU 62. Iron identified as a known constituent of the process waste stored in the impoundments (ENSR 2008c).
Molybdenum	One detected value in RZ-A background much greater than remainder of RZ-A data set (RSAT5-0.5). No explicit relation to CSM for RZ-A or LOU 62.
Nickel	Four samples from 3 locations in LOU 62 (RSAU4, RSAU5, and SA28) exceeded maximum detected RZ-A background concentrations. Non-hazardous concentrations of nickel were detected in a sludge sample collected from the eastern SI prior to closure.
Platinum	Two samples from two locations in LOU 62 (RSAU4 and SA28) exceeded maximum detected RZ-A background concentration. No explicit relation to CSM for LOU 62.
Sodium	Highest detected site concentrations from samples collected within LOU 62. Potentially associated with borax (hydrated sodium borate) that was identified as a known constituent of the process waste stored in the impoundments (ENSR 2008c).

Based on this evaluation, data associated with the six borings were excluded from the RZ-A dataset. The final "RZ-A background dataset" that is the basis for all background comparison evaluations is composed of 17 borings with a total of 66 samples at various depths.

Depth Interval Determination

For comparison purposes, the RZ-A background dataset was divided into shallow, middle and deep depth intervals. The shallow interval is from 0 to 10 feet below ground surface (bgs) and includes both a 0.5 feet bgs and 10 feet bgs sample. For some chemicals, the shallow interval was further divided into two intervals from 0 to 2 feet bgs and 2 to 10 feet bgs, based on a chemical-specific statistical comparison between the 0.5 feet bgs and 10 feet bgs samples. If this comparison showed that the 0.5-feet and 10-feet bgs samples were consistent with each other, they were grouped into one shallow depth interval (0-10 feet bgs). Otherwise, these samples were separated into two intervals (0-2 and 2-10 feet bgs) for comparison to the other RZs. The metals which are evaluated for the 0- to 2-foot and >2- to 10-foot depth intervals and are not evaluated for the 0- to 10-feet interval are: arsenic, chromium (total), mercury, magnesium, molybdenum, potassium, sodium, strontium, and uranium. The middle depth interval includes samples from 10 feet bgs to the top of the Upper Muddy Creek Formation (UMCf) and the deep depth interval includes samples from the UMCf.

Site Data

Site data collected during the Phase A and Phase B investigations from RZ-B through RZ-E were compared to the RZ-A background dataset. Field duplicates and Site samples were treated as independent samples on the basis of preliminary evaluation, in consultation with NDEP guidance (NDEP 2008c; Paul Black, personal communication, Nov. 11, 2009), indicating that the variance of the duplicates was similar to the variance of the Site samples. Non-detect results were set equal to one-half of the limit of detection for purposes of this evaluation. The Sample Quantitation Limit (SQL) was used as the detection limit for both the Site and background datasets as per NDEP guidance (NDEP 2008d).

Exploratory Data Analysis

The EDA was performed using summary statistics (Guidance on the Development of Summary Statistics Tables for the BMI Plant Sites and Common Areas Projects, Henderson, Nevada, NDEP, 2008b) and quantile-quantile plots and side-by-side box-and-whisker plots to qualitatively evaluate whether the Site (RZs B through E) and RZ-A background dataset are representative of a single population. The summary statistics for the Site and RZ-A background data are presented in separate tables for RZ-B through RZ-E (Tables 2B through 2D).

Statistical Comparisons

The statistical software package, Guided Interactive Statistical Decision Tools (GiSdT®; Neptune and Company 2007), was used to perform all statistical comparisons. Specifically, statistical background comparisons were performed using the Quantile test, Slippage test, t-test, and Wilcoxon Rank Sum test with Gehan modification. The t-test is parametric, which assumes that the data are normally distributed. In contrast, the Wilcoxon Rank Sum test, Quantile test, and Slippage test are non-parametric, which do not require an assumption of whether the data are normally or lognormally distributed (USEPA 2002c; NDEP, 2009c). These non-parametric tests are described further below.

- The Wilcoxon Rank Sum test performs a test for a difference between the sums of the ranks for two populations. This is a non-parametric method for assessing differences in the centers of the distributions that relies on the relative rankings of data values. Knowledge of the precise form of the population distributions is not necessary. The Wilcoxon Rank Sum test has less power than the two-sample t-test when the data are normally distributed, but the assumptions are not as restrictive. The GiSdT® version of the Wilcoxon Rank Sum test uses the Mantel approach for ranking the data, which is equivalent to using the Gehan ranking system. The Gehan ranking system is used to rank non-detects with the rest of the data (NDEP, 2009c).

- The Quantile test addresses tail effects which are not addressed in the Wilcoxon Rank Sum test. The Quantile test looks for differences in the right tails (upper-end of the dataset) rather than central tendency like the Wilcoxon Rank Sum test. The Quantile test was performed using a defined quantile = 0.80 (Paul Black, personal communication. Oct. 7, 2009).

- The Slippage test looks for a shift to the right in the extreme right-tail of the background dataset versus the extreme right-tail of the Site dataset. This test determines whether the number of Site samples that exceed the maximum background concentration for each metal is greater than would be expected, statistically, if the Site and background distributions were the same.

Finally, an alpha = 0.05 is typically used to evaluate a statistically significant result (USEPA, 2002c). However, as more tests are performed, it is more likely that a statistically significant result will be obtained purely by chance. Given the use of multiple statistical tests, an alpha = 0.025 was selected as a reasonable significance level for determining if Site data are different than background (NDEP, 2009c). Generally, any chemical that resulted in a p-value less than 0.025 in one of four tests will be retained for further consideration in the COPC selection process. Additionally, because these tests are set up with one-sided hypotheses, not only are differences between the two samples able to be detected, a directional determination can be made as well (e.g., Site is greater than background).

Results for the four statistical tests (p-values) are included in Tables 2A-2D, as well as a determination as to whether the site data are greater than background. Chemicals for which only one p-value was less than 0.025 are noted in the tables. Metals which are evaluated in the 0- to 2-feet and 2- to 10-feet depth intervals are not included in the evaluation for the combined 0- to 10-feet depth interval. (For example, sodium exceeds RZ-A background from 0-2 feet and 2-10 feet in RZs B through E, but is not evaluated in the 0- to 10-feet depth interval). Likewise, metals that are evaluated in the combined 0- to 10-feet depth interval are not evaluated in the 0- to 2-feet and 2- to 10-feet depth intervals.

It is important to note that there are several chemicals for which there is a low frequency of detection (less than 25%) in the site or RZ-A background dataset. For these chemicals, the statistical comparisons may be inappropriate and additional analysis was conducted as described below.

Evaluation of Chemicals with Low Detection Frequencies

~~For chemicals with a low frequency of detection, the results of the statistical comparison tests may not be reliable .~~ The chemicals with frequency of detection below 25% in either the background dataset or Site dataset are: antimony, boron, chromium (VI), selenium, silver, and tin. To evaluate these chemicals, an analysis of the comparability of the datasets was performed~~.~~ (Table 3). The frequencies of detection were compared using the Chi-squared test of independence with a threshold p-~~-~~value of 0.05. For chemicals with similar detection limits in the Site and background datasets, failing this test indicates a difference between the Site and background datasets which results in the chemical carried forward as a COPC. ~~-~~Chemicals that pass the test can be evaluated further on the basis of detected concentrations. ~~ions.~~ The standard procedure is to reevaluate the Gilbert's toolbox using only the detections. However, the detection count in the RZ-A background dataset is 7 for boron and 3 or fewer for all other the chemicals with detection frequency less than 25%. Therefore, EDA was performed to evaluate whether chemicals which passed the Chi-squared test are consistent with background. The results of comparability evaluations and EDAs for each of these chemicals with low detection frequencies are discussed below.

Antimony – ~~—~~The ~~-~~frequency of detection for antimony is below 25% in the RZ-A background dataset for the 0 to 10 feet bgs interval only ~~-~~(10%). The Site detection limits are similar to the RZ-A background dataset. Antimony failed the Chi-squared test for independence in RZ-B and RZ-C. By inspection of the summary statistics and statistical plots (box plot and qq-plot) for RZ-D and RZ-E, it can be determined that the Site datasets are consistent with the background dataset. Antimony is retained as a COPC in RZ-B and RZ-C for the 0 to 10 feet bgs depth interval.

Boron – The frequency of detection for boron is below 25% in the RZ-A background dataset for the 0 to 10 feet bgs depth interval only (23%). The detection limits for boron are similar between the Site and background datasets. Boron failed the Chi-squared test of independence in RZ-E only. By inspection of the summary statistics and statistical plots, it can be determined that the Site datasets are above the background dataset for RZ-B, RZ-C, and RZ-D. Boron is retained as a COPC in all remediation zones for the 0 to 10 feet bgs depth interval.

Chromium (VI) – The frequency of detection for chromium (VI) is below 25% in the RZ-A background dataset for the 0 to 10 feet bgs (3%) and the 10 feet to UMCf depth intervals (0%). The detection limits are similar between the Site and background datasets. Chromium (VI) failed the chi-squared test of independence for the 0 to 10 feet bgs interval in RZ-B, RZ-C, and RZ-E and for the 10 feet bgs to UMCf interval in RZ-C, RZ-D, and RZ-E. By inspection of summary statistics and statistical plots, it can be determined that chromium (VI) is above background in RZ-D from 0 to 10 feet bgs and RZ-B from 10 feet bgs to UMCf. Chromium (VI) is retained as a COPCs for all remediation zones at both depth intervals.

Selenium – The frequency of detection for selenium is below 25% for the 0 to 10 feet and the 10 feet bgs to UMCf depth intervals in all datasets (0-10%). The detection limits are similar for selenium in the Site and background datasets. Selenium failed the chi-squared test for independence in RZ-B from 0 to 10 feet bgs, but this was a failure based on the detection frequency in RZ-A being greater than RZ-B. Therefore, selenium is not carried forward as a COPC in this zone. Based on inspection of summary statistics and statistical plots, it can be determined that selenium is consistent with background in all remediation zones and both depth intervals except for in RZ-E from 0 to 10 feet bgs. Selenium is retained as a COPC in RZ-E from 0 to 10 feet bgs.

Silver – The frequency of detection for silver is below 25% for the 0 to 10 feet bgs (0%) and the 10 feet bgs to UMCf (15%) depth intervals in the RZ-A background dataset. The detection limits are lower for the Phase A data than for the Phase B data. Since the RZ-A background dataset only includes Phase B data, the detection limits may not be comparable. Silver failed the chi-squared test for independence in RZ-B to RZ-E from 0 to 10 feet bgs and in RZ-D for 10 feet bgs to UMCf. However, this is partially due to the lower detection limits in the Site data. To account for this, the chi-squared test was performed only on on only the Phase B data. Silver then fails the chi-squared test in only RZ-C to RZ-E from 0 to 10 feet bgs. Based on inspection of summary statistics and statistical plots, it can be determined that silver is consistent with background in all other remediation zones at both depth intervals. Silver is retained as a COPC in RZ-C to RZ-E for the 0 to 10 feet bgs depth interval.

Tin – The frequency of detection for tin is below 25% for the 0 to 10 feet bgs (0%) and the 10 feet bgs to UMCf (8%) depth intervals in the RZ-A background dataset. The detection limits are much lower for the Phase A data than for the Phase B data. Since the RZ-A background dataset only includes Phase B data, the detection limits may not be comparable. Tin failed the chi-squared test for independence in RZ-B and RZ-E for the 0 to 10 feet bgs depth interval. However, this is partially due to the lower detection limits in the Site data. To account for this, the chi-squared test was performed on only the Phase B data. Tin then passes the chi-squared test for all remediation zones at both depth intervals. Based on inspection of summary statistics and statistical plots, it can be determined that tin is consistent with background in all remediation zones at both depth intervals except for in RZ-E from 0 to 10 feet bgs. Tin is retained as a COPC in RZ-E for the 0 to 10 feet bgs depth interval.

~~Results for the four statistical tests (p-values) are included in Tables 2A-2D, as well as a determination as to whether the site data are greater than background. It is important to note that there are several chemicals for which there is a low frequency of detection (less than 25%) in the site or RZ-A background dataset. Finally, chemicals for which only one p-value was less than 0.025 are noted in the tables.~~

~~It is important to note in the following summaries that those metals which are evaluated in the 0- to 2-feet and 2- to 10-feet depth intervals are not included in the evaluation for the combined 0- to 10-feet depth interval. (For example, sodium exceeds RZ-A background from 0-2 feet and 2-10 feet in RZs B through E, but is not evaluated in the 0- to 10-feet depth interval). Likewise, metals that are evaluated in the combined 0- to 10-feet depth interval are not evaluated in the 0- to 2-feet and 2- to 10-feet depth intervals.~~

Relationships Between Background Comparisons and Conceptual Site Model

Based on the statistical comparisons provided in Tables 2B through 2E, the chemicals identified in each RZ are listed below, along with any comments as to how the elevated levels might be explained by the CSM.

Metals in RZ-B Greater than RZ-A Background	**Relation to Conceptual Site Model**
Antimony	Very low detection frequency in RZ-A from 0 to 10 ft. bgs. Exceeds background from 0 to 10 ft. bgs in RZ-B based on lack of comparability of detection frequencies (refer to text).
Arsenic	Exceeds background at 0-10 ft. bgs due to historical Site activities; however, surface soil (0-10 ft. bgs) exceeding surface background of 7.2 milligrams per kilogram (mg/kg) will be removed by excavation.
Boron	Exceeds background from 0-10 ft. bgs and >10 ft. bgs to UMCf due to Site related activities.
Chromium (total)	Exceeds background from 0-2 ft. bgs due to Site-related activities.
Chromium (VI)	Very low frequency of detection in both RZ-A background and RZ-B data. Exceeds background from 0 to 10 ft. bgs and >10 ft. bgs to the UMCf contact based on lack of comparability of detection frequencies (refer to text and statistical plots). Detections in RZ-B appear to be associated with previous Site activities.
Lead	Seven samples exceed maximum RZ-A background (>73 mg/kg) and are found in surface soil (0.5 ft. bgs) near the Unit 2 building.
Magnesium	Approximately 20 samples exceed maximum RZ-A background (>30,000 mg/kg) at depths of at least 20 ft. bgs. Appears to be associated with previous Site activities in the Unit 2 building and may be associated with groundwater.
Manganese	Numerous samples exceed maxi~~u~~mum RZ-A background (537 mg/kg for 0-10 ft. bgs and 336 mg/kg for >10 ft. bgs). Appears to be associated with previous Site activities.
Potassium	Elevated above RZ-A background between 2 to 10 ft. bgs. Potassium perchlorate was historically manufactured at site.
Selenium	Very low frequency of detection in both RZ-A background data set and RZ-B data set for 0 to 10 ft. bgs and >10 ft. bgs to the UMCf contact. Exceeds RZ-A background from >10 ft. bgs to the UMCf contact based on comparability of detection frequencies and inspection of statistical plots (refer to text discussion and RZ-E plots). No explicit relation to CSM for RZ-B.
Sodium	Highest concentrations appear to be associated with former sodium chlorate filter cake holding area (LOU 11) and Unit 4 building (LOU 43); old sodium chlorate plant decommissioning.
Uranium	Elevated above background only from ground surface to 2 ft. bgs. No explicit relation to CSM for RZ-B.

Metals in RZ-C Greater than RZ-A Background	**Relation to Conceptual Site Model**
Antimony	Very low detection frequency in RZ-A from 0 to 10 ft. bgs. Exceeds background from 0 to 10 ft. bgs in RZ-C based on lack of comparability of detection frequencies.

Metals in RZ-C Greater than RZ-A Background	Relation to Conceptual Site Model
Arsenic	Exceeds maximum RZ-A background at 0-10 ft. bgs due to historical Site activities;, however, surface soils exceeding surface background of 7.2 milligrams per kilogram (mg/kg) will be removed by excavation.
Barium	Exceeds maximum RZ-A background from ground surface to 2 ft. bgs, primarily at the Former Truck Dumping Area (LOU 35) and the Former Manganese Tailings Ponds (LOU 34W). Appears to be related to previous Site activities.
Boron	Exceeds maximum RZ-A background primarily at Pond C-1 (LOU 20), which received process waste streams, including boron neutralization solutions.
Chromium (total)	Numerous samples exceed maximum RZ-A background from the ground surface to 2 ft. bgs. Highest concentrations were detected in the Old P-2 Pond (LOU 7) and Old P-1 Pond (LOU 14).
Chromium (VI)	Very low frequencies of detection in both RZ-A background and RZ-C data sets. Exceeds background from 0 to 10 ft. bgs and >10 ft. bgs to the UMCf contact based on lack of comparability of detection frequencies (refer to text). Detections in RZ-C appear to be associated with the Old Pond P-2 (LOU 7), Old Pond P-3 (LOU 8), and the former Cooling Tower (LOU 46).
Cobalt	Exceeds maximum RZ-A background (9 mg/kg) at 0 to 10 ft. bgs and >10 ft. bgs to the UMCf contact; however, all soils exceeding the BCL of 331 mg/kg will be excavated. Remaining highest concentrations appear to be associated with the former Manganese Tailings Area (LOU 34) and the historical Manganese Tailings Pile Area (LOU 24).
Lead	Exceeds maximum RZ-A background (73 mg/kg) at 0 to 10 ft. bgs and >10 ft. bgs to the UMCf contact. Highest concentrations are associated with the former Manganese Tailings Area (LOU 24 and 34W) and Pond P-1 (LOU 14).
Magnesium	Exceeds maximum RZ-A background from 0 to 10 ft. bgs; however all surface soils exceeding the BCL of 100,000 mg/kg will be excavated. Remaining highest concentrations appear to be associated with the former Koch Materials facility (LOU 64) and the former Diesel Storage Area (LOU 45).
Manganese	Exceeds maximum RZ-A background at 0 to 10 ft. bgs and >10 ft. bgs to the UMCf contact; however, highest surface concentrations greater than the BCL of 13,700 mg/kg) will be removed by excavation. Remaining highest concentrations are associated with the former Diesel Storage Area (LOU 45) and the AP Plant Area Tank Farm (LOU 53).
Molybdenum	Two detected values exceed maximum RZ-A background (SA-39 and SA-56). No explicit relation to CSM for RZ-C.
Platinum	Approximately 10 samples exceed maximum RZ-A background from 0 to 10 ft. bgs. No explicit relation to CSM for RZ-C.
Silver	No detections in RZ-A background data set for 0 to 10 ft. bgs and very low detection frequency in RZ-A background data set for greater than 10 ft. bgs to the UMCf contact. Exceeds RZ-A background for 0 to 10 ft. bgs based on lack of comparability of detection frequencies (refer to text discussion and RZ-E plots). No explicit relation to CSM for RZ-C.

Metals in RZ-C Greater than RZ-A Background	Relation to Conceptual Site Model
Sodium	Exceeds RZ-A background at 0 to 10 ft. bgs and >10 ft. bgs to the UMCf contact. Related to previous Site activities and associated with sodium chlorate processing and AP Plant (LOU 57).
Thallium	Exceeds maximum RZ-A background (0.2 mg/kg) at 0 to 10 ft. bgs and >10 ft. bgs to the UMCf contact. Highest concentrations are associated with the former Manganese Tailings Area (LOU 24 and 34W).
Tungsten	Exceeds RZ-A background at 0 to 10 ft. bgs and >10 ft. bgs to the UMCf contact. Highest concentrations are associated with the former Manganese Tailings Area (LOU 34W), Pond P-1 (LOU 14), and Old Pond P-2 (LOU 7).
Uranium	Few detections above maximum background. Exceeds background only from ground surface to 2 ft. bgs. Highest concentrations are associated with the former Truck Emptying Site (LOU 35). No explicit relation to CSM.

Metals in RZ-D Greater than RZ-A Background	Relation to Conceptual Site Model
Arsenic	Exceeds maximum RZ-A background at 0-10 ft. bgs due to historical Site activities; however, surface soils exceeding surface background of 7.2 mg/kg will be removed by excavation.
Barium	Exceeds RZ-A background from 0 to 10 ft. bgs and >10 ft. bgs to the UMCf. Highest concentrations are associated with the impacted berm around the West and East Ponds (LOUs 22 and 23). Significant remediation will occur in these areas.
Beryllium	Few detections above maximum RZ-A background concentration. No explicit relation to CSM for RZ-D.
Boron	Exceeds RZ-A background from 0 to 10 ft. bgs. Highest concentrations are associated with the Closed Hazardous Waste Landfill (LOU 10).
Chromium (total)	Exceeds RZ-A background from 0 to 2 ft. bgs. Highest concentrations are associated with the Closed Hazardous Waste Landfill (LOU 10) and the impacted berm around the West and East Ponds (LOUs 22 and 23). Significant remediation will occur in these areas.
Chromium (VI)	Very low detection frequency in RZ-A background data set for 0 to 10 ft. bgs and no detections in RZ-A background data set for greater than 10 ft. bgs to the UMCf. Exceeds RZ-A background for 0 to 10 ft. bgs based on EDA and review of RZ-E statistical plots. No explicit relation to CSM for RZ-D.
Magnesium	Numerous detections exceed maximum RZ-A background from 0 to 10 ft. bgs. Highest concentrations are associated with the western portion of RZ-D, near the Closed Hazardous Waste Landfill, and the impacted berm around the West and East Pond (LOUs 22 and 23). Significant remediation will occur in these areas.

Metals in RZ-D Greater than RZ-A Background	Relation to Conceptual Site Model
Manganese	Exceeds RZ-A background (2,470 mg/kg) from 0 to 10 ft. bgs. Appears to be associated with previous Site activities. Highest concentrations are associated with the western portion of RZ-D, near the Closed Hazardous Waste Landfill and the impacted berm around the West and East Pond (LOUs 22 and 23). Significant remediation will occur in these areas.
Molybdenum	Maximum detected RZ-D concentration is below maximum RZ-A background concentration. No explicit relation to CSM for RZ-D.
Silver	No detections in RZ-A background data set for 0 to 10 ft. bgs and very low detection frequency in RZ-A background data set for greater than 10 ft. bgs to the UMCf. Exceeds RZ-A background for 0 to 10 ft. bgs based on lack of comparability of detection frequencies (refer to text discussion and RZ-E plots). No explicit relation to CSM for RZ-E.
Sodium	Exceeds RZ-A background at 0 to 10 ft. bgs and >10 ft. bgs to the UMCf contact. Related to previous Site activities and highest concentrations are associated with the western portion of RZ-D, near the Closed Hazardous Waste Landfill (LOU 10).
Strontium	Exceeds RZ-A background at 2 to 10 ft. bgs. Related to previous Site activities and highest concentrations are associated with the western portion of RZ-D, near the Closed Hazardous Waste Landfill (LOU 10).
Tungsten	Exceeds RZ-A background at 0 to 10 ft. bgs. Approximately 10 samples detected above maximum RZ-A background at various locations. No explicit relation to CSM for RZ-D.
Uranium	Exceeds RZ-A background at 2 to 10 ft. bgs. Highest concentrations are associated with the western portion of RZ-D, near the Closed Hazardous Waste Landfill (LOU 10).

Metals in RZ-E Greater than RZ-A Background	Relation to Conceptual Site Model
Aluminum	A few samples exceed RZ-A maximum background at 0- 10 ft. bgs. However, there is no explicit relation to CSM for RZ-E. Note: fails only the Slippage test from 0 to 10 ft. bgs.
Arsenic	Exceeds maximum RZ-A background at 0-10 ft. bgs due to historical Site activities; however, all soils exceeding surface background of 7.2 mg/kg will be removed by excavation.
Barium	Exceeds RZ-A background from 0 to 10 ft. bgs at several locations. No explicit relation to CSM.
Beryllium	A few samples exceed RZ-A maximum background at 0- 10 ft. bgs. However, there is no explicit relation to CSM for RZ-E. Note: fails only the Slippage test from 0 to 10 ft. bgs

Metals in RZ-E Greater than RZ-A Background	Relation to Conceptual Site Model
Boron	Very low frequency of detection in RZ-A background data set for 0 to 10 ft. bgs. Exceeds maximum RZ-A background at 0 to 10 ft. bgs based on lack of comparability of frequency of detection in RZ-E (see discussion in text). Associated with boron process waste effluent discharged into the Beta Ditch (LOU 5).
Chromium (Total)	Exceeds RZ-A background from 0 to 10 ft. bgs at several locations in RZ-E. Associated with Trade Effluent wastes and Cooling Tower blowdown discharged into the Beta Ditch (LOU 5).
Chromium (VI)	Exceeds RZ-A background from 0 to 10 ft. bgs at several locations in RZ-E. Associated with Trade Effluent wastes and Cooling Tower blowdown discharged into the Beta Ditch (LOU 5).
Cobalt	Exceeds RZ-A background from 0 to 10 ft. bgs at several locations in RZ-E. No explicit relation to the CSM for RZ-E.
Copper	Exceeds RZ-A background from 0 to 10 ft. bgs at several locations in RZ-E. No explicit relation to the CSM for RZ-E.
Lead	Exceeds RZ-A background from 0 to 10 ft. bgs at several locations in RZ-E. No explicit relation to the CSM for RZ-E.
Magnesium	Exceeds RZ-A background from 0 to 2 ft. bgs at several locations in RZ-E. No explicit relation to the CSM for RZ-E.
Manganese	Exceeds RZ-A background from 0 to 10 ft. bgs at several locations in RZ-E. May be associated with runoff from the Historic Manganese Tailings Area and waste water from dewatering of the manganese tailings placed in leach beds (LOU 24); discharges of recirculation water from the former Cooling Tower and several process wastes from historical U.S. government, Tronox, and Timet processes (LOU 46); and manganese perchlorate process waste discharges to the Beta Ditch (LOU 5).
Molybdenum	Fails Gehan test from 0 to 2 ft. bgs. No explicit relation to the CSM for RZ-E.
Nickel	Exceeds RZ-A background from 0 to 2 ft. bgs at several locations in RZ-E. No explicit relation to the CSM for RZ-E.
Platinum	Exceeds maximum RZ-A background from 0 to 2 ft. bgs at four locations in RZ-E. No explicit relation to the CSM for RZ-E.
Selenium	Very low frequency of detection in both RZ-A background data set and RZ-E data set for 0 to 10 ft. bgs. Exceeds RZ-A background based on comparability of detection frequencies and inspection of statistical plots (refer to text discussion and RZ-E plots).
Silver	No detections in RZ-A background data set for 0 to 10 ft. bgs and very low detection frequency in RZ-A background data set for greater than 10 ft. bgs to the UMCf. Exceeds RZ-A background for 0 to 10 ft. bgs based on lack of comparability of detection frequencies (refer to text discussion and RZ-E plots). No explicit relation to CSM for RZ-E.

Metals in RZ-E Greater than RZ-A Background	Relation to Conceptual Site Model
Sodium	Exceeds RZ-A background at 0 to 10 ft. bgs and >10 ft. bgs to the UMCf contact. May be associated with process waste discharges from the sodium chlorate and sodium perchlorate processes; also process wastes from the AP Plant (LOU 57)
Tin	No detections in RZ-A background data set for 0 to 10 ft. bgs and very low detection frequency in RZ-A background data set for greater than 10 ft. bgs to the UMCf. Exceeds RZ-A background for 0 to 10 ft. bgs based on lack of comparability of detection frequencies (refer to text discussion and RZ-E plots). No explicit relation to CSM for RZ-E.
Tungsten	Exceeds RZ-A background from 0 to 10 ft. bgs at several locations in RZ-E. No explicit relation to the CSM for RZ-E.
Uranium	Exceeds maximum RZ-A background (1.0 mg/kg) from 0 to 2 ft. bgs at several locations in RZ-E. No explicit relation to the CSM for RZ-E.
Zinc	Maximum detected RZ-E concentration is below maximum RZ-A background concentration. No explicit relation to CSM for RZ-E.

All of the metals identified above will be evaluated further in the COPC selection process for the Health Risk Assessment and soil to groundwater leaching evaluation regardless of whether the elevated concentrations can be related to the CSM.

Summary of Results for RZ-B

~~The results for RZ-B are presented in Attachment 2 Tables 2A and 3A.~~ Based on statistical comparisons and EDA, t~~T~~he metals which exceed RZ-A background are listed below:

- 0 to 2 feet bgs: arsenic, chromium (total), sodium, and uranium;
- 2 to 10 feet bgs: arsenic, potassium, and sodium;
- 0 to 10 feet bgs: antimony, boron, chromium (VI), lead, and manganese;
- 10 feet bgs to Upper Muddy Creek formation (UMCf): boron, chromium (VI), magnesium, ~~selenium,~~ and sodium.

The chemicals that are consistent with background at all depth intervals in RZ-B are: aluminum, barium, beryllium, cadmium, cobalt, copper, iron, mercury, molybdenum, nickel, platinum, selenium, silver, strontium, thallium, tin, titanium, tungsten, vanadium, and zinc.

Summary Results ~~Results~~ for RZ-C

Based on statistical comparisons and EDA, the ~~The results for RZ-C are presented in Attachment 2 Tables 2B and 3B. The~~ metals which exceed RZ-A background are listed below:

- 0 to 2 feet bgs: arsenic, chromium (total), magnesium, molybdenum, sodium, and uranium;
- 2 to 10 feet bgs: arsenic, and sodium;
- 0 to 10 feet bgs: antimony, barium, boron, chromium (VI), cobalt, lead, manganese, platinum, silver, thallium, and tungsten;
- 10 feet bgs to UMCf: barium, chromium (VI), cobalt, manganese, ~~selenium,~~ sodium, thallium, and tungsten.

The chemicals that are consistent with background at all depth intervals in RZ-C are: aluminum, ~~antimony,~~ beryllium, cadmium, copper, iron, mercury, nickel, platinum, potassium, selenium, ~~silver,~~ strontium, tin, titanium, vanadium, and zinc.

Summary Results for RZ-D

Based on statistical comparisons and EDA, the metals which exceed RZ-A background for RZ-D are listed below: ~~The results for RZ-D are presented in Attachment 2 Tables 2C and 3C. The metals which exceed background are listed below:~~

- 0 to 2 feet bgs: arsenic, chromium (total), magnesium, molybdenum, sodium, and uranium;
- 2 to 10 feet bgs: arsenic, magnesium, sodium, strontium, and uranium;
- 0 to 10 feet bgs: barium, beryllium, boron, chromium (VI), manganese, silver, and tungsten;
- 10 feet bgs to UMCf: barium, chromium (VI), and sodium.~~,~~

The chemicals that are consistent with background at all depth intervals in RZ-D are: aluminum, antimony, cadmium, cobalt, copper, iron, lead, mercury, nickel, platinum, potassium, selenium, ~~silver,~~ thallium, tin, titanium, vanadium, and zinc.

Summary Results for RZ-E

Based on statistical comparisons and EDA, the metals which exceed RZ-A background for RZ-E are listed below:

~~The results for RZ-E are presented in Attachment 2 Tables 2D and 3D. The metals which exceed background are listed below:~~

- 0 to 2 feet bgs: arsenic, chromium (total), magnesium, molybdenum, sodium, and uranium;
- 2 to 10 feet bgs: arsenic, chromium (total), and sodium;
- 0 to 10 feet bgs: aluminum, barium, beryllium, boron, chromium (VI), cobalt, copper, lead, manganese, nickel, platinum, selenium, silver, thallium, tin, tungsten, and zinc;
- 10 feet bgs to UMCf: sodium and chromium (VI).

The chemicals that are consistent with background at all depth intervals in RZ-E are: antimony, cadmium, iron, mercury, potassium, strontium, titanium, and vanadium.

PART II: Selection of Inorganic Chemicals of Potential Concern for the Leaching Evaluation

All chemicals identified in PART I to exceed background were further evaluated as part of the COPC process for the soil to groundwater leaching evaluation. Attachment 2, Tables 4~~3~~A through 4~~3~~D present the screening evaluation used to select the inorganic COPCs for the leaching evaluation.~~:~~ COPCs were selected for each Remedial Zone (RZ-B through RZ-E) using the steps summarized below:

1. Comparison with background dataset: chemicals that are consistent with background in each RZ for a given depth interval are excluded from further evaluation of leaching potential.

2. Screening using leaching-based, basic comparison levels (LBCLs) for a dilution attenuation factor (DAF) equal to one (no dilution). Chemicals that did not exceed LBCLs for DAF=1 were excluded from further evaluation.

3. Screening using LBCLs for DAF=20. Chemicals that did not exceed LBCLs for DAF=20 were excluded from further evaluation of leaching potential.

4. Chemicals that exceeded background and LBCLs for DAF=1 and DAF=20 were retained as COPCs for the leaching evaluation.[1]

In addition to the metals evaluated in Tables 3A through 3D, perchlorate was retained as a COPC because it exceeds the calculated generic LBCL of 0.072 milligrams per kilogram (mg/Kg) at all depth intervals in all RZ areas.[2]

Attachment 2, Table ~~3~~ 4 presents the Site-wide screening evaluation to select the organic COPCs for the leaching evaluation using the steps summarized below:

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[1] The maximum background concentration of iron in all depth intervals in the RZ-A background dataset exceeds the LBCL for DAF=20. Therefore, iron was excluded as a COPC in all RZs because it did not exceed background in RZ-A. The maximum background concentration of magnesium in the depth interval from >10 feet to the UMCf contact in the RZ-A background dataset exceeds the LBCL for DAF=20.

[2] For the purpose of defining and measuring source lengths, generic leaching-based comparison levels (LBCLs) were calculated for certain inorganic and organic chemicals for which LBCLs have not been published by NDEP. The generic LBCLs were calculated using default soil and chemical parameters as described in Attachment 3.

1. Screening using LBCLs for a DAF equal to one (no dilution). Chemicals that did not exceed LBCLs for DAF=1 were excluded from further evaluation.

2. Screening using LBCLs for DAF=20. Chemicals that did not exceed LBCLs for DAF=20 were excluded from further evaluation of leaching potential.

3. Chemicals that exceeded LBCLs for DAF=1 and DAF=20 were retained as COPCs for the leaching evaluation.

Tables

1 LOU 62 Comparison to RZ-A Background
2A RZ-B Comparison to RZ-A Background
2B RZ-C Comparison to RZ-A Background
2C RZ-D Comparison to RZ-A Background
2D RZ-E Comparison to RZ-A Background
3A RZ-B Chemicals with Low Detection Frequencies
3B RZ-C Chemicals with Low Detection Frequencies
3C RZ-D Chemicals with Low Detection Frequencies
3D RZ-E Chemicals with Low Detection Frequencies
~~3A~~4A ~~Screening~~ Selection of Inorganic ~~Chemicals~~ COPCs for Leaching ~~Concerns~~ Evaluation in RZ-B
~~3B~~4B ~~Screening~~ Selection of Inorganic ~~Chemicals~~ COPCs for Leaching ~~Concerns~~ Evaluation in RZ-C
~~3C~~4C ~~Screening~~ Selection of Inorganic ~~Chemicals~~ COPCs for Leaching ~~Concerns~~ Evaluation in RZ-D
~~3D~~4D ~~Screening~~ Selection of Inorganic ~~Chemicals~~ COPCs for Leaching ~~Concerns~~ Evaluation in RZ-E
~~4~~5 ~~Screening~~ Selection of Organic ~~Chemicals~~ COPCs for Leaching ~~Concerns~~Evaluation

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