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Technical Memorandum

To:	Kathy Arnold	**From:**	Amy L. Hudson, REM and Mark A. Williamson
Company:	Rosemont Copper Company	**Date:**	May 16, 2011
Re:	Rosemont Facility Fate and Transport Modeling Response to Comments	**Doc #:**	113/11-320878-5.3
CC:	David Krizek, P.E. (Rosemont Copper); Paul Ridlen, P.E. (Tetra Tech)		

1.0 Introduction

On behalf of the Coronado Forest Service (CNF), Rosemont Copper Company (Rosemont) received review comments on the following documents prepared by Tetra Tech. This review was prepared by SRK Consulting in a Technical Memorandum dated April 14, 2011 (see Attachment 1).

- Report titled *Infiltration, Seepage, Fate and Transport Modeling Report – Revision 1*, dated August 2010 (Tetra Tech, 2010a)
- Technical Memorandum titled *Rosemont Infiltration, Seepage, Fate and Transport Response to Comments*, dated November 23, 2010 (Tetra Tech, 2010b)

This is the second review cycle related to the infiltration, seepage, and fate and transport modeling work. The original modeling report by Tetra Tech, titled *Infiltration, Seepage, and Fate and Transport Modeling,* was completed in March 2010 and was the subject of review comments prepared by SRK Consulting in a Technical Memorandum titled *Technical Review of Infiltration, Seepage, and Fate and Transport Modeling Report* dated April 30, 2010. Tetra Tech, on behalf of Rosemont, responded to SRK's review comments in a Technical Memorandum titled *Rosemont Infiltration, Seepage, Fate and Transport and Response to Comments* dated November 23, 2010 as well as in the *Infiltration, Seepage, and Fate and Transport Modeling Report – Revision 1* dated August 2010.

SRK also provided another set of review comments concerning the two (2) technical memoranda listed. These review comments were dated February 14, 2011 and concentrated on the infiltration and seepage portions of the modeling work. The April 14, 2011 review comments, which are the subject of this Technical Memorandum, concentrated on the fate and transport aspects of the modeling work.

Due to the large number of technical and non-technical comments/recommendations made in this review cycle, the April 14, 2011 SRK memorandum has been reproduced verbatim within the body of this Technical Memorandum with comments by Tetra Tech added in red. This format was also selected since not all recommendations listed within the body of the memorandum were summarized at the end.

This response assumes that no updates will be made to the modeling report. Therefore, all pertinent information is provided herein.

2.0 SRK Technical Memorandum with Tetra Tech Comments in Red

A technical review has been undertaken and this Technical Memorandum prepared at the request of SWCA and the Coronado National Forest, in accordance with a request for a Statement of Work dated December 2, 2010. Provided here are comments related to the review of *Infiltration Seepage, Fate and Transport Modeling Report–Revision 1* prepared for the Rosemont Copper Company by Tetra Tech (Tetra Tech, 2010c) and the Technical Memorandum *Rosemont Infiltration, Seepage, Fate and Transport Response to Comments*, (Tetra Tech, 2010h). Stephen Day and Corolla Hoag of SRK Consulting (SRK) prepared these comments, which address some of the discussion held in a teleconference with Tetra Tech and Coronado Forest Service personnel[1] on 10 March 2011. Editorial review was provided by Claudia Stone, also of SRK.

Previous reports related to geochemical characterization, seepage, fate and transport models were used for reference. These documents include:

- *Mine Plan of Operations* (WestLand Resources, 2007)
- *Geologic Report, Relogging Program at the Rosemont Porphyry Skarn Copper Deposit* (Augusta Resource Corporation, 2007)
- *Baseline Geochemical Characterization, Rosemont Copper* (Tetra Tech 2007b)
- *Geochemical Characterization, Addendum I, Rosemont Copper* (Tetra Tech 2007c)
- *Dry Stack Tailings Storage Facility Design Report* (AMEC, 2009, Appendix D)
- *Geochemistry Sample Update* (Tetra Tech, 2008) *Rosemont Tailings Geochemistry Sample Sources*, Technical Memorandum, August 30, 2010 (Tetra Tech, 2010d). These documents include:
  - A – *Rosemont 2006-2008 Tailings Material Sample Sources*, August 30, 2010 (Tetra Tech, 2010e)
    - o Attachment 1 – *Tailings Geochemistry*, Technical Memorandum, March 24, 2009, 7p.
    - o Attachment 2 – 2006-2008 *Tailings Material Sample Metallurgical Database Codes*, Excel table, August 2010, 3 p.
    - o Attachment 3 – 2006-2007 Tailings Material Sample Cores, Excel table including rock type, borehole ID, code, depth and type of geochemistry test performed on three samples of Horquilla, August 2010, 1 p.
    - o Attachment 4 – 2008 *Tailings 0-3 Year Composite Material Sample Cores*, Excel table containing date, type of sample, laboratory, sample material and rock type, composite name, data file code, and comments, August 2010, 5 p.
  - B – *Tailings Material Sample Metallurgical Database Codes*, Excel table including work date, type of sample, laboratory, material and rock type, composite name, data file code, and

comments, August 2010, 2p.

˜ C – *2010 Tailings Material Sample Cores*, Excel table containing sample rock type, borehole ID, sample type code, depth, and type of geochemistry test performed, August 2010, 24p.

˜ D – *2010 Summary of Geochemical Data for Tailings Samples*, Excel table containing MWMP and SPLP results for 10 tailings samples, August 2010, 1p.

˜ E – *SVL Analytical Data for the 2010 Tailings Samples*, Laboratory results for MWMP and SPLP results for 10 tailings samples, August 2010, 1p.

- *Rosemont Geochemical Sample Selection*, October 26, 2010 (Tetra Tech, 2010f)
- *Rosemont Preliminary Geochemistry Review*, *Response to Comments*, Technical Memorandum, November 23, 2010 (Tetra Tech, 2010i).

This memorandum is organized into two sections, corresponding to the two topics under review:

Part 1 - Infiltration and seepage modeling previously addressed (SRK, 2011), and

Part 2 - Fate and transport (geochemical) modeling addressed in this memorandum.

Some remaining comments and recommendations related to the seepage geochemical model and the model documentation are addressed below. The report comments are related to recommendations to improve clarity and model documentation.

1 FATE AND TRANSPORT (GEOCHEMICAL) MODELING

Tetra Tech (2010c) used standard industry methods to prepare conceptual models for the movement of precipitation, draindown process solutions, and entrained pore fluids through the proposed Waste Rock Storage Facility, Heap Leach Facility, and the Dry Stack Tailings Facility. They used CTRAN/W to perform the particle tracking model. The computer code PHREEQC (version 2.15.06) was used to model the resulting water quality in conjunction with the WATEQ4F database. WATEQ4F includes thermodynamic and kinetic parameters for minerals relevant to the rock types and mineralization expected at Rosemont. These methods and software codes conform to current industry standards for geochemical modeling.

Tetra Tech revised and improved the report illustrations and text in the revised report (2010c). SRK recommends the following additional revisions in the reporting of method, results, and table presentation to make the modeling approach clearer to the public and other technical reviewers and the document more complete as a “stand-alone” document. In particular, the report would benefit from:

- Compiled tables (or reference to existing compilation) showing which actual samples Tetra Tech used to calculate the starting solutions for each model and model rock type and the calculation method used to assign an average starting solution chemistry if more than one sample was used to derive the concentration. This would enable the reader to assess the reasonableness of the method used to calculate the average starting solution as well as the representativeness of the results.

The list below presents the geochemical sampling results that were used to develop the waste rock modeling starting solutions. For each rock type represented within the Waste Rock Storage Area, the SPLP or MWMP testing results were averaged and the resulting concentrations were used as the starting solution. It should be noted that non-detect data were given a value of one-half the value of the method detection limit when used for averaging.

Rock Type	Sample ID
Abrigo:	average of 6 SPLP results (1561-01, 1561-03, 1916-02, 1926-02, A808-02, A818-01)
Arkose:	average of 11 MWMP results (AR2001-01, AR2003-03, AR2009-01, AR2011-01, AR2036-01, AR2040-01, AR2041-01, UAGH-Arkose-1, VABH0609-01)
Andesite:	average of 4 MWMP results (AR2011-03, AR2030-05, AR2038-04, AR2038-06)
Bolsa:	average of 5 SPLP results (1561-02, A780-02, AR2059-01, AR2066-01, AR2072-01)
Colina:	average of 5 SPLP results (A815-01, A860-02, A865-01, AR2011-04, AR2041-02)
Earp:	average of 6 SPLP results (A845-01, AR2014-05, AR2017-02, AR2019-03, AR2030-01, AR2035-02)
Epitath:	average of 5 SPLP results (A830-01, A847-01, A850-01, AR2002-03, AR2034-02)
Escabrosa:	average of 4 SPLP restuls (1461-01, 1506-02, A814-02, A872-01)
Horquilla:	average of 2 MWMP results (AR2000-04, AR2042-06)
Limestone:	MWMP results of AR2042-05 and arsenic from SPLP results of 1926-02
Martin:	average of 3 SPLP results (1461-02, A856-01, A866-01)
Overburden:	average of 2 SPLP results (A821-01, AR2039-01)
Qmp:	average of 2 SPLP results (1926-01, A815-02)

The data used for the heap leach model were from MWMP test results from leach column material:

Rock Type	Sample ID
Andesite	Andesite Col. Leach
Qmp	QMP Column Leach

The sample IDs of the tailings material testing results used for the fate and transport modeling was provided in Table 6.5 of the Infiltration, Seepage, Fate and Transport Modeling Report – Revision 1 (Tetra Tech, 2010).

- Additional citations in the text that reference or clarify the documents in which the geochemical data are presented and compiled.

The geochemical data are presented and summarized in the Baseline Geochemical Characterization Report and the Addendum 1 report:

Tetra Tech, 2007. Baseline Geochemical Characterization, Rosemont Copper. Prepared for Rosemont Copper Company. Report Dated June 2007.

Tetra Tech, 2007. Geochemical Characterization, Addendum 1. Prepared for Rosemont Copper Company. Report Dated November 2007.

- Documentation on PHREEQ inputs and outputs.

The PHREEQC input files are provided as Attachment 2.

1.1 Brief Responses to Comments in Tetra Tech 2010h

The Tetra Tech memo *Rosemont Infiltration, Seepage, Fate and Transport Response to Comments* dated November 23, 2010 (Tetra Tech, 2010h) addressed a number of questions brought up in a SRK memo (2010c) dated April 30, 2010. Only a few items were not addressed or were not addressed in sufficient detail. The Tetra Tech (2010h) sections and item numbers are provided for reference.

Section 3.2.1.1 Item 1 Provide detailed site mineralogy to calibrate the ABA method results

Detailed mineralogy is not part of the physical sample descriptions in any of the geochemical characterization reports that have been made available to SRK; the information provided is of a general nature (host rock type only). SRK understands from a discussion with Tetra Tech on 10 March 2011 that Tetra Tech did have access to the Rosemont assay database to query the database and select relevant sample intervals based on rock type, grade, and location within the project area, but that detailed mineralogy descriptions for the samples tested is not present in the existing records. SRK requests that a table be included in the model report showing the assumptions for the mineralogical sources of the acid generation potential, acid neutralization capacity, and soluble sulfate.

In the absence of detailed mineralogical analyses, it should be assumed that the mineralogical source of acid generation potential is primarily pyrite, acid neutralization potential is calcite and that soluble sulfate is derived from gypsum.

Section 3.2.1.1 Item 2 Evaluate the soluble form of sulfur

Section 6.3 in the updated report does not provide the requested explanation of the mineralogical source of soluble sulfate expected at Rosemont. It is expected that jarosite is not present but this needs to be confirmed. This would be addressed by a mineralogy assumption table as mentioned above.

Gypsum is anticipated to be the primary source of soluble sulfate at Rosemont, although small amounts of jarosite (or other sulfate salts) may be present locally as a result of weathering of the limited amounts of pyrite reported in the deposit.

Section 3.2.1.1 Item 3 Evaluate the possible effect on neutralization potential of carbonates that have been converted to silicates (calcsilicates)

Tetra Tech's response is that calibration of ABA for site-specific conditions is not needed due to the dominance of acid consuming minerals. However, potentially ARD generating (APG) materials are present and the classification of ARD potential may be affected by over-estimating NP. It appears the data are not available to reach a conclusion on the issue, but it can be addressed by allowing for a conservative approach for PAG waste rock management. Appropriate analytical methods will need to be developed for operational testing and classification of PAG materials.

Rosemont is committed to using standard Acid-Base Accounting (ABA) protocols that would capture the effective neutralization potential (NP) of minerals within the Rosemont deposit. This would include the suggested calcsilicates. To date, the presence of siderite (iron carbonate), a carbonate with no net neutralization potential (NNP) has not been noted at Rosemont. If it is determined in the future that such minerals exist in quantities sufficient to compromise the ABA classification, the modified Sobek method for measuring neutralization potential will be augmented with the siderite correction.

> *Section 3.2.1.1 Item 4 and Section 3.2.3.1 Nitrate from blasting residue*
>
> Blasting residue from ANFO or other products is expected and noted at some open pit mining operations. The starting solutions presented in Table 6.1 of Tetra Tech (2010c) consider only natural concentrations of nitrate, nitrite, and ammonia. There is extensive long-term evidence that leaching of explosives residues from waste rock at similar operations in wetter climates can result in elevated nitrate, nitrite, and ammonia concentrations in drainage from waste rock dumps and mines (eg Ferguson and Leask, 1988). A simple estimate of the effect can be made from explosives usage and anticipated explosives losses. An informal survey by C. Hoag in March 2011 of the water quality conditions at several large open pit copper mines in Arizona and of the Apache Nitrogen product test facility in Arizona indicates that anthropogenic nitrate+nitrite is not typically noted above the relevant numeric groundwater standards. The possible explanation is that mine rock is typically very dry and the residues volatilize resulting in this not being an important source in Arizona. Elevated anthropogenic nitrate+nitrite has been noted in historic tailings facilities where sewage disposal was incorporated in the tailings slurry, but this is not planned at the proposed Rosemont operation. No further action is required though Tetra Tech should acknowledge their predictions did not consider explosives residual leaching.

Tetra Tech acknowledges that explosives residual leaching was not considered in the starting solution associated with Waste Rock Storage Area. However, adding a residual impact to the model would have no impact on the overall predicted results. In addition because of the high solubility and mobility of nitrate, it is not anticipated that it will build up in the system, but rather be flushed from the pit walls and waste rock by precipitation or dust suppression activities, keeping the concentrations low.

> *Section 3.2.1.1. Items 7 and 8; Section 3.2.3.1 Item 1*
>
> SRK has reviewed the conceptual plan for testing waste characteristics and segregating waste according to acid-generating or non-acid generating capacity as described in (Tetra Tech, 2009; 2010h) . Rosemont plans to place non-acid generating and potentially acid generating (PAG) waste materials in a manner that segregates or co-mingles them as required to minimize impacts to groundwater. PAG materials will not be placed on the perimeter surfaces used to buttress the tailings storage facility, in the starter dams, drains, or in channel-grading fills. PAG materials will be placed in the waste rock facility and isolated to the greatest extent possible. On a daily or weekly basis, some acid-generating materials may be exposed on the outer face of the Waste Storage Facility, but will be covered in the succeeding day or week by non-acid generating materials depending on the short-term mine plan for any particular day or week. Total sulfur analyses (with potential carbon content analysis) by an onsite laboratory were proposed for periodic sampling and waste classification (Tetra Tech, 2009, p. 166).
>
> The conceptual planned identification and segregation methods look reasonable, but SRK recommends Rosemont provide additional engineering detail (or provide references to the details in another document) on implementation of the concepts, how the proposed approach will limit water contact with the PAG materials, what the potential for upsets might be, and benchmarking the planned procedures against procedures used at similar operations (i.e. Robinson Mine) to address this issue. Some items to clarify in Tetra Tech (2010c) related to

waste management include:

- Has Rosemont or others prepared a conceptual dump plan to address waste segregation of PAG materials using the life-of-mine plan and known proportions of PAG rock types through the mine life?

The block model used to develop the mine plan has an identifier for potentially acid generating (PAG) materials. The table below summarizes the occurrence of PAG materials identified in the block model per pit phase.

Pit Phase	Total Waste Rock (ktons)	PAG Waste Rock (ktons)	PAG Waste (%)
1	120,651	244	0.20
2	85,368	294	0.34
3	97,205	3,966	4.08
4	107,533	12,296	11.43
5	110,954	8,864	7.99
6	479,066	12,271	2.56
7	12,271	110	0.05
TOTALS	**1,231,465**	**38,045**	**3.1**

Of the total 1,231,465,000 tons of waste rock, only 38,046,000 tons has been identified as PAG. This amounts to about three (3) percent of the total waste rock tonnage. As noted on the table, only minor amounts of PAG material are generated during the first two pit phases. These waste rock materials will mainly used for constructing the underdrains, perimeter berms, and the dry stack buttress. Due to the minor amount (0.25%) of PAG materials in these pit phases, these materials will be incorporated with the other rock types with a high neutralizing potential. The current waste rock management plan includes placement of PAG materials within the interior of the Waste Rock Storage Area and possibly mixed with non-PAG materials. The Technical Memorandum titled *Rosemont Waste Rock Segregation Plan – Revision 1*, dated January 12, 2011 presents the current plan for operational identification, testing, and placement of PAG material within the Waste Rock Storage Area.

- SRK assumes the bulk of the materials placed initially will be gravel and Willow Canyon Arkose and that pit-internal sulfide waste will dominate the waste materials at the end of the mine life. Will stockpiled inert waste materials or local inert borrow materials be needed to ensure that the acid-generating materials (if any) mined in the later part of the mine life are encapsulated by inert waste?

Based on the table above, very little material is designated as PAG in the last pit phases. Approximately 70 Mt of waste rock materials may need to be rehandled to construct the final lift of the Phase 2 Dry Stack Tailings Facility buttress and for waste rock cover on top of the Phase

2 dry stack tailings. Minor amounts of PAG will be blended with other rock types with a high neutralizing potential while the majority of PAG will be placed to the interior of the Waste Rock Storage Area or covered by non-PAG material. The Tetra Tech Technical Memorandum titled *Rosemont Waste Rock Segregation Plan – Revision 1*, dated January 12, 2011 presents the current plan for operational identification, testing, and placement of PAG material within the Waste Rock Storage Area.

- SRK recommends that that a citation be added to Tetra Tech (2010c) text to refer the reader to the relevant supplementary document that describes the waste-rock identification protocols (for PAG and acid-neutralizing characteristics), proposed laboratory analyses to be done to assess waste classification, and the segregation techniques.

The technical memorandum titled *Rosemont Waste Rock Segregation Plan – Revision 1*, dated January 12, 2011 presents the current plan for operational identification, testing, and placement of PAG material within the Waste Rock Storage Area. This memorandum is provided as Attachment 3.

1.2 Waste Storage Facility Model, Tetra Tech (2010c) (facility name should read Waste Rock Storage Area)

The comments and questions below pertain to model set up, source terms, and model results as they relate to the geochemical model for the Waste Rock Storage Area. It should be noted that the Waste Rock Storage Area flow model resulted in a zero discharge condition. Thus, many of the discussed geochemical source term items and review comments do not improve the model application.

1.2.1 Source of Waste Rock Sample Results, Tetra Tech (2010c) SRK previously commented (2010a, 2010b) that descriptive mineralogy and some bulk materials characterization details are missing from the relevant Tetra Tech reports (Tetra Tech, 2007b; 2007c, 2010c, 2010d). The omitted information includes the copper grade analyses to demonstrate what materials were tested (waste, oxide or sulfide ore) and the mineralogical descriptions of the specific samples tested. Tetra Tech (2010f) has addressed the general sample collection method satisfactorily in *Rosemont Geochemical Sample Selection*. The lack of specific mineralogy or oxidation data available in the Rosemont database was discussed in the teleconference discussions on 10 March 2011.

Tetra Tech (2010h) responded to SRK (2010b) that the bulk characterization information for waste rock characterization was presented in previous Tetra Tech reports (2007b, 2007c) but that they added additional citations in Section 6.3.1 Waste Rock Storage Area (Tetra Tech, 2010c). Tetra Tech response item 7 (2010h, p. 8) lists the sources of waste rock characterization data as Tetra Tech's *Baseline Geochemical Characterization* report (2007b) and the *Geochemical Characterization, Addendum 1* (2007c). Section 6.3.1 on waste rock in the revised report (2010c), however, describes a different source of information for waste rock samples so a typographic error may exist in this section. Section 6.3.1 refers to SPLP and MWMP data generated by testing drill core as documented in *Rosemont Tailings Geochemistry Sample Sources* (Tetra Tech, 2010d); these samples are focused on tailings samples, however, rather than waste rock samples.

- SRK recommends clarifying the source of the waste rock samples in Section 6.3.1.

The reference in Section 6.3.1 is incorrect and should read as follows:

> *"The data used to generate the starting solutions was taken from Synthetic Precipitation Leaching Procedure (SPLP) or Meteoric Water Mobility Procedure (MWMP) testing results created from samples of drill core as documented in the Geochemical Characterization Addendum 1 (Tetra Tech, 2007)."*

From reference section:

> *"Tetra Tech, (2007). Geochemical Characterization, Addendum 1. Prepared for Rosemont Copper Company. Report Dated November 2007."*

- SRK recommends adding a statement in the description of the source of waste rock samples that all waste samples tested were below the relevant cutoff grades for oxide and sulfide ore with citation to the relevant technical memoranda describing waste sample selection method.

By definition, any material presented as representing waste rock for the Rosemont Copper Project are below the cutoff for oxide or sulfide ore, which has been verified against the geochemical assay database for the project.

1.2.2 Model Starting Solutions – Waste Storage Facility (facility name should read Waste Rock Storage Area)

Tetra Tech did not respond to SRK's concern about using dilute leachates from laboratory tests directly without scaling for arid conditions at the site except to acknowledge: "There is much debate about the proper scale up methods applied to this type of data, and there is currently not enough information to implement any type of adjustment." SRK agrees there is a debate but notes that analog site data provides a basis for determining whether small scale tests are providing relevant source terms. SRK provided a reference that can serve as a basis for the comparison. During the call on March 10, 2011, Tetra Tech indicated additional analysis had been done on the topic and this would be provided to SRK for review.

The SRK review team for the EIS provided an example of chemical data for actual field water to rock (W:R) contact solutions (although not at the Rosemont site) compared with laboratory test data. The results of that comparison make it fairly clear that laboratory SPLP, MWMP, as well as humidity cell test results, need to be scaled for *acid conditions.* For alkaline conditions, the agreement between lab and field is much more consistent (although variable). The result is that under alkaline conditions, SPLP test results appear to be reasonable to use, particularly when a reasonable number of measurements for a particular rock material are available.

The illustrations in the reference provided by the SRK review team show that, for alkaline field drainage, MWMP measurements:

- generally, but not always, under predict sulfate,
- are consistent with iron,
- are higher for arsenic, and
- are slightly low for zinc, but generally consistent.

The under prediction of sulfate is likely tied to the weathering of pyrite, which does not substantially occur in MWMP tests. However, in the absence of appreciable pyrite, in a rock anticipated to produce alkaline drainage (e.g., Rosemont rock), the agreement with respect to sulfate is likely better.

These results suggest that SPLP data for major species (sulfate) might be scaled to provide a closer agreement with field solutions and that trace constituents (arsenic and zinc) should *not* be scaled. This is consistent with the discussion above comparing SPLP test results for Rosemont rock with first flush data from HCT tests.

The majority of the waste rock at Rosemont is anticipated to be alkaline (Tetra Tech 2007, Illustration 3.2), with some, but not all, samples of andesite and arkose displaying uncertain character with respect to the formation of low pH drainage. Additional Net Acid Generation (NAG) pH testing (Tetra Tech 2007, Illustration 3.3) further refines waste rock characterization to indicate that even for arkose and andesite, only a very minimal amount of these materials (3 samples of 178 samples of waste rock) can be anticipated to produce low pH drainage. These samples are expected to be associated with limited local occurrences of material containing pyrite at the higher concentrations observed at Rosemont. Therefore, on the basis of these tests any potential drainage from the Rosemont mine is anticipated to be alkaline and that, per the SRK supplied reference, MWMP results provide a reasonable estimate of source term water quality.

> The source of data to calculate the model starting solutions is unclear. Section 6.3.1 of Tetra Tech (2010c, p. 71-72) indicates that average SPLP[2] or MWMP[3] results for each waste rock type were used to represent leachates derived from the rock under climatic conditions. The text in Section 6.3.1 further states that Table 6.1 presents the compiled average results and starting solutions used for each rock type. According to the explanation in Section 6.3.1, the SPLP and MWMP results are derived from tailings test work as documented in the technical memorandum *Rosemont Tailings Geochemistry Sample Sources* (Tetra Tech, 2010d).
>
> - SRK assumes there is a reference citation error in Section 6.3.1. Could Tetra Tech confirm that the leachate chemistry from the results of waste rock characterization (Tetra Tech 2007b, 2007c, and 2008) were used as inputs to the fate and transport model for the Waste Rock Storage Facility rather than the chemistry results from tailings characterization work?

The reference in Section 6.3.1 is incorrect and should read as follows:

> *"The data used to generate the starting solutions was taken from Synthetic Precipitation Leaching Procedure (SPLP) or Meteoric Water Mobility Procedure (MWMP) testing results created from samples of drill core as documented in the Geochemical Characterization Addendum 1 (Tetra Tech, 2007)."*

From reference section:

> *"Tetra Tech, (2007). Geochemical Characterization, Addendum 1. Prepared for Rosemont Copper Company. Report Dated November 2007."*

It is difficult to correlate the model starting chemistry shown for each constituent by waste rock type listed in Table 6.1 (Tetra Tech, 2010c) with analyses tabulated in a number of supplementary tables in other supporting documents. For completeness, SRK recommends adding tables (appendix) to the report listing the following information:

- The specific samples and results that were used to calculate the starting chemistry based on the planned proportions of each waste rock type (listed in separate tables by rock type if necessary). Listing the actual values would provide the minimum and maximum values measured and would help the reader verify that the chosen value is representative for each waste type.
- The report or data source, the type of analysis used (SPLP or MWMP), and the calculated average (and standard deviations if calculated) for each rock type.

Please see responses above referencing the source of the geochemical data and its referenced location.

Note 1 below Table 6.1 (Tetra Tech, 2010c) (p. 73) states: "NA = Metal is not part of the rock's composition and therefore was not included in the model's starting solution." SRK previously recommended a clarification on this footnote. The footnote may mislead the reader that the analyses are referring to whole rock analyses. Please clarify that the footnote is referring to SPLP or MWMP leachate results. For example, Table 6.1 lists the aluminum starting solution for a number of rock types as "NA" with an inference from the footnote that aluminum is not part of the rock composition. The whole rock analyses for these rock types, as documented by Tetra Tech (2007b and 2007c), confirm that aluminum is important part of the rock composition for these rock types. This comment applies to a number of other constituents where the solids analyses document the metals are present above detection or are in sufficient concentrations to be considered rock-forming components

- SRK recommends modifying Note 1 to clarify that "NA" is listed for metals that were not detected in SPLP or MWMP leachate chemistry and therefore will not be included in the model's starting solution.

See revised Table 6.1 below for clarified Note 1. Table 6.1 it should be changed to read:

"NA = Metal was not detected in any of that rock type's SPLP or MWMP testing and therefore was not included in the model's starting solution. Thirteen (13) starting solutions were assumed and mixed as appropriate based on the above rock types, i.e., Abrigo, Arkose, etc."

Table 6.1 Model Starting Solutions for the Waste Rock Storage Area Modeling (revised)

Parameter	Units	Abrigo	Arkose	Andesite	Bolsa	Colina	Earp	Epitath	Escabrosa	Horquilla	Concha and Glance	Martin	Overburden and Tertiary Gravel	Quartz Monzonite Porphyry
pH	-	8.22	7.8	7.7	7.0	8.21	7.54	8.43	8.46	8.78	7.42	8.2	7.84	7.41
pe		NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Total Alkalinity		NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Total Dissolved Solids	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Aluminum	mg/L	0.163	0.039	NA	0.104	NA	0.077	NA	NA	NA	NA	NA	0.62	0.46
Arsenic	mg/L	0.008	0.0135	0.0131	NA	NA	0.006	0.007	NA	0.0196	0.0052	NA	0.031	0.0082
Barium	mg/L	0.005	0.0064	0.021	0.003	0.021	0.006	0.016	0.002	0.0099	0.0029	0.002	0.063	0.0191
Carbon	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Calcium	mg/L	5.68	14.5	22.8	2.74	234	6.83	113	5.95	38.4	8.69	5.77	5.29	4.97
Cadmium	mg/L	NA	NA	NA	0.002	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	mg/L	0.795	3.46	3.03	0.508	1.85	0.905	0.88	0.83	36	0.88	1.18	1.18	1.43
Copper	mg/L	NA	0.012	NA	0.068	NA	NA	NA	NA	NA	NA	NA	NA	0.031
Fluoride	mg/L	0.225	0.834	0.89	0.226	1.11	0.423	1.16	0.423	1.46	0.17	0.257	0.32	0.3
Iron	mg/L	NA	NA	NA	0.072	NA	NA	NA	NA	NA	NA	NA	0.333	0.1095
Potassium	mg/L	4.16	6.41	14.8	1.59	2.78	2.31	3.88	1.03	6.64	0.83	2.92	2.72	3.59
Magnesium	mg/L	0.885	2.86	5.21	0.44	3.83	0.709	4.21	1.28	2.235	0.88	2.07	0.583	0.511
Manganese	mg/L	NA	0.0037	0.013	0.169	0.004	NA	NA	NA	NA	NA	NA	0.0064	NA
Molybdenum	mg/L	0.067	NA	NA	NA	0.07	0.113	0.025	0.007	NA	NA	0.015	NA	NA
Nitrite + Nitrate as N	mg/L	NA	0.027	0.042	NA	NA	NA	0.082	NA	0.04	NA	NA	NA	NA
Sodium	mg/L	1.5	14.1	14.6	3.64	2.7	4.38	4.23	1.97	13.7	5.29	1.87	8.9	6.17
Oxygen	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Lead	mg/L	NA	NA	0.0247	NA	NA	NA	NA	NA	NA	NA	NA	0.01737	NA
Sulfate	mg/L	3.08	27.7	75.3	6.18	609	10.2	298	2.78	39.4	6.34	4.4	3.54	2.37
Selenium	mg/L	NA	0.06	0.036	NA	NA	NA	NA	NA	0.1	NA	NA	NA	NA
Zinc	mg/L	NA	NA	NA	0.028	NA	NA	NA	NA	NA	NA	NA	0.01	NA

Notes:

1) NA = Metal was not detected in any of that rock type's SPLP or MWMP testing and therefore was not included in the model's starting solution. Thirteen (13) starting solutions were assumed and mixed as appropriate based on the above rock types, i.e., Abrigo, Arkose, etc.
2) NM = Not measured as part of the testing, but will be part of modeled results, so included for here for completeness.
3) Scherrer, Pre-Cambrian Granodiorite, and the Undefined rock types were not included in the model starting solutions since they are less than 1% of the total Waste Rock Storage Area (as shown in Table 6.2).
4) Where non-detect values occurred, ½ the detection level was added as the input parameter.
5) The Nitrate + Nitrite as N values provided represent only the nitrogen that is present as part of the rock's composition and does not include potential explosive residues.

SRK recommends adding footnote to indicate that the starting chemistry for nitrite + nitrate as N reflects the original rock composition and does not include an additional expected component related to residues from blasting slurry.

In order to address not adding nitrate to represent explosive residuals, Note 4 should be added below Table 6.1 stating:

> *"The Nitrate + Nitrite as N values provided represent only the nitrogen that is present as part of the rock's composition and does not include potential explosive residues."*

See revised Table 6.1 above.

1.2.3 Model Source Terms – Reference to Standards

Tetra Tech has accurately commented that there are no mandated regulatory criteria against which the SPLP, MWMP, (and humidity cell leachate) results should be compared (Tetra Tech, 2010d, p. 5). Leachate test results for operations that are applying for an Aquifer Protection Permit can be compared with the Arizona Aquifer Water Quality Standards (AWQS). This is for reference purposes only but provides an indication of potential impacts resulting from seepage from a discharging facility. Additional comparisons can be made against relevant surface water quality standards or wildlife water quality standards as relevant.

SRK recommends that the analytical results tables for geochemical test work and model source terms should provide the analytical data for all AWQS constituents routinely used by ADEQ for groundwater monitoring related to copper mining and processing facilities because these constituents have numeric standards that may be applied in the baseline or compliance monitoring of the proposed facility. If the leachate results indicate an AWQS constituent is not present above detection, that may be sufficient reason to eliminate it from the model starting solutions or from further discussion, but the approach should be explained. A conservative approach, however, would be to assign an average concentration equal to one-half of the reporting limit for each AWQS constituent that was measured below detection. Additionally, an explanation is expected (such as an explanation of the source of the soluble constituent) when one or more constituents show concentrations that exceed an AWQS.

With these comments in mind, please consider the following:

- AWQS parameters antimony (Sb), beryllium (Be), chromium, Pb, mercury, thallium (Tl), and gross alpha, radium, etc. are missing from the list of parameters included in the model starting solutions and results presented in Table 6.1 and Table 6.7, respectively . SRK recommends adding all AWQS constituents for completeness (with non-detect noted as one-half the reporting limit) or adding a note to explain why an AWQS constituent is omitted.

To simplify the information being presented, only those constituents that were actually present and being considered in the modeling were included in the tables. Antimony, beryllium, chromium, mercury, thallium, gross alpha, and radium were not detected in any of the SPLP or MWMP testing results of the waste rock material so they were not included in the starting solutions. In addition, the predictive modeling was intended to provide a snapshot of the expected water quality discharging from the facilities, and to include non-detected elements would not provide a representative overall solution. There is no justification for including all AWQS constituents if not present in the materials or leachates being considered.

Table 6.7 Waste Rock Storage Area Seepage (revised)

Parameter	AWQS (mg/L)	Waste Rock Seepage (mg/L)
pH	NE	7.73
pe (oxidation potential)	NE	12.9
Total Alkalinity (as $CaCO_3$)	NE	35.9
Total Dissolved Solids	NE	2216
Percent error	NE	0.06
Aluminum	NE	0.114
Arsenic	0.05	0.013
Barium	2	0.013
Carbon	NE	21.1
Calcium	NE	626
Cadmium	0.005	0.0004
Chloride	NE	7.01
Copper	NE	0.007
Fluoride	NE	1.18
Iron	NE	0.001
Potassium	NE	7.42
Magnesium	NE	3.36
Manganese	NE	0.0
Molybdenum	NE	0.055
Nitrite + Nitrate as N	10	0.018
Sodium	NE	18.9
Oxygen	NE	7.43
Lead	0.05	0.003
Sulfur	NE	1531
Selenium	0.05	0.036
Zinc	NE	0.004

Notes:
1) NE = A numeric AWQS has not been established for the constituent
2) Those constituents not detected in the resulting modeled solutions are not included in the seepage results table.

- SRK recommends revising Tables 6.1 and 6.7 to provide consistency between the numbers and names of constituents recorded in the starting solution chemistry and model results. For example, nickel is listed as "NA" for all rock types in Table 6.1 but is omitted from Table 6.7. Total alkalinity, total dissolved solids, carbon (total inorganic carbon?), and Pb are listed in Table 6.7 results but are not listed in the starting solutions. Elemental fluorine (Fl_2) and chlorine (Cl_2) are reported on Tables 6.1 and 6.7 instead of the fluoride (F^-) and chloride (Cl^-), which are the results that were reported in the laboratory analyses. Table 6.1 lists a solution starting chemistry for "sulfate" while Table 6.7 lists modeled results for "sulfur" and Table 6.8 lists model results for combined "sulfate + sulfide."

Those elements that were not present in the resulting modeled solutions were not included in the results table. The results tables were focused on those constituents that are likely to be present. It is acknowledged that there could be some typographical errors in these tables resulting in inconsistencies; however, these have no impact on the overall conclusions of the predictive modeling.

See revised Tables 6.1 and 6.7 above.

Note: The current AWQS for arsenic of 0.05 mg/L is used throughout this memorandum in the revised tables. Previous technical memoranda and reports used a proposed value of 0.01 mg/L.

- The laboratory reporting limits for some constituents used in the models are above the AWQS. For example, the SPLP and MWMP results for Sb and Tl reported in Tetra Tech (2010c, Attachment D) and the SPLP results in of Tetra Tech (2007c, Table A.4) are above the AWQS of 0.006 mg/L and 0.002 mg/L, respectively. SRK recommends adding any subsequent analyses for waste rock samples with reporting limit below the AWQS for these two constituents if they are available.

It is unclear what memo/report to which this comment refers; reference Tetra Tech, 2010c does not contain an Attachment D. It is assumed that SRK is referencing an Attachment D table that originally summarized tailings samples. In the tailings discussion that is part of this Technical Memorandum, the Attachment D summary table was updated in a Tetra Tech memorandum titled *Rosemont Additional Tailings Analysis* (dated March 16, 2011). Tailings samples prepared in 2010 were reanalyzed as needed with detection limits below AWQS.

- The selenium starting solution concentrations for both arkose (0.0135 mg/L) and Horquilla (0.0196 mg/L) exceed the 0.006 mg/L AWQS for selenium. This should be noted or referenced in Section 6.3.1 and/or Table 6.1 (Tetra Tech, 2010c) with some indication of the source of this selenium because arkose comprises more than 44 percent of the waste materials.

Table 6.1 reports the concentration for arkose as 0.06 mg/L and Horquilla as 0.1 mg/L. The values presented above in the review comment refer to the arsenic concentration for these rock types. It is our understanding that the AWQS for selenium is 0.05 mg/L, not 0.006 mg/L as cited. Also, the leach testing of materials does not provide information on the source of selenium in the tested solids. It is an empirical evaluation performed solely to assess what is leached. Knowledge of the source (mineral phase) of the selenium would in no way alter the model calculations made.

- The arsenic starting solution concentrations by rock type do not exceed the AWQS of 0.05 mg/L. The starting concentrations in arkose, andesite, Horquilla and the overburden/gravel, however, would exceed the proposed arsenic AWQS of 0.01 mg/L if this numeric standard is approved. This should be noted in Section 6.3.1 and/or Table 6.1 of Tetra Tech 2010c. Arkose and the overburden comprise approximately 56 percent of the waste materials and will therefore have a dominant impact on generation of any metals in leachate associated with this rock type.

The AWQS for arsenic is 0.05 mg/L, and though a lower value has been proposed it has not been accepted and is not enforced at this time. The information being presented in this study is being compared to the current regulatory limits in place.

- SRK recommends including geochemical model support documentation in an appendix to itemize model input data, minerals used for modeling, and the model output; this could be similar to what was done for the infiltration model.

The input files for the geochemical modeling are provided with this memo as Attachment 2.

1.2.4 Model Results – Seepage Quality

The test work and modeling completed to date show that some individually tested waste materials have the potential to generate acid and metal-bearing leachate based on a comparison with reference standards. When the waste materials are blended in the expected life-of-mine proportions, however, the Waste Rock Storage Facility is expected to generate near-neutral seepage with a modeled pH of 7.73. The quantity of impacted seepage in gallons per minute (gpm) is forecast to be *de minimus* as shown by the results of the infiltration model.

The seepage water quality for the majority of constituents analyzed and modeled to date will not exceed the relevant AWQS. A conclusive opinion is not possible on the constituents where the laboratory method reporting limit exceeds the AWQS (primarily Sb and Tl) or where the analyses were not performed (radiochemicals).

- SRK recommends confirmatory analyses on a small set of representative samples, if they haven't been done already, to eliminate possible questions about whether these constituents, when compared with the reference AWQS, indicate there is the potential to contribute to groundwater impacts.

Given the lack of seepage from the Waste Rock Storage Facility, confirmatory analyses would not appear to offer any improvement on assessment of contribution to groundwater impacts. Therefore per Rosemont, no additional sampling/analysis of waste rock samples is planned except during the operational phase per the waste rock segregation plan provided as Attachment 3.

The seepage from the Waste Rock Storage Facility is not modeled to generate acid rock drainage or exceed current AWQSs. It may, however, have an arsenic concentration that exceeds the proposed AWQS for arsenic of 0.01 mg/L. Arsenic-bearing minerals have been noted in Rosemont mineralization and are commonly present in arsenopyrite and other trace gangue and ore minerals associated with skarn, carbonate-hosted replacement deposits, and porphyry deposits. As noted by Tetra Tech (2010c) naturally occurring arsenic elevated above 0.01 mg/L has been documented in the groundwater wells and seeps at the project site, which is consistent with this background mineral occurrence.

Data and model results presented in Tetra Tech (2010c) indicate that additional aquifer loading attributable to seepage from the Waste Rock Storage Facility is not anticipated to increase significantly the overall concentration of arsenic, other metals, or sulfate in the local groundwater.

1.3 Heap Leach Facility Model, Tetra Tech (2010c)

The revised report includes additional characterization comments and description about the model starting solutions and results. Some additional clarification is recommended relative to documentation of source terms and results.

The modeling of the heap leach facility has recently been revised. The revised assessment is provided in Attachment 4 in a Technical Memorandum titled *Revised Heap Leach Facility Fate and Transport Modeling and Treatment Options Evaluation*, dated April 12, 2011.

1.3.1 Source of Heap Sample Results, Tetra Tech (2010c)

The model is constructed to use sample geochemistry in the relative proportions of ore material expected to be placed on the Heap Leach Facility. The Heap ore consists of 63 percent arkose, 21 percent quartz monzonite porphyry, and 16 percent andesite. According to documents provided online by Rosemont (WLR Consulting, 2006; M-3, 2009), material placed on the Heap for copper extraction will contain greater than 0.1% TCu copper grade. Section 6.3.2 indicates that the model was constructed by contacting spent ore with water mixed with 0.5% sulfuric acid solution.

SRK recommends adding the following information for clarification and completeness:

- A summary of expected mineralogy for the spent Heap Leach materials (based on column leach residues or materials from similar operations);

As noted elsewhere, Rosemont does not currently possess a mineralogical analysis of lithologies associated with ore and waste rock beyond those that are associated with the basic rock type.

- A table of the minerals and soluble salts that were incorporated into the PHREEQC model for the spent Heap materials; and

The PHREEQC model did not include any soluble salts, but it did include a range of minerals that were allowed to precipitate from solution if they reached an over-saturated condition in the model. The list of minerals allow to precipitate are included in the model input files provided in Attachment 2.

- A table providing the sample IDs/laboratory IDs and relevant analytical data for the samples that were used as the basis for Heap draindown chemistry prior to mixing the draindown with precipitation or seepage from overlying waste rock. Of particular interest, what samples were used to represent leached arkose materials?

The data used for the heap leach model were from MWMP testing leach column material:

Rock Type	Sample ID
Andesite	Andesite Col. Leach
Qmp	QMP Column Leach

1.3.2 Model Starting Solutions – Heap Leach Facility

The model uses the analytical results from test work on column leach residues for the expected Heap rock types. The starting solutions shown in Table 6.3 for leached andesite and quartz monzonite porphyry were traced back to MWMP results presented in Tetra Tech (2007c, Appendix A *Laboratory Results* Table A.6). It was not clear from the text or Table 6.3, however, which results were used to support the starting solutions for arkose. There are two other leach residue samples listed in Table A.6 (Leach-1 and Composite-1) but they appear to be composites rather than leached arkose samples.

Since the *Infiltration, Seepage, Fate and Transport Modeling Report – Revision 1* (Tetra Tech, August 2010), the heap leach facility was re-addressed and a separate memo prepared. The comments raised below are addressed in the updated Technical Memorandum titled:

> *Revised Heap Leach Facility Fate and Transport Modeling and Treatment Options Evaluation*, dated April 12, 2011 (Tetra Tech, 2011)

- SRK recommends amending Table 6.3 to indicate how many samples were used, the range of values measured (max, min, standard deviation), and how the calculation was performed on the solutions for each of the three rock types.

Only one acid leach test was conducted for andesite and quartz monzonite porphyry.

- Please clarify in the text why the starting solution for spent arkose leach ore in the Heap Leach Facility (Table 6.3) is identical to the starting solution chemistry shown for waste rock in Table 6.1 (except for sodium, nitrite+nitrate, and zinc). Different rock/mineral chemistry is expected in leached, acid-equilibrated spent arkose ore materials than is found in the barren, non-leached arkose waste materials so is expected to generate a different leachate quality.

The use of this starting solution was removed from the updated modeling. This change was made (1) because no acid leach tests of arkose ore were conducted and (2) because the acid leached andesite was viewed as a better approximation of acid leached arkose than the leach test results for arkose waste rock that were initially used.

- Please confirm the Heap starting chemistry in Table 6.3 for sodium, nitrite + nitrate, and zinc. The starting chemistry for "Arkose" listed in Table 6.1 appears to contain some typographical errors. Should the starting values be: sodium = 14.1 mg/L, nitrite+nitrate = 0.027, and zinc = NA? Is this a table error or were these the values used in the model?

The use of this starting solution was removed from the updated modeling (see Tetra Tech, 2011 in Attachment 4).

- The pH of solutions derived from contact with leached arkose would be expected to have a lower pH than the 7.8 value used. The post-leach rock materials will be acid equilibrated and would be expected to generate additional acidity relative to non-leached materials in contact with water or dilute sulfuric acid. Is there column leach test work that indicates post-leach residues for arkose will generate near-neutral to slightly alkaline leachates?

The arkose leach chemistry from waste rock characterization, that had the pH noted in the review comment, was replaced with acid leached andesite. This change was made (1) because no acid leach tests of arkose ore were conducted and (2) because the acid leached andesite was viewed as a better approximation of acid leached arkose than the leach test results for arkose waste rock that were initially used. This change is consistent with the review comment noting the elevated pH of the starting solution used.

- The rock types in Tables 6.3 and 6.4 appear to include "Arkose", "Andesite", and "Quartz Monzonite Porphyry." Footnote 2 to Table 6.3 indicates the three starting solutions were for "Abrigo", "Arkose", and "Quartz Monzonite." Footnote 2 should be clarified.

This footnote was to provide clarification on what is meant by rock type and provided Abrigo, Arkose, and Quartz Monzonite as examples of rock types. To clarify this footnote, it should be revised to read:

> *"Two (2) starting solutions were assumed and mixed as appropriate based on the above rock types, (i.e., Andesite and Quartz Monozonite Porphyry)."*

See revised Tables 6.3 and 6.4 below.

1.3.3 Model Source Terms – Reference to Standards

As expected for process solution, the Heap starting solutions have elevated concentrations of metals and are forecast to exceed a number of AWQSs including Be, cadmium (Cd), nickel (Ni), Pb, and selenium and the proposed AWQS for arsenic. For the reader's convenience and understanding, the tables listing the model starting solutions and results should be amended for consistency and clarity.

- Tables 6.3 and 6.8 should have consistent parameters (number of constituents, names) even if some constituents are non-detect in the starting solutions or model results. A note should be added to explain the absence of AWQS constituents such as Sb, Pb, Se, Tl, and gross alpha, radium etc. from the Heap starting solutions in Table 6.3. Chloride and fluoride are incorrectly designated as chlorine and fluorine in Table 6.3. The modeled results in Table 6.8 are missing results for Sb, Be, fluoride, Pb, mercury, Tl, and gross alpha, radium, etc. A note should be added to explain their absence.

The constituents of antimony, lead, selenium, thallium, gross alpha, and radium were not included in the starting solutions because they were not detected in the heap leach material testing results. They were also not included in the modeled at one half the detection limit, because this would be added constituents that have not been determined to be present and would not provide a representative situation. Those elements that were not present in the resulting modeled solutions were not included in the results table. The results tables were focused on those constituents that are likely to be present. It is acknowledged that there could be some typographical errors in these tables resulting in inconsistencies; however, these have no impact on the overall conclusions of the predictive modeling.

See revised Tables 6.3 and 6.4 below.

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Table 6.3 Model Starting Solutions for the Heap Leach Facility Modeling (revised)

Parameters	Units	Andesite	Quartz Monzonite Porphyry
pH		3.34	3.65
pe			
Total Alkalinity	mg/l $CaCO_3$		
Total Dissolved Solids	mg/L		
Sulfate	mg/L	2500	772
Sulfide	mg/L		
Silver	mg/L	0.017	0.007
Aluminum	mg/L	71.4	14
Arsenic	mg/L	0.0039	NA
Barium	mg/L	0.0271	0.0422
Beryllium	mg/L	0.0291	0.0075
Cadmium	mg/L	0.377	0.0849
Calcium	mg/L	526	172
Chloride	mg/L	6.97	2.8
Chromium	mg/L	0.04	0.014
Copper	mg/L	53.1	90.1
Fluoride	mg/L	6.38	1.57
Iron	mg/L	1.09	0.46
Mercury	mg/L	NA	0.00038
Potassium	mg/L	9.81	3.07
Magnesium	mg/L	187	32
Manganese	mg/L	31.1	6.78
Molybdenum	mg/L	0.009	NA
Sodium	mg/L	10.3	6.21
Nickel	mg/L	0.734	0.141
Nitrite + Nitrate as Nitrogen	mg/L	0.122	0.058
Lead	mg/L	0.0342	0.0445
Selenium	mg/L	0.13	NA
Zinc	mg/L	21.5	4.95

Notes:
1) NA = Metal was not detected in any of that rock type's SPLP or MWMP testing and therefore was not included in the model's starting solution.
2) Two (2) starting solutions were assumed and mixed as appropriate based on the above rock types, (i.e., Andesite and Quartz Monozonite Porphyry)

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Table 6.8 Summary of Revised Heap Drain-Down Leachate Quality (revised)

	AWQS	Heap Leachate	Passive Limestone Drain	Passive Biological Treatment
pH		3.04	6.59	6.31
Pe		17.6	14.0	-3.27
Total Alkalinity (mg/l $CaCO_3$)		-173	497	1905
Total Dissolved Solids (mg/L)		2848	2828	1717
Silver (mg/l)		0.005	0.005	0.005
Aluminum (mg/l)		57.7	0.0115	0.127
Arsenic (mg/l)	0.05	0.003	0.002	0.003
Barium (mg/l)	2	0.013	0.011	0.013
Calcium (mg/l)		442	649	237
Chloride (mg/l)		5.980	5.981	5.975
Cadmium (mg/l)	0.005	0.307	0.305	0.002
Chromium, total (mg/l)	0.1	0.034	0.034	0.009
Copper (mg/l)		62.2	0.49	0.002
Fluoride (mg/l)		5.23	1.96	2.64
Iron (mg/l)		4.844E-04	5.30E-09	4.84E-04
Potassium (mg/l)		8.21	8.21	8.20
Magnesium (mg/l)		150	150	105
Manganese (mg/l)		0.214	7.147E-04	0.214
Molybdenum (mg/l)		0.004	0.002	1.476E-29
Nitrate (mg/l)	10	0.107	0.107	0.107
Sodium (mg/l)		9.34	9.34	9.33
Nickel (mg/l)	0.1	0.592	0.593	8.39E-07
Lead (mg/l)	0.05	0.037	0.037	0.037
Sulfide (mg/l)		0.00E+00	0.00E+00	656
Sulfate (mg/l)		2089	1871	0.88
Selenium (mg/l)	0.05	0.099	0.099	7.60E-13
Zinc (mg/l)		17.6	17.6	0.3

1) Those constituents not detected in the resulting modeled solutions are not included in the seepage results table.

- For consistency of presentation, the starting solution chemistry in Table 6.3 should include total alkalinity, total dissolved solids (TDS), and any other relevant non-AWQS constituents reported as results in Table 6.8.

See revised Tables 6.3 and 6.8 above.

1.3.4 Model Results – Particle Tracking and Seepage Quality

A starting chemistry of 7.8 used for 63 percent of the spent Heap materials seems higher than expected and requires more explanation. The modeled seepage pH result of 3.23 as shown in Table 6.8, however, looks reasonable for the no-treatment case. Model results for some constituents such as arsenic, TDS, and sulfate appear low for the untreated seepage and for both treatment steps/options. The copper concentration in arkose for both starting and ending solution concentrations appears to be low – likely owing to the use of barren arkose to represent this material.

The Heap draindown is estimated to be about 10 gpm for 3 years post-leaching. The draindown would generate approximately 14,400 gallons per day during this expected timeframe, which will collect in the double-lined PLS Pond outfitted with a leak collection and recovery system. Tetra Tech's memorandum *Prescriptive BADCT Closure for the Heap Leach Facility Ponds*, (Tetra Tech, 2010a, p. 2) indicates that "contained solutions will be allowed to evaporate (in the pond or on top of the spent ore) or pumped to the SW-EW (sic) Plant for processing or possible treatment and/or incorporation into the sulfide ore circuit." The PLS Pond was designed to contain routine 8-hr operational flows of 2,500-3,000 gpm and temporary 24-hr draindown flows as described the leaching facility design criteria (Tetra Tech (2007a), so it appears to have adequate capacity to handle the draindown flow at the post-closure rate.

The Heap closure plan (Tetra Tech 2010a) proposes to manage the residual draindown by a one- or two-stage treatment process using the existing double-lined ponds. The modeled results for the two treatment options shown in Table 6.8 (Tetra Tech, 2010c) show three constituents (Cd, Ni, and Se) will remain above their respective AWQS after treatment. Ultimately, the treated draindown is proposed to be disposed of through evaporation (natural or by wobblers or other devices), processing in a SX-EW Plant, or by incorporation into the sulfide process circuit. Other remediation methods to treat acidic, metal-bearing drainage are also locally in use[4]. All of the methods Rosemont proposed for treatment and disposal are reasonable handling methods for the Heap draindown solution. As commented previously, SRK cautions the draindown may take longer than 3 years.

1.4 Dry Stack Tailings Facility Model, Tetra Tech (2010c)

The comments below address additional comments and questions related to the geochemical model set up, source terms, and model results for the Dry Stack Tailings Storage Facility.

1.4.1 Source of Dry Stack Tailings Samples and Model Construction

Tetra Tech (2010d; 2010e) provided extensive documentation of the drillhole names/footage intervals and coarse reject materials composited for tailings test work. The samples were prepared and tested by Mountain States to simulate the milling, flotation, and concentration procedures used in sulfide processing operations. The residual tailings materials were analyzed by Arizona-certified laboratories although the reporting or method detection limits used for some parameters were too high to confirm their concentration relative to AWQS. The nine[5] samples, although limited in nature, appear to be representative of the tailings to be generated during the first 7 years of operation.

The procedures used to set up the conceptual model and to model the particle flow path and expected geochemical characterization follow standard industry procedures. Some additions or clarifications in the support documentation, input descriptions, and table presentations, as described below, would improve model documentation and reader understanding.

1.4.2 Model Starting Solutions – Dry Stack Tailings Facility

The starting solutions for the Dry Stack Tailings Storage Facility listed in Table 6.5 match the MWMP values presented in Attachment D (Tetra Tech, 2010d) so can be easily traced back to the original sample results. The only exception is the model starting solution of pH 7.82 for the 2010 Horquilla sample in Table 6.5 versus the reported result of 8.2 in Tetra Tech (2010d, Attachment D). To improve model documentation, SRK recommends the following changes:

- Add a footnote to Table 6.5 indicating the results are based on the MWMP results tabulated in the relevant Tetra Tech report (2010d, Attachment D).

See revised Tables 6.5 and 6.9 below.

- Use consistent numbers of parameters and parameter names in Tables 6.5 and 6.9.

See revised Tables 6.5 and 6.9 below.

Table 6.5 Model Starting Solutions for the for the Dry Stack Tailings Facility (revised)

Parameter	Units	Tailings-022807	Escabrosa	Tailings-05 June2007	Year 0-3 Tailings	4-7 Yr. Composite	Horquilla (2010)	Colina (2010)	Epitaph (2010)	Earp (2010)
Rock Type		*Horquilla*	*Escabrosa*	*Horquilla*	*Composite*	*Composite*	*Horquilla*	*Colina*	*Epitaph*	*Earp*
Final pH		NM	8.81	7.43	8.51	8.2	7.82	8.42	6.47	6.86
pe		NM	NM	NM	NM	NM	NM	NM	NM	NM
Total Alkalinity	mg/L as $CaCO_3$	NM	NM	NM	NM	NM	NM	NM	NM	NM
Total Dissolved Solids	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	NM
Barium	mg/l	ND	0.02	0.02	0.02	0.0191	0.008	0.0346	0.0266	0.0297
Carbon	mg/L	NM	NM	NM	NM	NM	NM	NM	NM	NM
Calcium	mg/l	8.78	27.1	103	150	52.6	29.4	658	557	151
Chloride	mg/l	0.36	0.35	5.69	5.18	6.27	3.56	4.14	ND	3.51
Copper	mg/l	ND	ND	ND	ND	ND	ND	0.011	0.016	0.01
Fluoride	mg/l	1.25	1.00	1.02	1.11	6.49	1.05	2.76	0.944	1.25
Magnesium	mg/l	0.23	1.30	0.65	1.91	13.8	0.535	15.5	148	11.4
Manganese	mg/l	ND	0.007	0.02	0.02	0.0081	ND	ND	0.0988	0.0372
Mercury	mg/l	ND	ND	0.00033	ND	ND	ND	ND	ND	ND
Molybdenum	mg/l	NM	NM	0.46	0.46	NM	NM	NM	NM	NM
Potassium	mg/l	0.62	0.86	8.33	11.30	11.6	4.97	5.53	17.9	15
Selenium	mg/L	NM	ND	ND	ND	ND	ND	0.048	ND	ND
Sodium	mg/l	2.57	2.10	27.60	37.10	33.9	19.3	15.4	32.6	33.9
Sulfate, SO4	mg/l	6.95	61.5	285	441	264	91.1	1560	1960	435
Nitrate + Nitrite as N	mg/l	0.04	ND	0.02	NM	NM	NM	NM	NM	NM

Notes:

1) ND = Parameter was not detected during sample testing and therefore was not included in the model's starting solution.
2) NM = Parameter not measured

Table 6.9 Dry Stack Tailings Facility Seepage (revised)

Parameter	AWQS (mg/L)	Tailings Seepage (mg/L)
pH	NE	5.87
pe	NE	14.7
Total Alkalinity (as $CaCO_3$)	NE	0.206
Total Dissolved Solids	NE	810
Percent error	NE	2.77
Barium	2.00	0.017
Carbon	NE	0.909
Calcium	NE	188
Chloride	NE	3.98
Fluoride	NE	2.37
Potassium	NE	9.35
Magnesium	NE	19.61
Molybdenum	NE	0.076
Sodium	NE	26.5
Nitrite + Nitrate as N	NE	0.001
Selenium	NE	0.006
Sulfate	NE	559

NE = A numeric AWQS has not been established for the constituent.

1.4.3 Model Source Terms – Reference to Standards

Section 6.3.3 provides a good summary of the nine tailings samples. The text explains that a number of parameters were not included in the starting solutions listed in Table 6.5 owing to lack of detection in the samples. This is sufficient reason to eliminate them from further modeling or discussion as long as the reporting limits are below the AWQS numeric value.

The presence or absence of two parameters is not known because the laboratory reporting limit exceeded the AWQS numeric value for all of the Sb analyses and the majority of Tl analyses.

- SRK recommends adding a footnote to Table 6.5 to reiterate the omission of the parameters specified in Section 6.3.3 as well as other AWQS parameters such as nitrite+nitrate as N, gross alpha, and radium.

Those elements that were not present in the resulting modeled solutions (i.e., manganese, mercury, etc.) were not included in the results table. The results tables were focused on those constituents that are likely to be present. It is acknowledged that there could be some typographical errors in these tables resulting in inconsistencies; however, these have no impact on the overall conclusions of the predictive modeling. See revised Table 6.5 above.

1.4.4 Model Results – Particle Tracking and Seepage Quality

The particle tracking approach and seepage quality results appear reasonable.

Seepage from the Dry Stack Tailings Facility is expected to occur over a long period as the residual pore water drains down and will vary seasonally. The average quantity of seepage is expected to be minimal at approximately 8.4 gallons per minute (gpm) or 0.0074gpm/acre.

The information reviewed to date indicates the tailings seepage quality results, when compared with AWQS for reference purposes only, will not to exceed AWQSs. The only exception to this statement is that sufficient analytical data are not available for Sb, Tl, and radionuclides to make a determination for these parameters. The seepage is expected to be elevated in sulfate with a slightly acidic pH of 5.87.

A revised Table D is provided as Attachment 5 to this Technical Memorandum in a Tetra Tech memorandum titled *Rosemont Additional Tailings Analysis* (dated March 16, 2011) that provided updated tailings test results with detection limits set below the AWQS. Attachment 6 provides laboratory analysis results on radiochem analyses performed on tailings samples generated in 2010. The results of this testing generally show non-detectable or very low levels of the radiochem parameters. It is not anticipated that this will have an impact on the overall conditions.

2 RECOMMENDATIONS

For the fate and transport components of the model report, SRK has the following recommendations:

Clarify the source citations for the samples used for the three geochemical models.

- For models consisting of calculated starting solutions based on a number of analyses, include tables or an appendix (or reference to such tables) showing the samples used including type (SPLP or MWMP) so that the range of values can be reviewed and the basis for the starting calculations verified.
- Standardize the names and numbers of parameters listed on all starting solution and model results tables. Include all relevant AWQS regulated constituents even if the inputs are below detection in the starting solutions or model results. Correct the minor typographical errors in the tables and add footnotes to clarify definitions and source data.
- Provide model input/run documentation for each model. Explain the basis for using chemical analyses from arkose waste rock to model the leachate expected from acid-equilibrated spent arkose leach ore.

Please see previous discussions and responses.

3 REFERENCES

AMEC, 2009, Rosemont Copper Company, Dry stack tailings storage facility, Final design report: unpublished report prepared for Rosemont Copper Company, AMEC Project 842-1191, 54 p., 7 appendices.

Ferguson, K.D. and Leask, S.M., 1988, The export of nutrients from surface coal mines: Environment Canada, Regional Program Report 87-11.

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_____, 2010a, Prescriptive BADCT closure for the Heap Leach Facility: unpublished report prepared for Rosemont Copper, Tetra Tech Project No. 004/10-320807, January 14, 2010, 4 p.

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_____, 2010d, Rosemont tailings geochemistry sample sources: unpublished technical memorandum prepared for Rosemont Copper Company by M. Dieckhaus, Tetra Tech Project No. 236/10320887-5.3, August 30, 2010, 7 p., 1 attachment.

_____, 2010e, Rosemont 2006-2008 tailings material sample sources: unpublished technical memorandum prepared for Rosemont Copper Company by M. Dieckhaus, Tetra Tech Project No. 235/10-320887-5.3, August 30, 2010, 4 p., 4 attachments.

_____, 2010f, Rosemont geochemical sample selection: unpublished technical memorandum prepared for Rosemont Copper Company by A.L. Hudson, Tetra Tech Project No. 257/10-320884-5.3, October 26, 2010, 4 p., 1 attachment.

_____, 2010g, Rosemont SPLP usage for pit wall runoff: unpublished technical memorandum prepared for Rosemont Copper Company by M.A. Williamson, Tetra Tech Project No. 256/10-320884-5.3, October 26, 2010, 3 p., 1 attachment.

_____, 2010h, Rosemont infiltration, seepage, fate and transport response to comments: unpublished technical memorandum prepared for Rosemont Copper Company by A. Hudson, Tetra Tech Project No. 268/10-320884-5.3, November 23, 2010, 24p.

_____, 2010i, Rosemont preliminary geochemistry review response to comments: unpublished technical memorandum prepared for Rosemont Copper Company by A. Hudson, Tetra Tech Project No. 269/114-320884-5.3, November 23, 2010, 128p.

WestLand Resources, Inc., 2007, Mine plan of operations: unpublished report prepared for Augusta Resource Corporation, WestLand Project No. 1049.05 B 700, 106 p., 4 appendices.

WLR Consulting, Inc., 2006, Mineral resources estimate – Revised technical report for the Rosemont deposit, Pima County, Arizona, USA: public document prepared for Augusta Resource Corporation and submitted to the Canadian Securities Administrators in the online SEDAR filing system, April 21, 2006, 68 p.

[1] Conference call with S. Day, C. Hoag, C. Stone, SRK; D. Ortman; S. Shafiquallah, M. Roth, CNF; M. Williamson, A. Hudson, Tetra Tech

[2] Synthetic Precipitation Leaching Procedure

[3] Meteoric Water Mobility Procedure

[4] The BioteQ plant treating the drainage from a low-grade heap stockpile in Bisbee is an example

[5] The 2006 sample was discarded as the reporting limits were higher than the respective AWQS values.

ATTACHMENT 1
SRK TECHNICAL MEMORANDUM TITLED
TECHNICAL REVIEW OF INFILTRATION, SEEPAGE, AND FATE AND TRANSPORT MODELING REPORT – REVISION 1, PART 2 GEOCHEMICAL FATE AND TRANSPORT MODELING
(DATED APRIL 14, 2011)

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Technical Memorandum

To:	Dale Ortman, P.E.	**Date:**	April 14, 2011
Copy to:	Tom Furgason, SWCA File, SRK	**From:**	Stephen Day, P.Geo. Corolla Hoag, P.G.
		Project #:	183101
Subject:	Technical Review of *Infiltration, Seepage, Fate and Transport Modeling Report – Revision 1*, Part 2 Geochemical Fate and Transport Modeling		

A technical review has been undertaken and this Technical Memorandum prepared at the request of SWCA and the Coronado National Forest, in accordance with a request for a Statement of Work dated December 2, 2010. Provided here are comments related to the review of *Infiltration Seepage, Fate and Transport Modeling Report–Revision 1* prepared for the Rosemont Copper Company by Tetra Tech (Tetra Tech, 2010c) and the Technical Memorandum *Rosemont Infiltration, Seepage, Fate and Transport Response to Comments*, (Tetra Tech, 2010h). Stephen Day and Corolla Hoag of SRK Consulting (SRK) prepared these comments, which address some of the discussion held in a teleconference with Tetra Tech and Coronado Forest Service personnel[1] on 10 March 2011. Editorial review was provided by Claudia Stone, also of SRK.

Previous reports related to geochemical characterization, seepage, fate and transport models were used for reference. These documents include:

- *Mine Plan of Operations* (WestLand Resources, 2007)
- *Geologic Report, Relogging Program at the Rosemont Porphyry Skarn Copper Deposit* (Augusta Resource Corporation, 2007)
- *Baseline Geochemical Characterization, Rosemont Copper* (Tetra Tech 2007b)
- *Geochemical Characterization, Addendum I, Rosemont Copper* (Tetra Tech 2007c)
- *Dry Stack Tailings Storage Facility Design Report* (AMEC, 2009, Appendix D)
- *Geochemistry Sample Update* (Tetra Tech, 2008)
- *Rosemont Tailings Geochemistry Sample Sources*, Technical Memorandum, August 30, 2010 (Tetra Tech, 2010d). These documents include:
  - A – *Rosemont 2006-2008 Tailings Material Sample Sources*, August 30, 2010 (Tetra Tech, 2010e)
    - Attachment 1 – *Tailings Geochemistry*, Technical Memorandum, March 24, 2009, 7p.
    - Attachment 2 – 2006-2008 *Tailings Material Sample Metallurgical Database Codes*, Excel table, August 2010, 3 p.
    - Attachment 3 – 2006-2007 *Tailings Material Sample Cores*, Excel table including rock type, borehole ID, code, depth and type of geochemistry test performed on three samples of Horquilla, August 2010, 1 p.

[1] Conference call with S. Day, C. Hoag, C. Stone, SRK; D. Ortman; S. Shafiquallah, M. Roth, CNF; M. Williamson, A. Hudson, Tetra Tech

  - o Attachment 4 – 2008 *Tailings 0-3 Year Composite Material Sample Cores*, Excel table containing date, type of sample, laboratory, sample material and rock type, composite name, data file code, and comments, August 2010, 5 p.
- B – *Tailings Material Sample Metallurgical Database Codes*, Excel table including work date, type of sample, laboratory, material and rock type, composite name, data file code, and comments, August 2010, 2p.
- C – *2010 Tailings Material Sample Cores*, Excel table containing sample rock type, borehole ID, sample type code, depth, and type of geochemistry test performed, August 2010, 24p.
- D – *2010 Summary of Geochemical Data for Tailings Samples*, Excel table containing MWMP and SPLP results for 10 tailings samples, August 2010, 1p.
- E – *SVL Analytical Data for the 2010 Tailings Samples*, Laboratory results for MWMP and SPLP results for 10 tailings samples, August 2010, 1p.

- *Rosemont Geochemical Sample Selection*, October 26, 2010 (Tetra Tech, 2010f)
- *Rosemont Preliminary Geochemistry Review*, *Response to Comments*, Technical Memorandum, November 23, 2010 (Tetra Tech, 2010i).

This memorandum is organized into two sections, corresponding to the two topics under review:

Part 1 - Infiltration and seepage modeling previously addressed (SRK, 2011), and

Part 2 - Fate and transport (geochemical) modeling addressed in this memorandum.

Some remaining comments and recommendations related to the seepage geochemical model and the model documentation are addressed below. The report comments are related to recommendations to improve clarity and model documentation.

1 FATE AND TRANSPORT (GEOCHEMICAL) MODELING

Tetra Tech (2010c) used standard industry methods to prepare conceptual models for the movement of precipitation, draindown process solutions, and entrained pore fluids through the proposed Waste Rock Storage Facility, Heap Leach Facility, and the Dry Stack Tailings Facility. They used CTRAN/W to perform the particle tracking model. The computer code PHREEQC (version 2.15.06) was used to model the resulting water quality in conjunction with the WATEQ4F database. WATEQ4F includes thermodynamic and kinetic parameters for minerals relevant to the rock types and mineralization expected at Rosemont. These methods and software codes conform to current industry standards for geochemical modeling.

Tetra Tech revised and improved the report illustrations and text in the revised report (2010c). SRK recommends the following additional revisions in the reporting of method, results, and table presentation to make the modeling approach clearer to the public and other technical reviewers and the document more complete as a “stand-alone” document. In particular, the report would benefit from:

- Compiled tables (or reference to existing compilation) showing which actual samples Tetra Tech used to calculate the starting solutions for each model and model rock type and the calculation method used to assign an average starting solution chemistry if more than one sample was used to derive the concentration. This would enable the reader to assess the reasonableness of the method used to calculate the average starting solution as well as the representativeness of the results.
- Additional citations in the text that reference or clarify the documents in which the geochemical data are presented and compiled.
- Documentation on PHREEQ inputs and outputs.

1.1 Brief Responses to Comments in Tetra Tech 2010h

The Tetra Tech memo *Rosemont Infiltration, Seepage, Fate and Transport Response to Comments* dated November 23, 2010 (Tetra Tech, 2010h) addressed a number of questions brought up in a SRK memo (2010c) dated April 30, 2010. Only a few items were not addressed or were not addressed in sufficient detail. The Tetra Tech (2010h) sections and item numbers are provided for reference.

Section 3.2.1.1 Item 1 Provide detailed site mineralogy to calibrate the ABA method results

Detailed mineralogy is not part of the physical sample descriptions in any of the geochemical characterization reports that have been made available to SRK; the information provided is of a general nature (host rock type only). SRK understands from a discussion with Tetra Tech on 10 March 2011 that Tetra Tech did have access to the Rosemont assay database to query the database and select relevant sample intervals based on rock type, grade, and location within the project area, but that detailed mineralogy descriptions for the samples tested is not present in the existing records. SRK requests that a table be included in the model report showing the assumptions for the mineralogical sources of the acid generation potential, acid neutralization capacity, and soluble sulfate.

Section 3.2.1.1 Item 2 Evaluate the soluble form of sulfur

Section 6.3 in the updated report does not provide the requested explanation of the mineralogical source of soluble sulfate expected at Rosemont. It is expected that jarosite is not present but this needs to be confirmed. This would be addressed by a mineralogy assumption table as mentioned above.

Section 3.2.1.1 Item 3 Evaluate the possible effect on neutralization potential of carbonates that have been converted to silicates (calcsilicates)

Tetra Tech's response is that calibration of ABA for site-specific conditions is not needed due to the dominance of acid consuming minerals. However, potentially ARD generating (APG) materials are present and the classification of ARD potential may be affected by over-estimating NP. It appears the data are not available to reach a conclusion on the issue, but it can be addressed by allowing for a conservative approach for PAG waste rock management. Appropriate analytical methods will need to be developed for operational testing and classification of PAG materials.

Section 3.2.1.1 Item 4 and Section 3.2.3.1 Nitrate from blasting residue

Blasting residue from ANFO or other products is expected and noted at some open pit mining operations. The starting solutions presented in Table 6.1 of Tetra Tech (2010c) consider only natural concentrations of nitrate, nitrite, and ammonia. There is extensive long-term evidence that leaching of explosives residues from waste rock at similar operations in wetter climates can result in elevated nitrate, nitrite, and ammonia concentrations in drainage from waste rock dumps and mines (eg Ferguson and Leask, 1988). A simple estimate of the effect can be made from explosives usage and anticipated explosives losses. An informal survey by C. Hoag in March 2011 of the water quality conditions at several large open pit copper mines in Arizona and of the Apache Nitrogen product test facility in Arizona indicates that anthropogenic nitrate+nitrite is not typically noted above the relevant numeric groundwater standards. The possible explanation is that mine rock is typically very dry and the residues volatilize resulting in this not being an important source in Arizona. Elevated anthropogenic nitrate+nitrite has been noted in historic tailings facilities where sewage disposal was incorporated in the tailings slurry, but this is not planned at the proposed Rosemont operation. No further action is required though Tetra Tech should acknowledge their predictions did not consider explosives residual leaching.

Section 3.2.1.1. Items 7 and 8; Section 3.2.3.1 Item 1

SRK has reviewed the conceptual plan for testing waste characteristics and segregating waste according to acid-generating or non-acid generating capacity as described in (Tetra Tech, 2009; 2010h) . Rosemont plans to place non-acid generating and potentially acid generating (PAG) waste materials in a manner that segregates or co-mingles them as required to minimize impacts to groundwater. PAG materials will not be placed on the perimeter surfaces used to buttress the tailings storage facility, in the starter dams, drains, or in channel-grading fills. PAG materials will be placed in the waste rock facility and isolated to the greatest extent possible. On a daily or weekly basis, some acid-generating materials may be exposed on the outer face of the Waste Storage Facility, but will be covered in the succeeding day or week by non-acid generating materials depending on the short-term mine plan for any particular day or week. Total sulfur analyses (with potential carbon content analysis) by an onsite laboratory were proposed for periodic sampling and waste classification (Tetra Tech, 2009, p. 166).

The conceptual planned identification and segregation methods look reasonable, but SRK recommends Rosemont provide additional engineering detail (or provide references to the details in another document) on implementation of the concepts, how the proposed approach will limit water contact with the PAG materials, what the potential for upsets might be, and benchmarking the planned procedures against procedures used at similar operations (i.e. Robinson Mine) to address this issue. Some items to clarify in Tetra Tech (2010c) related to waste management include:

- Has Rosemont or others prepared a conceptual dump plan to address waste segregation of PAG materials using the life-of-mine plan and known proportions of PAG rock types through the mine life?
- SRK assumes the bulk of the materials placed initially will be gravel and Willow Canyon Arkose and that pit-internal sulfide waste will dominate the waste materials at the end of the mine life. Will stockpiled inert waste materials or local inert borrow materials be needed to ensure that the acid-generating materials (if any) mined in the later part of the mine life are encapsulated by inert waste?
- SRK recommends that that a citation be added to Tetra Tech (2010c) text to refer the reader to the relevant supplementary document that describes the waste-rock identification protocols (for PAG and acid-neutralizing characteristics), proposed laboratory analyses to be done to assess waste classification, and the segregation techniques.

1.2 Waste Storage Facility Model, Tetra Tech (2010c)

The comments and questions below pertain to model set up, source terms, and model results as they relate to the geochemical model for the Waste Storage Facility.

1.2.1 Source of Waste Rock Sample Results, Tetra Tech (2010c)

SRK previously commented (2010a, 2010b) that descriptive mineralogy and some bulk materials characterization details are missing from the relevant Tetra Tech reports (Tetra Tech, 2007b; 2007c, 2010c, 2010d). The omitted information includes the copper grade analyses to demonstrate what materials were tested (waste, oxide or sulfide ore) and the mineralogical descriptions of the specific samples tested. Tetra Tech (2010f) has addressed the general sample collection method satisfactorily in *Rosemont Geochemical Sample Selection*. The lack of specific mineralogy or oxidation data available in the Rosemont database was discussed in the teleconference discussions on 10 March 2011.

Tetra Tech (2010h) responded to SRK (2010b) that the bulk characterization information for waste rock characterization was presented in previous Tetra Tech reports (2007b, 2007c) but that they added additional citations in Section 6.3.1 Waste Rock Storage Area (Tetra Tech, 2010c). Tetra Tech response item 7 (2010h, p. 8) lists the sources of waste rock characterization data as Tetra Tech's *Baseline Geochemical Characterization* report (2007b) and the *Geochemical Characterization, Addendum 1* (2007c). Section 6.3.1 on waste rock in the revised report (2010c), however, describes a different source of information for waste rock samples so a typographic error may exist in this section. Section 6.3.1 refers to SPLP and MWMP data generated by testing drill core as documented in *Rosemont Tailings Geochemistry Sample Sources* (Tetra Tech, 2010d); these samples are focused on tailings samples, however, rather than waste rock samples.

- SRK recommends clarifying the source of the waste rock samples in Section 6.3.1.
- SRK recommends adding a statement in the description of the source of waste rock samples that all waste samples tested were below the relevant cutoff grades for oxide and sulfide ore with citation to the relevant technical memoranda describing waste sample selection method.

1.2.2 Model Starting Solutions – Waste Storage Facility

Tetra Tech did not respond to SRK's concern about using dilute leachates from laboratory tests directly without scaling for arid conditions at the site except to acknowledge: "There is much debate about the proper scale up methods applied to this type of data, and there is currently not enough information to implement any type of adjustment." SRK agrees there is a debate but notes that analog site data provides a basis for determining whether small scale tests are providing relevant source terms. SRK provided a reference that can serve as a basis for the comparison. During the call on March 10, 2011, Tetra Tech indicated additional analysis had been done on the topic and this would be provided to SRK for review.

The source of data to calculate the model starting solutions is unclear. Section 6.3.1 of Tetra Tech (2010c, p. 71-72) indicates that average SPLP[2] or MWMP[3] results for each waste rock type were used to represent leachates derived from the rock under climatic conditions. The text in Section 6.3.1 further states that Table 6.1 presents the compiled average results and starting solutions used for each rock type. According to the explanation in Section 6.3.1, the SPLP and MWMP results are derived from tailings test work as documented in the technical memorandum *Rosemont Tailings Geochemistry Sample Sources* (Tetra Tech, 2010d).

- SRK assumes there is a reference citation error in Section 6.3.1. Could Tetra Tech confirm that the leachate chemistry from the results of waste rock characterization (Tetra Tech 2007b, 2007c, and 2008) were used as inputs to the fate and transport model for the Waste Rock Storage Facility rather than the chemistry results from tailings characterization work?

It is difficult to correlate the model starting chemistry shown for each constituent by waste rock type listed in Table 6.1 (Tetra Tech, 2010c) with analyses tabulated in a number of supplementary tables in other supporting documents. For completeness, SRK recommends adding tables (appendix) to the report listing the following information:

- The specific samples and results that were used to calculate the starting chemistry based on the planned proportions of each waste rock type (listed in separate tables by rock type if necessary). Listing the actual values would provide the minimum and maximum values measured and would help the reader verify that the chosen value is representative for each waste type.
- The report or data source, the type of analysis used (SPLP or MWMP), and the calculated average (and standard deviations if calculated) for each rock type.

Note 1 below Table 6.1 (Tetra Tech, 2010c) (p. 73) states: "NA = Metal is not part of the rock's composition and therefore was not included in the model's starting solution." SRK previously recommended a clarification on this footnote. The footnote may mislead the reader that the analyses are referring to whole rock analyses. Please clarify that the footnote is referring to SPLP or MWMP leachate results. For example, Table 6.1 lists the aluminum starting solution for a number of rock types as "NA" with an inference from the footnote that aluminum is not part of the rock composition. The whole rock analyses for these rock types, as documented by Tetra Tech (2007b and 2007c), confirm that aluminum is important part of the rock composition for these rock types. This comment applies to a number of other constituents where the solids analyses document the metals are present above detection or are in sufficient concentrations to be considered rock-forming components

[2] Synthetic Precipitation Leaching Procedure
[3] Meteoric Water Mobility Procedure

- SRK recommends modifying Note 1 to clarify that “NA” is listed for metals that were not detected in SPLP or MWMP leachate chemistry and therefore will not be included in the model’s starting solution.
- SRK recommends adding footnote to indicate that the starting chemistry for nitrite + nitrate as N reflects the original rock composition and does not include an additional expected component related to residues from blasting slurry.

1.2.3 Model Source Terms – Reference to Standards

Tetra Tech has accurately commented that there are no mandated regulatory criteria against which the SPLP, MWMP, (and humidity cell leachate) results should be compared (Tetra Tech, 2010d, p. 5). Leachate test results for operations that are applying for an Aquifer Protection Permit can be compared with the Arizona Aquifer Water Quality Standards (AWQS). This is for reference purposes only but provides an indication of potential impacts resulting from seepage from a discharging facility. Additional comparisons can be made against relevant surface water quality standards or wildlife water quality standards as relevant.

SRK recommends that the analytical results tables for geochemical test work and model source terms should provide the analytical data for all AWQS constituents routinely used by ADEQ for groundwater monitoring related to copper mining and processing facilities because these constituents have numeric standards that may be applied in the baseline or compliance monitoring of the proposed facility. If the leachate results indicate an AWQS constituent is not present above detection, that may be sufficient reason to eliminate it from the model starting solutions or from further discussion, but the approach should be explained. A conservative approach, however, would be to assign an average concentration equal to one-half of the reporting limit for each AWQS constituent that was measured below detection. Additionally, an explanation is expected (such as an explanation of the source of the soluble constituent) when one or more constituents show concentrations that exceed an AWQS.

With these comments in mind, please consider the following:

- AWQS parameters antimony (Sb), beryllium (Be), chromium, Pb, mercury, thallium (Tl), and gross alpha, radium, etc. are missing from the list of parameters included in the model starting solutions and results presented in Table 6.1 and Table 6.7, respectively . SRK recommends adding all AWQS constituents for completeness (with non-detect noted as one-half the reporting limit) or adding a note to explain why an AWQS constituent is omitted.

- SRK recommends revising Tables 6.1 and 6.7 to provide consistency between the numbers and names of constituents recorded in the starting solution chemistry and model results. For example, nickel is listed as “NA” for all rock types in Table 6.1 but is omitted from Table 6.7. Total alkalinity, total dissolved solids, carbon (total inorganic carbon?), and Pb are listed in Table 6.7 results but are not listed in the starting solutions. Elemental fluorine (Fl_2) and chlorine (Cl_2) are reported on Tables 6.1 and 6.7 instead of the fluoride (F^-) and chloride (Cl^-), which are the results that were reported in the laboratory analyses. Table 6.1 lists a solution starting chemistry for “sulfate” while Table 6.7 lists modeled results for “sulfur” and Table 6.8 lists model results for combined “sulfate + sulfide.”

- The laboratory reporting limits for some constituents used in the models are above the AWQS. For example, the SPLP and MWMP results for Sb and Tl reported in Tetra Tech (2010c, Attachment D) and the SPLP results in of Tetra Tech (2007c, Table A.4) are above the AWQS of 0.006 mg/L and 0.002 mg/L, respectively. SRK recommends adding any subsequent analyses for waste rock samples with reporting limit below the AWQS for these two constituents if they are available.

- The selenium starting solution concentrations for both arkose (0.0135 mg/L) and Horquilla (0.0196 mg/L) exceed the 0.006 mg/L AWQS for selenium. This should be noted or referenced in Section 6.3.1 and/or Table 6.1 (Tetra Tech, 2010c) with some indication of the source of this selenium because arkose comprises more than 44 percent of the waste materials.

- The arsenic starting solution concentrations by rock type do not exceed the AWQS of 0.05 mg/L. The starting concentrations in arkose, andesite, Horquilla and the overburden/gravel, however, would exceed the proposed arsenic AWQS of 0.01 mg/L if this numeric standard is approved. This should be noted in Section 6.3.1 and/or Table 6.1 of Tetra Tech 2010c. Arkose and the overburden comprise approximately 56 percent of the waste materials and will therefore have a dominant impact on generation of any metals in leachate associated with this rock type.

- SRK recommends including geochemical model support documentation in an appendix to itemize model input data, minerals used for modeling, and the model output; this could be similar to what was done for the infiltration model.

1.2.4 Model Results – Seepage Quality

The test work and modeling completed to date show that some individually tested waste materials have the potential to generate acid and metal-bearing leachate based on a comparison with reference standards. When the waste materials are blended in the expected life-of-mine proportions, however, the Waste Rock Storage Facility is expected to generate near-neutral seepage with a modeled pH of 7.73. The quantity of impacted seepage in gallons per minute (gpm) is forecast to be *de minimus* as shown by the results of the infiltration model.

The seepage water quality for the majority of constituents analyzed and modeled to date will not exceed the relevant AWQS. A conclusive opinion is not possible on the constituents where the laboratory method reporting limit exceeds the AWQS (primarily Sb and Tl) or where the analyses were not performed (radiochemicals).

- SRK recommends confirmatory analyses on a small set of representative samples, if they haven't been done already, to eliminate possible questions about whether these constituents, when compared with the reference AWQS, indicate there is the potential to contribute to groundwater impacts.

The seepage from the Waste Rock Storage Facility is not modeled to generate acid rock drainage or exceed current AWQSs. It may, however, have an arsenic concentration that exceeds the proposed AWQS for arsenic of 0.01 mg/L. Arsenic-bearing minerals have been noted in Rosemont mineralization and are commonly present in arsenopyrite and other trace gangue and ore minerals associated with skarn, carbonate-hosted replacement deposits, and porphyry deposits. As noted by Tetra Tech (2010c) naturally occurring arsenic elevated above 0.01 mg/L has been documented in the groundwater wells and seeps at the project site, which is consistent with this background mineral occurrence.

Data and model results presented in Tetra Tech (2010c) indicate that additional aquifer loading attributable to seepage from the Waste Rock Storage Facility is not anticipated to increase significantly the overall concentration of arsenic, other metals, or sulfate in the local groundwater.

1.3 Heap Leach Facility Model, Tetra Tech (2010c)

The revised report includes additional characterization comments and description about the model starting solutions and results. Some additional clarification is recommended relative to documentation of source terms and results.

1.3.1 Source of Heap Sample Results, Tetra Tech (2010c)

The model is constructed to use sample geochemistry in the relative proportions of ore material expected to be placed on the Heap Leach Facility. The Heap ore consists of 63 percent arkose, 21 percent quartz monzonite porphyry, and 16 percent andesite. According to documents provided online by Rosemont (WLR Consulting, 2006; M-3, 2009), material placed on the Heap for copper extraction will contain greater than 0.1% TCu copper grade. Section 6.3.2 indicates that the model was constructed by contacting spent ore with water mixed with 0.5% sulfuric acid solution.

SRK recommends adding the following information for clarification and completeness:

- A summary of expected mineralogy for the spent Heap Leach materials (based on column leach residues or materials from similar operations);
- A table of the minerals and soluble salts that were incorporated into the PHREEQC model for the spent Heap materials; and
- A table providing the sample IDs/laboratory IDs and relevant analytical data for the samples that were used as the basis for Heap draindown chemistry prior to mixing the draindown with precipitation or seepage from overlying waste rock. Of particular interest, what samples were used to represent leached arkose materials?

1.3.2 Model Starting Solutions – Heap Leach Facility

The model uses the analytical results from test work on column leach residues for the expected Heap rock types. The starting solutions shown in Table 6.3 for leached andesite and quartz monzonite porphyry were traced back to MWMP results presented in Tetra Tech (2007c, Appendix A *Laboratory Results* Table A.6). It was not clear from the text or Table 6.3, however, which results were used to support the starting solutions for arkose. There are two other leach residue samples listed in Table A.6 (Leach-1 and Composite-1) but they appear to be composites rather than leached arkose samples.

- SRK recommends amending Table 6.3 to indicate how many samples were used, the range of values measured (max, min, standard deviation), and how the calculation was performed on the solutions for each of the three rock types.

- Please clarify in the text why the starting solution for spent arkose leach ore in the Heap Leach Facility (Table 6.3) is identical to the starting solution chemistry shown for waste rock in Table 6.1 (except for sodium, nitrite+nitrate, and zinc). Different rock/mineral chemistry is expected in leached, acid-equilibrated spent arkose ore materials than is found in the barren, non-leached arkose waste materials so is expected to generate a different leachate quality.

- Please confirm the Heap starting chemistry in Table 6.3 for sodium, nitrite + nitrate, and zinc. The starting chemistry for "Arkose" listed in Table 6.1 appears to contain some typographical errors. Should the starting values be: sodium = 14.1 mg/L, nitrite+nitrate = 0.027, and zinc = NA? Is this a table error or were these the values used in the model?

- The pH of solutions derived from contact with leached arkose would be expected to have a lower pH than the 7.8 value used. The post-leach rock materials will be acid equilibrated and would be expected to generate additional acidity relative to non-leached materials in contact with water or dilute sulfuric acid. Is there column leach test work that indicates post-leach residues for arkose will generate near-neutral to slightly alkaline leachates?

- The rock types in Tables 6.3 and 6.4 appear to include "Arkose", "Andesite", and "Quartz Monzonite Porphyry." Footnote 2 to Table 6.3 indicates the three starting solutions were for "Abrigo", "Arkose", and "Quartz Monzonite." Footnote 2 should be clarified.

1.3.3 Model Source Terms – Reference to Standards

As expected for process solution, the Heap starting solutions have elevated concentrations of metals and are forecast to exceed a number of AWQSs including Be, cadmium (Cd), nickel (Ni), Pb, and selenium and the proposed AWQS for arsenic. For the reader's convenience and understanding, the tables listing the model starting solutions and results should be amended for consistency and clarity.

- Tables 6.3 and 6.8 should have consistent parameters (number of constituents, names) even if some constituents are non-detect in the starting solutions or model results. A note should be added to explain the absence of AWQS constituents such as Sb, Pb, Se, Tl, and gross alpha, radium etc. from the Heap starting solutions in Table 6.3. Chloride and fluoride are incorrectly designated as chlorine and fluorine in Table 6.3. The modeled results in Table 6.8 are missing results for Sb, Be, fluoride, Pb, mercury, Tl, and gross alpha, radium, etc. A note should be added to explain their absence.
- For consistency of presentation, the starting solution chemistry in Table 6.3 should include total alkalinity, total dissolved solids (TDS), and any other relevant non-AWQS constituents reported as results in Table 6.8.

1.3.4 Model Results – Particle Tracking and Seepage Quality

A starting chemistry of 7.8 used for 63 percent of the spent Heap materials seems higher than expected and requires more explanation. The modeled seepage pH result of 3.23 as shown in Table 6.8, however, looks reasonable for the no-treatment case. Model results for some constituents such as arsenic, TDS, and sulfate appear low for the untreated seepage and for both treatment steps/options. The copper concentration in arkose for both starting and ending solution concentrations appears to be low – likely owing to the use of barren arkose to represent this material.

The Heap draindown is estimated to be about 10 gpm for 3 years post-leaching. The draindown would generate approximately 14,400 gallons per day during this expected timeframe, which will collect in the double-lined PLS Pond outfitted with a leak collection and recovery system. Tetra Tech's memorandum *Prescriptive BADCT Closure for the Heap Leach Facility Ponds*, (Tetra Tech, 2010a, p. 2) indicates that "contained solutions will be allowed to evaporate (in the pond or on top of the spent ore) or pumped to the SW-EW (sic) Plant for processing or possible treatment and/or incorporation into the sulfide ore circuit." The PLS Pond was designed to contain routine 8-hr operational flows of 2,500-3,000 gpm and temporary 24-hr draindown flows as described the leaching facility design criteria (Tetra Tech (2007a), so it appears to have adequate capacity to handle the draindown flow at the post-closure rate.

The Heap closure plan (Tetra Tech 2010a) proposes to manage the residual draindown by a one- or two-stage treatment process using the existing double-lined ponds. The modeled results for the two treatment options shown in Table 6.8 (Tetra Tech, 2010c) show three constituents (Cd, Ni, and Se) will remain above their respective AWQS after treatment. Ultimately, the treated draindown is proposed to be disposed of through evaporation (natural or by wobblers or other devices), processing in a SX-EW Plant, or by incorporation into the sulfide process circuit. Other remediation methods to treat acidic, metal-bearing drainage are also locally in use[4]. All of the methods Rosemont proposed for treatment and disposal are reasonable handling methods for the Heap draindown solution. As commented previously, SRK cautions the draindown may take longer than 3 years.

1.4 Dry Stack Tailings Facility Model, Tetra Tech (2010c)

The comments below address additional comments and questions related to the geochemical model set up, source terms, and model results for the Dry Stack Tailings Storage Facility.

1.4.1 Source of Dry Stack Tailings Samples and Model Construction

Tetra Tech (2010d; 2010e) provided extensive documentation of the drillhole names/footage intervals and coarse reject materials composited for tailings test work. The samples were prepared and tested by Mountain States to simulate the milling, flotation, and concentration procedures used in sulfide processing operations. The residual tailings materials were analyzed by Arizona-certified laboratories although the reporting or method detection limits used for some parameters were too

[4] The BioteQ plant treating the drainage from a low-grade heap stockpile in Bisbee is an example.

high to confirm their concentration relative to AWQS. The nine[5] samples, although limited in nature, appear to be representative of the tailings to be generated during the first 7 years of operation.

The procedures used to set up the conceptual model and to model the particle flow path and expected geochemical characterization follow standard industry procedures. Some additions or clarifications in the support documentation, input descriptions, and table presentations, as described below, would improve model documentation and reader understanding.

1.4.2 Model Starting Solutions – Dry Stack Tailings Facility

The starting solutions for the Dry Stack Tailings Storage Facility listed in Table 6.5 match the MWMP values presented in Attachment D (Tetra Tech, 2010d) so can be easily traced back to the original sample results. The only exception is the model starting solution of pH 7.82 for the 2010 Horquilla sample in Table 6.5 versus the reported result of 8.2 in Tetra Tech (2010d, Attachment D). To improve model documentation, SRK recommends the following changes:

- Add a footnote to Table 6.5 indicating the results are based on the MWMP results tabulated in the relevant Tetra Tech report (2010d, Attachment D).
- Use consistent numbers of parameters and parameter names in Tables 6.5 and 6.9.

1.4.3 Model Source Terms – Reference to Standards

Section 6.3.3 provides a good summary of the nine tailings samples. The text explains that a number of parameters were not included in the starting solutions listed in Table 6.5 owing to lack of detection in the samples. This is sufficient reason to eliminate them from further modeling or discussion as long as the reporting limits are below the AWQS numeric value.

The presence or absence of two parameters is not known because the laboratory reporting limit exceeded the AWQS numeric value for all of the Sb analyses and the majority of Tl analyses.

- SRK recommends adding a footnote to Table 6.5 to reiterate the omission of the parameters specified in Section 6.3.3 as well as other AWQS parameters such as nitrite+nitrate as N, gross alpha, and radium.

1.4.4 Model Results – Particle Tracking and Seepage Quality

The particle tracking approach and seepage quality results appear reasonable.

Seepage from the Dry Stack Tailings Facility is expected to occur over a long period as the residual pore water drains down and will vary seasonally. The average quantity of seepage is expected to be minimal at approximately 8.4 gallons per minute (gpm) or 0.0074gpm/acre.

The information reviewed to date indicates the tailings seepage quality results, when compared with AWQS for reference purposes only, will not to exceed AWQSs. The only exception to this statement is that sufficient analytical data are not available for Sb, Tl, and radionuclides to make a determination for these parameters. The seepage is expected to be elevated in sulfate with a slightly acidic pH of 5.87.

2 RECOMMENDATIONS

For the fate and transport components of the model report, SRK has the following recommendations:

- Clarify the source citations for the samples used for the three geochemical models.
- For models consisting of calculated starting solutions based on a number of analyses, include tables or an appendix (or reference to such tables) showing the samples used including type

[5] The 2006 sample was discarded as the reporting limits were higher than the respective AWQS values.

(SPLP or MWMP) so that the range of values can be reviewed and the basis for the starting calculations verified.

- Standardize the names and numbers of parameters listed on all starting solution and model results tables. Include all relevant AWQS regulated constituents even if the inputs are below detection in the starting solutions or model results. Correct the minor typographical errors in the tables and add footnotes to clarify definitions and source data.
- Provide model input/run documentation for each model.
- Explain the basis for using chemical analyses from arkose waste rock to model the leachate expected from acid-equilibrated spent arkose leach ore.

3 REFERENCES

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_____, 2010e, Rosemont 2006-2008 tailings material sample sources: unpublished technical memorandum prepared for Rosemont Copper Company by M. Dieckhaus, Tetra Tech Project No. 235/10-320887-5.3, August 30, 2010, 4 p., 4 attachments.

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4 REVIEWER QUALIFICATIONS

The Senior Reviewer for Geochemistry, Stephen Day, P. Geo., is a Principal Geochemist with SRK Consulting in Vancouver, Canada. Mr. Day has more than 30 years of experience in geochemistry; in particular, he has more than 10 years of experience in the development of waste management plans to address acid rock drainage and leaching of mine wastes in general, as related to hard rock mining. One area of Mr. Day's expertise relevant to the present review is in the development of prediction methods for mine planning and modeling of leachate chemistry.

The reviewer for geochemistry, Corolla K Hoag, R.G., is a Principal Geologist with SRK Consulting in Tucson. Ms. Hoag has 24 years of experience in mining and environmental geology including 10 years of experience in site characterization (geological, hydrogeological, geochemical) of operating and closed copper mining and processing facilities. Relevant experience for similar operations is the collection of geochemical sample data, and compilation and review of leachate chemistry associated with waste rock and tailings storage facilities, in-situ leaching operations, and heap leach operations. Her experience has focused on using site geochemical data for groundwater permitting applications, compliance monitoring, and assessment of engineering controls to demonstrate compliance with Arizona's water quality standards and best available demonstrated control technology (BADCT) requirements to minimize and mitigate impacts to groundwater.

ATTACHMENT 2
PHREEQC INPUT FILES

Dry Stack Tailings PHREEQC model

```
SOLUTION 1 Horquilla 1 (Tailings-022807)
    temp      25
    pH        8.78
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    Ca        8.78
    Cl        0.36
    F         1.25
    Mg        0.23
    K         0.62
    Na        2.57
    S(6)      20
    N         0.04
    -water    1 # kg
SOLUTION 2 Horquilla 2 (Tailings-05June2007)
    temp      25
    pH        7.43
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    Ba        0.02
    Ca        103
    Cl        5.69
    F         1.02
    Mg        0.65
    Mo        0.46
    K         8.33
    Na        27.6
    S(6)      285
    Mn        0.02
    N         0.02
    -water    1 # kg
SOLUTION 3 Years 0-3 Composite
    temp      25
    pH        8.51
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    Ba        0.02
    Ca        150
    Cl        5.18
    F         1.11
    Mg        1.91
    Mo        0.46
    K         11.3
    Na        37.1
    S(6)      441
    Mn        0.02
    -water    1 # kg
SOLUTION 4 Years 4-7 Composite
```

```
    temp      25
    pH        8.2
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    Ba        0.0191
    Ca        52.6
    Cl        6.27
    F         6.49
    Mg        13.8
    Mn        0.0081
    K         11.6
    Na        33.9
    S(6)      264
    -water    1 # kg
SOLUTION 5 Escabrosa
    temp      25
    pH        8.81
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    Ba        0.02
    Ca        27.1
    Cl        0.35
    F         1
    Mg        1.3
    Mn        0.007
    K         0.86
    Na        2.1
    S(6)      61.5
    -water    1 # kg
SOLUTION 6 Horquilla
    temp      25
    pH        7.82
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    Ba        0.008
    Ca        29.4
    Cl        3.56
    F         1.05
    Mg        0.535
    K         4.97
    Na        19.3
    S(6)      91.1
    -water    1 # kg
SOLUTION 7 Colina
    temp      25
    pH        8.42
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    Ba        0.0346
```

```
    Ca        658
    Cl        4.14
    Cu        0.011
    F         2.76
    Mg        15.5
    K         5.53
    Se        0.048
    Na        15.4
    S(6)      1560
    -water    1 # kg
SOLUTION 8 Epitaph
    temp      25
    pH        6.47
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    Ba        0.0266
    Ca        557
    Cu        0.016
    F         0.944
    Mg        148
    Mn        0.0988
    K         17.9
    Na        32.6
    S(6)      1960
    -water    1 # kg
SOLUTION 9 Earp
    temp      25
    pH        6.86
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    Ba        0.0297
    Ca        151
    Cl        3.51
    Cu        0.01
    F         1.25
    Mg        11.4
    Mn        0.0372
    K         15
    Na        33.9
    S(6)      435
    -water    1 # kg
END
MIX 1 Mixing
    1    0.015
    2    0.015
    3    0.15
    4    0.2
    5    0.03
    6    0.28
    7    0.12
    8    0.09
    9    0.1
EQUILIBRIUM_PHASES 1 Minerals that can precipitate
```

```
    Barite    0 0
    Calcite   0 0
    CO2(g)    -3.5 1
    Gypsum    0 0
    O2(g)     -0.67 1
    Witherite 0 0
END
```

Heap Leach PHREEQC Model

```
TITLE Heap Leach Pad Mixing Model
SOLUTION 2 Andesite
    temp      25
    pH        3.34
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    S(6)      2500
    Ag        0.017
    Al        71.4
    As        0.0039
    Ba        0.0271
    Cd        0.377
    Ca        526
    Cl        6.97
    Cr        0.04
    Cu        53.1
    F         6.38
    Fe        1.09
    K         9.81
    Mg        187
    Mn        31.1
    Mo        0.009
    Na        10.3
    Ni        0.734
    N         0.122
    Pb        0.0342
    Se        0.13
    Zn        21.5
    -water    1 # kg
SOLUTION 3 Qmp
    temp      25
    pH        3.65
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    S(6)      772
    Ag        0.007
    Al        14
    Ba        0.0422
    Cd        0.0849
    Ca        172
    Cl        2.8
    Cr        0.014
    Cu        90.1
    F         1.57
    Fe        0.46
    K         3.07
    Mg        32
    Mn        6.78
    Na        6.21
    Ni        0.141
```

```
    N         0.058
    Pb        0.0445
    Zn        4.95
    -water    1 # kg
END
MIX 1
    2    0.758
    3    0.242
EQUILIBRIUM_PHASES 1 Minerals that can precipitate
    Al(OH)3(a) 0 0 precipitate_only
    Anglesite 0 0 precipitate_only
    Barite    0 0 precipitate_only
    Calcite   0 0 precipitate_only
    Cerrusite 0 0 precipitate_only
    CO2(g)    -3.5 1
    CuMoO4    0 0 precipitate_only
    CupricFerrite 0 0 precipitate_only
    Fe(OH)3(a) 0 0 precipitate_only
    Goethite  0 0 precipitate_only
    Gypsum    0 0 precipitate_only
    Jarosite-K 0 0 precipitate_only
    Jarosite-Na 0 0 precipitate_only
    O2(g)     -0.67 1
    Pb(OH)2   0 0 precipitate_only
    Pyrolusite 0 0 precipitate_only
    Witherite 0 0 precipitate_only
SELECTED_OUTPUT
    -file                 C:\Users\amy.hudson\Documents\Projects\Rosemont\EIS
Geochem Response to comments\Model Files\Heap Leach\baseline results.sel
    -totals               Ag  Al  Alkalinity  As  Ba  C  Ca
                          Cd  Cl  Cr  Cu  F  Fe  K
                          Mg  Mn  Mo  N  Na  Ni  Pb
                          S(-2)  S(6)  Se  Zn
SAVE solution 5
END
USE solution 5
REACTION 1
    CH3OH      1
    0.05 moles in 1 steps
EQUILIBRIUM_PHASES 1 Minerals that can precipitate
    Al(OH)3(a) 0 0 precipitate_only
    Anglesite 0 0 precipitate_only
    Antlerite 0 0 precipitate_only
    As2S3(am) 0 0 precipitate_only
    Atacamite 0 0 precipitate_only
    Azurite   0 0 precipitate_only
    Ba3(AsO4)2 0 0 precipitate_only
    Barite    0 0 precipitate_only
    Boehmite  0 0 precipitate_only
    Brochantite 0 0 precipitate_only
    Calcite   0 0.001
    Cd(OH)2(a) 0 0 precipitate_only
    CdMoO4    0 0 precipitate_only
    Cerrusite 0 0 precipitate_only
    Chalcocite 0 0 precipitate_only
    Covellite 0 0 precipitate_only
    Cr(OH)3(am) 0 0 precipitate_only
```

```
    Cu(OH)2   0 0 precipitate_only
    CuMoO4    0 0 precipitate_only
    CupricFerrite 0 0 precipitate_only
    CuprousFerrite 0 0 precipitate_only
    CuSO4     0 0 precipitate_only
    Dolomite  0 0 precipitate_only
    Fe(OH)3(a) 0 0 precipitate_only
    FeS(ppt)  0 0 precipitate_only
    FeSe2     0 0 precipitate_only
    Fluorite  0 0 precipitate_only
    Goethite  0 0 precipitate_only
    Greenockite 0 0 precipitate_only
    Gypsum    0 0 precipitate_only
    Jarosite-K 0 0 precipitate_only
    Jarosite-Na 0 0 precipitate_only
    Magnetite 0 0 precipitate_only
    Malachite 0 0 precipitate_only
    Manganite 0 0 precipitate_only
    Millerite 0 0 precipitate_only
    MoS2      0 0 precipitate_only
    Pb(OH)2   0 0 precipitate_only
    PbMoO4    0 0 precipitate_only
    Se(s)     0 0 precipitate_only
    SeO2      0 0 precipitate_only
    Sphalerite 0 0 precipitate_only
    Tenorite  0 0 precipitate_only
    Witherite 0 0 precipitate_only
    Wurtzite  0 0 precipitate_only
    ZnO(a)    0 0 precipitate_only
    ZnS(a)    0 0 precipitate_only
SELECTED_OUTPUT
    -file                C:\Users\amy.hudson\Documents\Projects\Rosemont\EIS
Geochem Response to comments\Model Files\Heap Leach\bio treatment results.sel
    -totals              Ag  Al  Alkalinity  As  Ba  C  Ca
                         Cd  Cl  Cr  Cu  F  Fe  K
                         Mg  Mn  Mo  N  Na  Ni  Pb
                         S(-2)  S(6)  Se  Zn
END
USE solution 5
REACTION 2
    Calcite    1
    1 moles in 1 steps
EQUILIBRIUM_PHASES 1 Minerals that can precipitate
    Al(OH)3(a) 0 0 precipitate_only
    Anglesite 0 0 precipitate_only
    Antlerite 0 0 precipitate_only
    As2S3(am) 0 0 precipitate_only
    Atacamite 0 0 precipitate_only
    Azurite   0 0 precipitate_only
    Ba3(AsO4)2 0 0 precipitate_only
    Barite    0 0 precipitate_only
    Boehmite  0 0 precipitate_only
    Brochantite 0 0 precipitate_only
    Calcite   0 0.001
    Cd(OH)2(a) 0 0 precipitate_only
    CdMoO4    0 0 precipitate_only
    Cerrusite 0 0 precipitate_only
```

```
    Chalcocite 0 0 precipitate_only
    Covellite 0 0 precipitate_only
    Cr(OH)3(am) 0 0 precipitate_only
    Cu(OH)2   0 0 precipitate_only
    CuMoO4    0 0 precipitate_only
    CupricFerrite 0 0 precipitate_only
    CuprousFerrite 0 0 precipitate_only
    CuSO4     0 0 precipitate_only
    Dolomite  0 0 precipitate_only
    Fe(OH)3(a) 0 0 precipitate_only
    FeS(ppt)  0 0 precipitate_only
    FeSe2     0 0 precipitate_only
    Fluorite  0 0 precipitate_only
    Goethite  0 0 precipitate_only
    Greenockite 0 0 precipitate_only
    Gypsum    0 0 precipitate_only
    Jarosite-K 0 0 precipitate_only
    Jarosite-Na 0 0 precipitate_only
    Magnetite 0 0 precipitate_only
    Malachite 0 0 precipitate_only
    Manganite 0 0 precipitate_only
    Millerite 0 0 precipitate_only
    MoS2      0 0 precipitate_only
    Pb(OH)2   0 0 precipitate_only
    PbMoO4    0 0 precipitate_only
    Se(s)     0 0 precipitate_only
    SeO2      0 0 precipitate_only
    Sphalerite 0 0 precipitate_only
    Tenorite  0 0 precipitate_only
    Witherite 0 0 precipitate_only
    Wurtzite  0 0 precipitate_only
    ZnO(a)    0 0 precipitate_only
    ZnS(a)    0 0 precipitate_only
SELECTED_OUTPUT
    -file                C:\Users\amy.hudson\Documents\Projects\Rosemont\EIS
Geochem Response to comments\Model Files\Heap Leach\lime treatment
results.sel
    -totals              Ag  Al  Alkalinity  As  Ba  C  Ca
                         Cd  Cl  Cr  Cu  F  Fe  K
                         Mg  Mn  Mo  N  Na  Ni  Pb
                         S(-2)  S(6)  Se  Zn
END
```

Waste Rock Storage Area PHREEQC Model

```
SOLUTION 1 Abrigo
    temp      25
    pH        8.22
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    Ba        0.005
    Ca        5.68
    Cl        0.795
    K         4.16
    Mg        0.885
    Na        1.5
    S(6)      25
    Al        0.163
    As        0.008
    F         0.225
    -water    1 # kg
SOLUTION 2 Arkose
    temp      25
    pH        7.8
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    Al        0.039
    As        0.0135
    Ba        0.0064
    Ca        14.5
    Cl        3.46
    Cu        0.012
    F         0.834
    K         6.41
    Mg        2.86
    Mn        0.0037
    Na        14.1
    Se        0.06
    S(6)      70
    N         0.027
    -water    1 # kg
SOLUTION 3 Andesite
    temp      25
    pH        7.7
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    As        0.0131
    Ca        22.8
    Cl        3.03
    F         0.89
    K         14.8
    Mg        5.21
    Mn        0.013
```

```
    Na        14.6
    Pb        0.0247
    Se        0.036
    S(6)      100
    Ba        0.021
    N         0.042
    -water    1 # kg
SOLUTION 4 Bolsa
    temp      25
    pH        7
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    Al        0.104
    Ca        2.74
    Cl        0.508
    Cu        0.068
    F         0.226
    Fe        0.072
    K         1.59
    Mg        0.44
    Na        3.64
    S(6)      20
    Ba        0.003
    Cd        0.002
    Mn        0.169
    Zn        0.028
    -water    1 # kg
SOLUTION 5 Colina
    temp      25
    pH        8.21
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    Ba        0.021
    Ca        234
    Cl        1.85
    F         1.11
    K         2.78
    Mg        3.83
    Na        2.7
    S(6)      609
    Mn        0.004
    Mo        0.07
    -water    1 # kg
SOLUTION 6 Earp
    temp      25
    pH        7.54
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    Al        0.077
    As        0.006
    Ba        0.006
```

```
    Ca        6.83
    Cl        0.905
    F         0.423
    K         2.31
    Mg        0.709
    Na        4.38
    S(6)      30
    Mo        0.113
    -water    1 # kg
SOLUTION 7 Epitath
    temp      25
    pH        8.43
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    As        0.007
    Ba        0.016
    Ca        113
    Cl        0.88
    F         1.16
    K         3.88
    Mg        4.21
    Na        4.23
    S(6)      298
    Mo        0.025
    N         0.082
    -water    1 # kg
SOLUTION 8 Horquilla
    temp      25
    pH        8.78
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    As        0.0196
    Ba        0.0099
    Ca        38.4
    Cl        36
    F         1.46
    K         6.64
    Mg        2.235
    Na        13.7
    Se        0.1
    S(6)      75
    N         0.04
    -water    1 # kg
SOLUTION 9 Limestone
    temp      25
    pH        7.42
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    As        0.0052
    Ba        0.0029
    Ca        8.69
```

```
    Cl        0.88
    F         0.17
    K         0.83
    Mg        0.88
    Na        5.29
    S(6)      40
    -water    1 # kg
SOLUTION 10 Overburden
    temp      25
    pH        7.84
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    Al        0.62
    As        0.031
    Ba        0.063
    Ca        5.29
    Cl        1.18
    F         0.32
    Fe        0.333
    K         2.72
    Mg        0.583
    Mn        0.0064
    Na        8.9
    Pb        0.01737
    Zn        0.0325
    S(6)      35
    -water    1 # kg
SOLUTION 11 Qmp
    temp      25
    pH        7.41
    pe        4 O2(g) -0.67
    redox     pe
    units     mg/l
    density   1
    Al        0.46
    As        0.0082
    Ba        0.0191
    Ca        4.97
    Cl        1.43
    Cu        0.031
    F         0.3
    Fe        0.1095
    K         3.59
    Mg        0.511
    Na        6.17
    S(6)      30
    -water    1 # kg
SOLUTION 12 Escabrosa
    temp      25
    pH        8.46
    pe        4 O2(g) -0.67
    redox     pe
    units     mmol/kgw
    density   1
    S(6)      7
```

```
    Ba        0.002
    Ca        4.3
    Cl        1.1
    F         0.82
    K         0.61
    Mg        1.28
    Mo        0.007
    Na        1.97
    -water    1 # kg
SOLUTION 13 Martin
    temp      25
    pH        8.2
    pe        4 O2(g) -0.67
    redox     pe
    units     mmol/kgw
    density   1
    S(6)      6
    Ba        0.002
    Ca        4.5
    Cl        1.74
    F         0.47
    K         1.55
    Mg        1.1
    Mo        0.015
    Na        1.87
    -water    1 # kg
END
MIX 1
    1    0.092
    2    0.444
    3    0.04
    4    0.019
    5    0.013
    6    0.024
    7    0.022
    8    0.071
    9    0.094
    10    0.1153
    11    0.011
    12    0.019
    13    0.026
EQUILIBRIUM_PHASES 1 Minerals that can precipitate
    Al(OH)3(a) 0 0
    Anglesite 0 0
    Barite    0 0
    Calcite   0 0.003
    Cerrusite 0 0
    Fe(OH)3(a) 0 0
    Gypsum    0 0.1
    Jarosite-K 0 1e-005
    Jarosite-Na 0 0.0003
    Pb(OH)2   0 0
    Pyrolusite 0 0
    Witherite 0 0
    CO2(g)    -3.5 1
    O2(g)     -0.67 1
END
```

ATTACHMENT 3
TETRA TECH TECHNICAL MEMORANDUM TITLED
ROSEMONT WASTE ROCK SEGREGATION PLAN – REVISION 1
(DATED JANUARY 25, 2011)

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Technical Memorandum

To:	Kathy Arnold	**From:**	David Krizek
Company:	Rosemont Copper Company	**Date:**	January 25, 2011
Re:	Rosemont Waste Rock Segregation Plan – Revision 1	**Doc #:**	010/10-320877-5.3
CC:	Amy Hudson (Tetra Tech)		

1.0 Introduction

A Technical Memorandum titled *Rosemont Waste Rock Segregation Plan* (Tetra Tech, 2010) was prepared in response to the April 14, 2010 *Comprehensive Request for Additional Information* from the Arizona Department of Environmental Quality (ADEQ) to Rosemont Copper Company (Rosemont). This request is part of the aquifer protection permit (APP) application (Tetra Tech, 2009) submitted to ADEQ in February 2009 associated with the proposed Rosemont Copper Project (Project) in Pima County, Arizona. Specifically, Tetra Tech (2010) was developed to answer item no. 30a on page 13 of 18 of the April 14, 2010 request for information:

> *Application Vol. 1, February 2009, states "Waste rock will be managed by monitoring potentially acid generating (PAG) and non-acid generating (NAG) materials and placing materials in designated areas." It further states, "Because waste rock will be placed by segregating materials based on acid generating potential and testing results by source type and Waste Rock Storage Area will achieve greater engineering control potential compared to a typical unsegregated waste rock pile."*
>
> *Please provide the following:*
>
> a) *A detailed work plan for segregating potentially acid generating materials, including method of sampling, frequency of sampling, and what triggers or activates segregation and testing procedures;*
>
> *For characterizing waste rock to determine if the material is non-acid generating. Rosemont is referred to the guidelines specified under CHARACTERIZATION OF TAILING, SPENT ORE AND WASTE ROCK contained in the Arizona Mining BADCT Guidance Manual.*

An updated Technical Memorandum titled *Rosemont Waste Rock Segregation Plan – Revision 1* was prepared in response to additional comments received by Rosemont Copper Company in a letter from ADEQ titled *Incomplete Response to Technical Deficiencies* (dated December 3, 2010). Specifically this Technical Memorandum responds to Additional ADEQ's Comment #13 on page 25 of 34 of the December 3, 2010 letter:

> *Rosemont's proposed frequency of ABA testing on at least two random samples per week up to a maximum of 10 samples during one month and conduct quarterly Synthetic*

Precipitation Leaching Procedure, EPA Method 1312, on samples used as buttress or drain materials, is rather general and imprecise. ADEQ recommends that Rosemont should develop a more comprehensive plan to ensure segregation of potentially acid generating material using ABA testing and Synthetic Precipitation Leaching Procedure. Please submit a copy of the comprehensive plan for segregating potentially acid generating material.

2.0 General Project Information

The Project will include both sulfide and oxide ore mining and processing activities. Throughout active mining operations, grade control sampling and analysis will be performed as part of the overall mining process to control plant operations, to verify metals recovery, and to ensure proper segregation of materials.

Oxide ore will be placed on a lined heap leach pad and leached with dilute sulfuric acid. Sulfide ore will be processed in the milling and flotation circuit, with concentrate being shipped off-site for further processing. Tailings will be stored in the Dry Stack Tailings Facility. Waste rock, depending upon its type and characterization, will be placed in the Waste Rock Storage Area, used as buttress material for the Dry Stack Tailings, screening berms for the Waste Rock Storage Area, or used for various fill requirements.

Table 1 identifies the rock types, anticipated material tonnages, and the percentage of that rock type compared to the total anticipated waste rock volume. These tonnages are based on the current P673 pit configuration. Table 1 also lists some of the geochemical characterization tests previously performed on the various waste rock types. Analyses performed included Acid Base Accounting (ABA), net acid generation pH test (NAG pH), whole rock analysis, Synthetic Precipitation Leaching Procedure (SPLP), and Meteoric Water Mobility Procedure (MWMP).

Based on Table 1, approximately 1.2 billion tons of waste rock will be mined from the proposed Rosemont open pit. Mining rates vary but could be up to about 375,000 tons per day, with an average rate of about 210,000 tons per day.

Table 1 Summary of Rosemont Waste Rock Types and Tonnages

Rock Type	Tons of Material	Percent of Material (by weight)	No. of ABA/NAG pH Tests	No. of SPLP Tests	No. of MWMP Tests
Arkose	546,336,000	44.38%	55	8	8
Tertiary Gravel	141,227,000	11.47%	5	0	0
Abrigo	113,815,000	9.24%	6	5	0
Horquilla	87,141,000	7.08%	26	8	2
Glance	80,841,000	6.57%	4	0	0
Andesite	49,118,000	3.99%	38	4	6
Concha	34,107,000	2.77%	6	1	1
Martin	32,304,000	2.62%	7	4	0
Earp	29,577,000	2.40%	14	6	0
Epitaph	27,150,000	2.21%	16	6	0
Escabrosa	22,859,000	1.86%	10	4	0
Bolsa	23,447,000	1.90%	13	6	0
Colina	16,145,000	1.31%	11	4	0
Quartz Monzonite Porphyry	13,047,000	1.06%	9	2	1
Scherrer	8,524,000	0.69%	0	0	0
Pre-Cambrian Granodiorite	4,203,000	0.34%	0	0	0
Undefined	941,000	0.08%	0	0	0
Overburden	391,000	0.03%	6	2	2
Total Amounts	**1,231,173,000**	**100%**	**226**	**60**	**20**

3.0 Summary of Material Classification

As referenced in Section 1, the non-acid generating nature of the material will be based on the section in the Arizona Best Available Demonstrated Control Technology (BADCT) Guidance Manual (ADEQ, 2004) titled Characterization of Tailing, Spent Ore, and Waste Rock (Part A of Appendix B).

ABA analyses previously conducted for the waste rock samples evaluated the potential of the waste rock to generate acid based on Part A: Characterization of Tailing, Spent Ore and Waste Rock of Appendix B of the Arizona Mining BADCT Guidance Manual (ADEQ, 2004). The ABA analyses included a determination of the sulfur content, acid neutralization potential (ANP), and the acid generating potential (AGP) of the waste rock. The sulfur and sulfide content indicates the likelihood of whether the rock type may be acid generating. There are two (2) methods for evaluating ABA analysis results: the net neutralization potential and the neutralization potential ratio.

3.1 Net Neutralization Potential (NNP)

The ANP and the AGP are expressed in units of tons of calcium carbonate ($CaCO_3$) per kiloton of rock (tons $CaCO_3$/kton rock). The difference between the ANP and AGP is defined as the net neutralization potential (NNP) (NNP = ANP-AGP).

In general, a sample would be acid-generating if it has a significant amount of sulfur or sulfide minerals or if its net neutralization potential (NNP) was less than zero (0); however, the risk of acid rock drainage (ARD) has been found to be highest for samples with NNP values less than -20 tons $CaCO_3$/kton rock and is low when the NNP is greater than +20 tons $CaCO_3$/kton rock (Price, 1997).

Appendix B of the BADCT Manual (ADEQ, 2004) provides the following guidance:

- If the NNP is less than –20 tons $CaCO_3$/kton (NNP ≤ –20), then the sample is acid generating;
- If the NNP is between –20 and +20 (–20 < NNP < +20), then the sample is potentially acid generating; and
- If the NNP is greater than +20 (NNP > +20), then the sample is considered non-acid generating.

If NNP is less than -20 tons of $CaCO_3$/kton, it can be considered acid generating. Between -20 and +20, the potential exists for the waste rock to be acid generating. The more positive the NNP, the lower is the risk for the waste rock to be acid generating. When the NNP is above +20, the material can generally be considered non-acid generating. Prediction of the acid generating potential when the NNP is between +20 and -20 tons of $CaCO_3$/kton of sample is more difficult due to uncertainty in analysis and conversion factors.

3.2 Neutralization Potential Ratio

The ratio of ANP to AGP, the neutralization potential ratio (NPR) (NPR = ANP/AGP), can also be used to assess risk of developing acidic rock drainage (ARD). An NPR greater than 3 is thought to have a low ARD risk while samples with an NPR less than one (1) have a high ARD risk (Price, 1997).

The BADCT manual (ADEQ, 2004) provides the following guidance for evaluating the NPR:

- If the ratio is less than or equal to one (1) (ANP/AGP ≤ 1), the sample is likely to be acid generating;
- If the ratio is greater than one (1) but less than three (3), then the sample is potentially acid generating; and
- If the ratio is equal to or greater than three (3) to one (1) (ANP/AGP ≥ 3), then the sample is considered non-acid generating.

Ratios of ANP/AGP can also be used to assess the acid generation potential. An ANP/AGP ratio of 1:1 is equivalent to an NNP of zero (0). If the ratio of a sample's neutralization potential and acid production potential is greater than 3:1, then there is a low risk for acid drainage to develop. For samples with a NPR between 1:1 and 3:1, the uncertainty increases. As a result, additional testing is usually necessary using kinetic test methods as described under the Tire #2 protocols (ADEQ, 2004). Samples with a ratio of 1:1 or less are more likely to generate acid (Smith and Barton-Bridges, 1991).

3.3 Waste Rock Sampling

A total of 226 waste rock samples have been tested to date to evaluate the acid generating and acid neutralizing potential of the material. Based on previous characterization work, twelve (12) of the 226 waste rock samples analyzed for NPR were identified as being likely acid generating;

- Five (5) of 38 samples of Andesite had NPRs indicating that were likely acid generating;
- One (1) of 55 Arkose samples had an NPR indicating that the sample was likely acid generating; and
- The remaining potentially acid generating samples included five (5) Bolsa and one (1) Abrigo sample.

In summary, twelve (12) samples from Andesite, Arkose, Bolsa, Earp, and Qmp rock types had NPR ranges that indicated that the rock types were moderate or uncertain acid generation potential.

The NNPs for the 226 samples indicated that only one (1) sample of Andesite was likely acid generating, and approximately 51 samples of Abrigo, Andesite, Arkose, Bolsa, Earp, overburden, and Qmp, contained NNPs indicative of the type being moderately acid generating or uncertain. Most of these 51 samples were from Andesite, Arkose, and Qmp rock types.

Based on this information, very little of the waste rock at Rosemont has the potential to generate acidic conditions. Therefore, sampling and analysis of waste rock during operation will target specific rock types as well as incorporate an overall characterization plan. The plan would be designed to provide verification of the expected behavior of the materials that have been defined through the previous characterization program.

4.0 Waste Rock Segregation Plan

In general, the plan to segregate acid generating waste rock will be based on observations, sampling, and characterization of samples completed during mining operations. The operational sampling will be compared to prior to testing to verify the expected behavior of the material. Although specific material testing frequencies were not provided, the Global Acid Rock Drainage Guide (GARD) developed by the International Network for Acid Prevention (INAP, 2008) was reviewed and used to develop the plan outlined herein.

During the mining operations, drilling will be completed on 50-foot benches. Variations in lithology and mineralogy/geology, as well as degree and extent of fracturing, will be evaluated by a Rosemont Copper geologist or trained technician. Composites from the drill holes will be assayed as needed to characterize the material as waste rock, oxide ore, or sulfide ore. If waste rock material is identified and determined to be in one of, or include one of, the units (i.e., Andesite, Arkose, etc.) that have been identified as potentially acid generating, sampling and testing of the composite drill hole samples will be targeted to isolate the area within the blast zone that would require special handling. Although any material identified as waste rock will be subject to the operational testing program, the focus will be on those materials previously identified as uncertain or likely to generate acid.

Characterization of these samples will include Acid Base Accounting (ABA) or net acid generation pH test (NAG pH). The degree of sulfide and oxide mineralization would be determined as part of the aforementioned characterization. The data collected through the operational testing program will be added to the existing geochemical database. The full characterization database would be reviewed weekly to ensure the expected behavior of the material, and the characterization of the lithologies, are updated as necessary.

Decisions for segregation, particularly of any potentially acid generating waste rock, will be based on the results of the previous characterization program. Non-acid generating waste rock will be preferentially placed in the east and south haul roads, screening berms, dry stack tailings buttresses and exterior haul roads, drain fills, permanent diversion crossings, the crusher haul road, as leach pad cover, and any other exterior surface. Acid generating waste rock will be placed to the interior of the Waste Rock Storage Area and possibly mixed (comingled) with non-acid generating waste rock. Additionally, potentially acid generating waste rock will not be placed immediately below within 50 feet of areas designated for water management ponds that are part of the final landform. Potentially acid generating material placed with the interior of the Waste Rock Storage Area will also not be placed in areas subject to water conveyance, etc.

Specific waste rock segregation requirements will be detailed in operating plans that will be modified as appropriate. In general, however, these plans will include Rock Inspection and Classification, and Rock Type Monitoring as specified below.

4.1 Rock Inspection and Classification

As described above, drilling will be completed on 50-foot benches. Variations in lithology and mineralogy/geology, as well as degree and extent of fracturing, will be evaluated by the geologist or trained technician. Composites from the drill holes will be assayed as needed to characterize the material as waste rock, oxide ore, or sulfide ore. If waste rock material is identified and determined to be one of, or include one of, the units (i.e., Andesite, Arkose, etc.) that have been identified as potentially acid generating, sampling and testing of the composite drill hole samples will be targeted to isolate the area within the blast zone that would require special handling. The composite samples will be characterized using either ABA or NAG pH testing. Fizz testing with dilute hydrochloric acid (HCl) will also be conducted on the drill hole cuttings to help target samples collecting for ABA or NAG pH testing.

Both testing records and waste rock placement decisions shall be maintained, including the personnel involved in the decision, the testing or review involved, and if the rock was determined to be acid generating or not. Placement of the material should also be verified. The records shall be maintained on site and available for inspection.

4.2 Type Monitoring

In addition to the testing targeting specific lithologic units described in Section 4.1, ABA tests shall be completed at an on-site lab (when constructed) on at least two (2) random samples per week or one (1) sample per approximate 250,000 tons of waste rock material mined, whichever is more frequent. Sample selection will be distributed based on the rock types/lithologies encountered during the sampling period/increment.

These random samples will not be selected based on lithology and will be used to verify previous characterization work. ABA testing includes a measurement of the Acid Neutralization Potential (ANP) and the Acid Generating Potential (AGP) of the waste rock.

SPLP (Synthetic Precipitation Leaching Potential EPA Method 1312) shall be completed at the on-site lab when constructed on samples used as outer berm/buttress or drain materials to confirm that these materials are non-acid generating and have limited reactivity.

For waste rock materials used in the flow-through drains, one (1) SPLP sample shall be taken per blast zone or one (1) sample per 250,000 tons, whichever is less.

All geochemical testing records will be maintained on-site either in hardcopy or electronic form.

REFERENCES

Arizona Department of Environmental Quality (ADEQ) (2004). *Arizona Mining Best Available Demonstrated Control Technology (BADCT) Guidance Manual*. Aquifer Protection Program. Publication TB-04-01.

Hem, J.D. (1985). *Study and Interpretation of the Chemical Characteristics of Natural Water. USGS Water Supply Paper 2254*. US Government. Print Office. Washington DC 263 pgs.

Price, W.A. (1997). Draft: *Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia*. British Columbia Mine Reclamation Services (MRS). British Columbia Ministry of Employment and Investment, Energy and Minerals Division, Smithers, BC (April) 143 pgs.

Smith, A. and J.B. Barton Bridges, (1991). *Some Consideration in the Prediction and Control of Acid Mine Drainage Impact on Groundwater from Mining in North America*. Proceedings of the EPPIC Water Symposium. May 16-17, 1991, Johannesburg, South Africa.

Tetra Tech (2009). *Aquifer Protection Permit (APP) Application*. Prepared for Rosemont Copper Company. Report Dated February 2009.

The International Network for Acid Prevention (INAP), Global Acid Rock Drainage Guide (GARD Guide) http://www.gardguide.com/ (2008)

ATTACHMENT 4
TETRA TECH TECHNICAL MEMORANDUM TITLED
REVISED HEAP LEACH FACILITY FATE AND TRANSPORT MODELING AND TREATMENT OPTIONS EVALUATION
(DATED APRIL 12, 2011)

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Technical Memorandum

To:	Kathy Arnold	**From:**	Mark A. Williamson and Amy L. Hudson, REM
Company:	Rosemont Copper Company	**Date:**	April 12, 2011
Re:	Revised Heap Leach Facility Fate and Transport Modeling and Treatment Options Evaluation	**Doc #:**	087/11-320878-5.3
CC:	David Krizek, P.E. (Rosemont Copper)		

1.0 Introduction

This Technical Memorandum presents revised Fate and Transport modeling of the proposed Rosemont Copper Project (Project) Heap Leach Facility. The original modeling was presented in a memorandum dated January 14, 2010 (Tetra Tech, 2010a) and in the *Infiltration, Seepage, Fate and Transport Modeling Report – Revision 1* dated August 2010 (Tetra Tech, 2010b).

2.0 Summary of Previous Modeling

The previous modeling applied a simplified approach to the Fate and Transport simulations by including only mixing, oxidation-reduction reactions, and precipitation of oversaturated mineral phases. More complicated factors, such as adsorption, were not considered. The intention of this previous modeling effort was to provide relatively conservative results.

The heap leach materials are anticipated to be about 63% arkose, 21% quartz-monzonite porphyry (QMP), and 16% andesite. Starting solutions used in the geochemical model (PHREEQC) were derived from the Meteoric Water Mobility Procedure (MWMP) testing results. The arkose and QMP materials were represented by analytical results from MWMP testing performed on column leach material, i.e., both of these material types were leached with acid for metallurgical testing purposes prior to MWMP testing. However, the starting solution for the andesite material was an average of nine (9) waste rock samples (AR2001-01, AR2003-03, AR2009-01, AR2011-01, AR2036-01, AR2040-01, AR2041-01, UAGH-Arkose-1, VABH0609-01) tested using the MWMP method. These materials were unweathered and were not previously subjected to column leach solution.

The results of the original predictive modeling for the heap drain-down leachate solution quality, including the quality of the post-treatment effluents, are summarized in Table 1 below.

Treatment of the heap drain-down leachate included passive treatment using a limestone only system (limestone drain) and limestone with organic material (biological treatment).

Table 1 Summary of Originally Modeled Heap Drain-Down Leachate Quality

	AWQS	Heap Leachate	Passive Limestone Drain	Passive Biological Treatment
pH		3.23	6.84	6.24
Pe		17.4	13.8	-3.2
Total Alkalinity (mg/L $CaCO_3$)		-86.9	241	1215
Total Dissolved Solids, mg/L		970	1207	2185
Silver, mg/L		0.005	0.005	0.005
Aluminum, mg/L		16.0	0.6	1.2
Arsenic, mg/L	0.01	0.008	0.008	0.008
Barium, mg/L	2	0.015	0.015	0.015
Calcium, mg/L		149	249	149
Cadmium, mg/L	0.005	0.087	0.087	0.087
Chloride, mg/L		3.77	3.77	3.76
Chromium, mg/L	0.1	0.010	0.010	0.010
Copper, mg/L		30.2	30.2	30.2
Fluoride, mg/L		1.95	1.95	1.95
Iron, mg/L		0.300	0.003	0.300
Potassium, mg/L		5.93	5.93	5.93
Magnesium, mg/L		42.3	42.3	42.2
Manganese, mg/L		0.008	0.000	0.008
Molybdenum, mg/L		0.002	0.002	0.002
Sodium, mg/L		10.9	10.9	10.9
Nickel, mg/L	0.1	0.163	0.163	0.163
Nitrate, mg/L	10	0.035	0.035	0.035
Lead, mg/L	0.05	0.016	0.016	0.016
Sulfate, mg/L		704	704	235
Selenium, mg/L	0.05	0.056	0.056	0.056
Zinc, mg/L		4.97	4.97	4.97

The results showed that the untreated heap drain-down leachate would be acidic with cadmium, nickel, and selenium exceeding the Arizona Water Quality Standards (AWQS). For this reason, two (2) passive treatment options were considered, a limestone drain and a biological treatment system. The simulated treatment options resulted in improved pH and decrease of some constituents in solution; however, cadmium, nickel, and selenium remained above the AWQS.

3.0 Scope of Revised Modeling

After further review of the previous model, revisions were made to refine the original model assumptions and the source term data utilized. Some of the previous modeling constraints, such as not allowing absorption, were also revisited. Changes to the model included:

- An alternate chemical composition of the starting solution representing andesite, including the removal of added sulfuric acid solution; and
- Inclusion of a broader range of mineral phases that would likely precipitate from solution.

4.0 Model Revision

In the original modeling, the arkose and QMP starting solutions were derived from the results of MWMP testing on the acid-leached material samples. No samples of acid-leached andesite were available to perform MWMP testing. As indicated, the starting solution for andesite was therefore originally derived from the average of nine (9) MWMP testing results from the waste rock characterization program. These MWMP results also required the use of sulfuric acid solution to try and mimic the residual acid character of the metallurgical testing program, similar to that of arkose and QMP. However, the chemistry of the leached arkose and QMP materials is significantly different from that of just adding sulfuric acid to unleached and unweathered andesite material.

For the revised modeling, the original andesite starting solution was replaced with the leached arkose solution. The resulting new baseline leachate quality for the heap had a higher total dissolved solids load and lower pH. The arkose and andesite materials are sufficiently similar materials so that leached andesite material chemistry is expected to be more like leached arkose than the previous mix of nine (9) waste rock samples.

Additionally, the revised modeling provided for the inclusion of additional mineral phases that were allowed to precipitate from solution due to being oversaturated. The previous modeling used a limited list of common equilibrium phases and did not fully account for all potential precipitation reactions. The mineral phases used in the revised modeling were expanded to include a broad range of trace metal sulfides that would likely precipitate based on the anticipated treatment options.

4.1 Revised Model Results

The heap drain-down leachate quality, effluent quality from a passive limestone drain and effluent quality from a passive biological treatment system were reassessed, the results of which are presented in Table 2. As described above, the reassessment used a starting solution derived from previous leach column material (only arkose and QMP).

The passive treatment, limestone drain system was simulated as a reaction of the heap drain-down leachate with calcite resulting in neutralization of pH. In the biological treatment system, an organic carbon source was added along with the limestone, allowing the carbon to react which resulted in a near complete reduction of sulfate and associated increase in pH.

Table 2 Summary of Revised Heap Drain-Down Leachate Quality

	AWQS	Heap Leachate	Passive Limestone Drain	Passive Biological Treatment
pH		3.04	6.59	6.31
Pe		17.6	14.0	-3.27
Total Alkalinity (mg/l $CaCO_3$)		-173	497	1905
Total Dissolved Solids (mg/L)		2848	2828	1717
Silver (mg/l)		0.005	0.005	0.005
Aluminum (mg/l)		57.7	0.0115	0.127
Arsenic (mg/l)	0.01	0.003	0.002	0.003
Barium (mg/l)	2	0.013	0.011	0.013
Calcium (mg/l)		442	649	237
Chloride (mg/l)		5.980	5.981	5.975
Cadmium (mg/l)	0.005	0.307	0.305	0.002
Chromium, total (mg/l)	0.1	0.034	0.034	0.009
Copper (mg/l)		62.2	0.49	0.002
Fluoride (mg/l)		5.23	1.96	2.64
Iron (mg/l)		4.844E-04	5.30E-09	4.84E-04
Potassium (mg/l)		8.21	8.21	8.20
Magnesium (mg/l)		150	150	105
Manganese (mg/l)		0.214	7.147E-04	0.214
Molybdenum (mg/l)		0.004	0.002	1.476E-29
Nitrate (mg/l)	10	0.107	0.107	0.107
Sodium (mg/l)		9.34	9.34	9.33
Nickel (mg/l)	0.1	0.592	0.593	8.39E-07
Lead (mg/l)	0.05	0.037	0.037	0.037
Sulfide (mg/l)		0.00E+00	0.00E+00	656
Sulfate (mg/l)		2089	1871	0.88
Selenium (mg/l)	0.05	0.099	0.099	7.60E-13
Zinc (mg/l)		17.6	17.6	0.3

The results of the revised modeling are similar to the previous modeling, although total dissolved solids are generally higher. As with the original evaluation, cadmium, nickel, and selenium exceed AWQS. However, the revised model representing the effluent from a passive biological treatment system produced results that showed all chemical constituents were below AWQS. This improved model performance is due specifically to the proper inclusion of additional potential mineral precipitates. The results of the passive biological system model suggest that this treatment method can result in water quality that meets all AWQS. The limestone treatment results in an improved pH and some constituents are decreased relative to the baseline heap leachate. However, the limestone only treatment method does not appear to lower the cadmium, nickel, and selenium to levels below the AWQS.

The performance of the modeled passive biological treatment system achieves both sulfate reduction and a reduction of all constituents below AWQS. Site-specific conditions at the time of drain-down will drive engineering designs and the performance of the treatment system. Thus, future bench and pilot scale studies performed during the initial three (3) year drain-down period of the heap will identify and constrain the critical design issues such as selection of suitable and appropriate organic amendments to support vigorous sulfate reduction. This will allow for system optimization prior to full scale construction and prior to covering the treatment ponds with waste rock.

REFERENCES

Tetra Tech, Hudson, A. (2010a). *Heap Leach Facility Infiltration, Seepage, and Fate and Transport Modeling/Treatment Options*. Technical Memorandum to Kathy Arnold (Rosemont Copper Company). Technical Memorandum Dated January 14, 2010.

Tetra Tech (2010b). *Infiltration, Seepage, and Fate and Transport Modeling Report – Revision 1*. Prepared for Rosemont Copper Company. Report Dated August 2010.

ATTACHMENT 5
TETRA TECH TECHNICAL MEMORANDUM TITLED
ROSEMONT ADDITIONAL TAILINGS ANALYSIS
(DATED MARCH 16, 2011)

Tucson Office
3031 West Ina Road
Tucson, AZ 85741
Tel 520.297.7723 Fax 520.297.7724
www.tetratech.com

Technical Memorandum

To:	Kathy Arnold	**From:**	David Krizek
Company:	Rosemont Copper Company	**Date:**	March 16, 2011
Re:	Rosemont Additional Tailings Analysis	**Doc #:**	059/11-320877-5.3
CC:	Mark Williamson, Amy Hudson (Tetra Tech)		

1.0 Introduction

The Technical Memorandum titled *Rosemont Tailings Geochemistry Sample Sources* (Tetra Tech, 2010) was prepared in response to the April 14, 2010 *Comprehensive Request for Additional Information* from the Arizona Department of Environmental Quality (ADEQ) to Rosemont Copper Company (Rosemont). This request was with regard to the aquifer protection permit (APP) application submitted to ADEQ in 2009 (Tetra Tech, 2009) for the Rosemont Copper Project (Project). Specifically, Tetra Tech (2010) provided analytical results from six (6) additional tailings samples prepared and analyzed in 2010.

- 4-7 Year Composite
- Escabrosa
- Horquilla
- Colina
- Epitaph
- Earp

Analytical results from these 2010 tailings samples, as well as previous sample results, have been updated and summarized in Attachment 1. The table in Attachment 1 supersedes the original Attachment D table provided in Tetra Tech (2010) titled *Summary of Geochemical Data for Tailings Samples*.

In a letter titled *Incomplete Response to Technical Deficiencies* (dated December 3, 2010) from ADEQ, additional information of the tailings samples was requested. Additional ADEQ's comment #3, on page 13 of 34 of the December 3, 2010 letter, is as follows along with responses provided by Rosemont in a letter titled *Response to ADEQ December 3, 2010 Correspondence* (dated February 11, 2011).

TETRA TECH

Additional ADEQ's Comment #3

ADEQ: *Rosemont mine life of the sulfide ore production is expected to last some 20 years plus. However, the geochemical characterization of the ore samples is conducted up to 7 years of production. In order to characterize and make determination of geochemical properties of the sulfide ore material in the pit, please provide geochemical analysis of the currently delineated mineable ore to depth.*

Rosemont: Tailings samples were physically prepared to represent production years 0-3 and years 4-7. A mixing model was used to prepare a representative tailings "sample" for production years 8-21. Geochemical analysis results for the major rock types making up production years 8-21 were used. Please refer to the Tetra Tech Technical Memorandum titled *RCC Preliminary Geochemistry Review Response to Comments* (dated November 23, 2010). This memo, along with a CD, was provided to ADEQ at the January 5, 2011 meeting.

ADEQ: *Please provide justification for not measuring a particular constituent in all the samples tested and using higher detection limit for some of the constituents in characterizing the geochemical behavior of the dry stack tailings as listed below:*

- Be was not measured in 8 of 10 samples;

- Ni was not measured in 7 of 10 samples, and the detection limit is too high in 1 of 10 samples;

- Sb detection limit is too high (higher than AWQS);

- Tl was not measured in 8 of 10 samples, and the detection limit exceeds the AWQS in the 2 of 10 samples.

Rosemont: The reported detection limits for antimony, nickel and thallium in the tailing samples were an oversight and not noticed until ADEQ's comment above. Rosemont is currently discussing the issue with the laboratory to see what measures can be taken to address this issue. Based on the discussions with the laboratory, a full response will be provided to ADEQ under separate cover by the end of February 2011.

In addition to retrieving previous analysis results from SVL Analytical (SVL) in Kellogg, Idaho (via stored data), and performing data QC checks, tailings samples were also retrieved from AMEC Earth & Environmental (AMEC). The tailings samples prepared in 2010 were sent to AMEC for physical testing and to SVL for geochemical analysis. Tailings samples retrieved from AMEC that were not moisture conditioned were used to perform whole rock, SPLP, and MWMP analyses in order to obtain results for Thallium at a detection limit of 0.0002 (AWQS) and also for Uranium.

In summary, the following changes/additions are noted:

- For Tailings Sample 022807, the Nickel value for the SPLP analysis was modified from <1 to <0.1 based on records review.
- For Horquilla (2010), the pH End value for the MWMP analysis was modified from 8.2 to 7.82 based on records review.

- For Escabrosa (2010), the Potassium value for the SPLP analysis was modified from 1.05 to 0.86 based on records review.
- For the 2010 tailings samples, results for Antimony were modified based on records review.
- For the 2010 tailings samples, results for Beryllium, Molybdenum, and Nickel were added based on previous unrecorded analysis.
- Values that were previously included in the table for Chloride, Fluoride, Nitrogen, and Sulfate under the Whole Rock analysis columns were removed and recorded as Not Applicable (NA). Whole Rock analyses are not applicable for these constituents.
- Thallium results were added to table based on a lower detection limit.
- Uranium results were added to the table.

Attachment 2 provides the 2011 analytical data received from the lab.

References

Tetra Tech (2009). *Aquifer Protection Permit Application*. Prepared for Rosemont Copper Company. Report Dated April 2009.

Tetra Tech, Dieckhaus, M. (2010). *Rosemont Tailings Geochemistry Sample Sources*. Technical Memorandum to Kathy Arnold (Rosemont Copper Company). Technical Memorandum Dated August 30, 2010.

Attachment 1
Updated Attachment D Table
in reference to
Tetra Tech (2010)
titled
Summary of Geochemical Data
for Tailings Samples

Attachment D
Summary of Geochemical Data for Tailings Samples
Rosemont Copper Project
Updated March 2011

Parameter	Tailings – May 2006		Tailings 022807		Tailings-05 June2007			Year 0-3 Tailings			4-7 Year Composite			Escabrosa		Horquilla			Colina			Epitaph			Earp		
	Whole Rock (mg/kg)	SPLP (mg/L)	Whole Rock (mg/kg)	SPLP (mg/L)	Whole Rock (mg/kg)	SPLP (mg/L)	MWMP (mg/L)	Whole Rock (mg/kg)	SPLP (mg/L)	MWMP (mg/L)	Whole Rock (mg/kg)	SPLP (mg/L)	MWMP (mg/L)	Whole Rock (mg/kg)	SPLP (mg/L)	Whole Rock (mg/kg)	SPLP (mg/L)	MWMP (mg/L)	Whole Rock (mg/kg)	SPLP (mg/L)	MWMP (mg/L)	Whole Rock (mg/kg)	SPLP (mg/L)	MWMP (mg/L)	Whole Rock (mg/kg)	SPLP (mg/L)	MWMP (mg/L)
pH End	NA	NM	NA	NM	NA	NM	7.43	NA	NM	8.5	NA	8.66	8.20	NA	8.81	NA	9.48	7.82	NA	9.48	8.42	NA	7.85	6.47	NA	8.74	6.86
Alkalinity	NA	NM	NA	NM	NA	NM	NM	NA	8.3	11.5	NA	NM	NM	NA	NM	NA	NM	NM	NA	NM	NM	NA	NM	NM	NA	NM	NM
Aluminum	12000	NM	3910	0.08	6210	0.08	<0.08	5870	<0.08	<0.08	9,180	<0.08	<0.08	7,350	<0.08	7,110	0.7	<0.080	4,870	<0.08	<0.08	5,500	<0.08	<0.080	13,700	<0.08	<0.080
Antimony	<10	NM	2	NM	2.2	<0.02	<0.02	<2	<0.02	<0.02	<0.3	<0.005	<0.005	<0.3	<0.005	<0.3	<0.005	0.006	<0.3	<0.005	0.010	4.6	0.006	0.011	3.3	<0.005	<0.005
Arsenic	5.5	<1	8.6	<0.003	8.2	<0.003	<0.003	22	<0.02	<0.003	8.8	<0.02	<0.025	16.5	<0.02	13.5	<0.02	<0.025	27.6	<0.02	<0.025	28.7	<0.02	<0.025	5.3	<0.02	<0.025
Barium	20	<10	7.7	<0.0020	12.2	0.0032	0.0172	25.6	0.02	0.0229	22.0	0.02	0.0191	15.0	0.02	5.17	0.005	0.0080	12.5	0.02	0.0346	13.6	0.02	0.0266	67.6	0.05	0.0297
Beryllium	NM	NM	0.36	NM	0.58	<0.0020	<0.002	0.537	<0.002	<0.002	0.815	<0.002	<0.0020	1.27	<0.002	0.722	<0.002	<0.0020	0.393	<0.002	<0.0020	<0.200	<0.002	<0.0020	0.709	<0.002	<0.0020
Cadmium	0.9	<0.5	1.51	<0.0020	0.97	<0.0020	<0.002	1.1	<0.002	<0.002	<0.20	<0.002	<0.0020	0.60	<0.002	0.24	<0.002	<0.0020	0.58	<0.002	<0.0020	0.64	<0.002	<0.0020	0.29	<0.002	<0.0020
Calcium	150000	NM	125000	8.8	146000	13	103	126000	15.6	150	99,900	10.5	52.6	163,000	27.1	84,600	9.8	29.4	167,000	193	658	155,000	107	557	62,600	18.4	151
Chloride	NA	NM	N/A	0.36	NA	0.43	5.69	NA	0.55	5.18	NA	0.425	6.27	NA	0.352	NA	<0.200	3.56	NA	0.218	4.14	NA	0.340	<1.00	NA	0.628	3.51
Chromium	14	<1	10.4	<0.0060	21	<0.0060	<0.006	17.7	<0.006	<0.006	23.9	<0.006	<0.0060	36.6	<0.006	14.3	<0.006	<0.0060	11.8	<0.006	<0.0060	11.8	<0.006	<0.0060	30.7	<0.006	<0.0060
Copper	NM	NM	2070	<0.010	1100	<0.010	<0.01	1120	<0.01	<0.01	2,380	<0.01	<0.010	1,120	<0.01	1,030	0.17	<0.010	2,770	<0.01	0.011	1,780	<0.01	0.016	2,250	<0.01	0.010
Fluoride	NA	NM	NA	1.25	NA	1.29	1.02	NA	0.85	1.11	NA	1.12	6.49	NA	1.00	NA	0.694	1.05	NA	0.844	2.76	NA	0.846	0.944	NA	0.630	1.25
Iron	18000	NM	15300	<0.06	23600	<0.06	<0.06	21700	<0.06	<0.06	26,100	<0.06	<0.060	36,800	<0.06	33,800	1.2	<0.060	20,100	<0.06	<0.006	37,700	<0.06	<0.060	25,900	<0.06	<0.060
Lead	7	<1	10.4	NM	13.6	<0.0075	<0.0075	20	<0.0075	<0.008	4.92	<0.0075	<0.008	27.4	<0.0075	30.4	<0.0075	<0.008	2.55	<0.0075	<0.008	11.9	<0.0075	<0.008	14.8	<0.0075	<0.008
Magnesium	8400	NM	4960	0.23	5410	0.17	0.65	8300	0.2	1.91	24,400	2.5	13.8	11,400	1.3	6,010	1.9	0.535	57,900	3.7	15.5	35,800	8.5	148	16,600	1.0	11.4
Manganese	2100	NM	1520	<0.0040	2000	<0.0040	0.019	1670	<0.004	0.0172	1,990	<0.004	0.0081	2,510	0.007	1,950	0.10	<0.0040	1,460	<0.004	<0.0040	1,980	0.01	0.0988	1,720	<0.004	0.0372
Mercury	<0.100	<0.01	0.038	<0.0002	0.042	<0.0002	0.00033	1.77	0.0007	<0.0002	0.058	<0.0002	<0.00020	0.050	<0.0002	0.130	<0.0002	<0.00020	0.057	<0.0002	<0.00020	<0.033	<0.0002	<0.00020	0.053	<0.0002	<0.00020
Molybdenum	NM	NM	90	NM	46	0.075	0.46	13.8	0.06	0.463	109	0.18	0.731	94.8	0.04	53.3	0.03	0.385	112	0.11	0.590	122	0.05	0.424	78.9	0.06	0.679
Nickel	NM	NM	8.8	<0.1	5.5	<0.01	<0.01	11.2	<0.01	<0.01	8.39	<0.01	<0.010	19.9	<0.01	3.34	<0.01	<0.010	3.99	<0.01	<0.010	5.67	<0.01	<0.010	13.3	<0.01	<0.010
NO_2+NO_3 as N	NA	NM	NA	0.04	NA	NM	0.021	NA	NM	NM	NA	0.120	<0.500	NA	<0.100	NA	<0.100	<0.500	NA	<0.100	<0.500	NA	0.111	<0.500	NA	<0.100	<0.500
Potassium	1000	NM	786	0.62	977	0.86	8.33	1040	1.24	11.3	1,120	1.05	11.6	1,040	0.86	435	0.84	4.97	1,130	1.27	5.53	799	1.04	17.9	2,020	1.97	15.0
Selenium	<5	<0.5	<4	<0.50	<4	<0.04	<0.04	<4	<0.04	<0.04	29.2	<0.040	<0.040	52.7	<0.040	5.5	<0.040	<0.040	22.1	<0.040	0.048	<4.0	<0.040	<0.040	<4.0	<0.040	<0.040
Silver	0.8	NM	2.41	<0.0050	0.87	<0.0050	<0.005	1.15	<0.005	<0.005	1.92	<0.005	<0.0050	1.59	<0.005	0.56	<0.005	<0.0050	2.60	<0.005	<0.0050	2.22	<0.005	<0.0050	2.29	<0.005	<0.0050
Sodium	<250	NM	117	2.57	154	2.22	27.6	225	4.1	37.1	262	3.2	33.9	97.5	2.1	102	2.4	19.3	76.1	1.4	15.4	94.2	3.3	32.6	579	3.3	33.9
Sulfate	NA	NM	NA	6.95	NA	20	285	NA	35	441	NA	24.3	264	NA	61.5	NA	6.88	91.1	NA	432	1,560	NA	278	1,960	NA	36.8	435
TDS	NA	NM	NA	13	NA	66	505	NA	NM	NM	NA	NM	NM	NA	NM	NA	NM	NM	NA	NM	NM	NA	NM	NM	NA	NM	NM
Thallium	NM	NM	1.5	NM	2	<0.015	<0.015	<1.5	<0.02	<0.015	<0.100	<0.001	<0.00100	<0.100	<0.001	<0.100	<0.001	<0.00100	0.101	<0.001	<0.00100	<0.100	<0.001	<0.00100	<0.100	<0.001	<0.00100
Uranium	NM	NM	NM	NM	NM	NM	NM	2.89	<0.002	<0.001	2.66	<0.001	<0.00100	3.10	<0.001	3.07	<0.001	0.00181	3.39	<0.001	<0.00100	4.23	<0.001	<0.00100	2.16	0.001	0.0476
Zinc	85	NM	271	NM	118	<0.01	<0.01	108	<0.01	<0.01	146	<0.01	<0.0100	234	<0.01	184	0.05	<0.0100	163	<0.01	<0.0100	141	<0.01	<0.010	140	<0.01	<0.0100

NA = Not applicable NM = Not measured

Attachment 2
Laboratory Analytical Data

One Government Gulch - PO Box 929 Kellogg ID 83837-0929 (208) 784-1258 Fax (208) 783-0891

Tetra Tech EM, Inc. (Tucson)	**Project Name: Rosemont**
3031 West Ina Road	Work Order: **W1B0493**
Tucson, AZ 85741	Reported: 11-Mar-11 14:43

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
ESCABROSA	W1B0493-01	Soil	—	23-Feb-2011
4-7 YEAR COMPOSITE	W1B0493-02	Soil	—	23-Feb-2011
COLINA	W1B0493-03	Soil	—	23-Feb-2011
HORQUILLA	W1B0493-04	Soil	—	23-Feb-2011
EPITAPH	W1B0493-05	Soil	—	23-Feb-2011
EARP	W1B0493-06	Soil	—	23-Feb-2011

Solid samples are analyzed on an as-received, wet-weight basis, unless otherwise requested.
Sample preparation is defined by the client as per their Data Quality Objectives.
This report supercedes any previous reports for this Work Order. The complete report includes pages for each sample, a full QC report, and a notes section.
The results presented in this report relate only to the samples, and meet all requirements of the NELAC Standards unless otherwise noted.

Case Narrative

03/09/2011 KG....Meteoric Water Mobility Extractions were performed a second time to obtain enough volume for gross alpha and total radium testing.

SVL ANALYTICAL

One Government Gulch - PO Box 929 Kellogg ID 83837-0929 (208) 784-1258 Fax (208) 783-0891

Tetra Tech EM, Inc. (Tucson)
3031 West Ina Road
Tucson, AZ 85741

Project Name: Rosemont
Work Order: **W1B0493**
Reported: 11-Mar-11 14:43

Client Sample ID: **ESCABROSA**
SVL Sample ID: **W1B0493-01 (Soil)**

Sample Report Page 1 of 1

Sampled: —
Received: 23-Feb-11
Sampled By:

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total)										
EPA 6020	Thallium	< 0.100	mg/kg	0.100	0.002	5	W109270	DG	02/28/11 10:03	
EPA 6020	**Uranium**	3.10	mg/kg	0.050	0.002	5	W109270	DG	02/28/11 10:03	
Meteoric Water Mobility Extraction Parameters										
ASTM E2242-02	**Extraction Fluid pH**	5.31	pH Units				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Extraction Fluid pH**	5.36	pH Units				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Extraction Time**	24.0	Hrs				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Extraction Time**	24.0	Hrs				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	Extraction Type	Rotation					W109283	ESB	02/26/11 13:30	
ASTM E2242-02	Extraction Type	Rotation					W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Feed Moisture**	0.680	%				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Feed Moisture**	0.680	%				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Final Fluid pH**	6.45	pH Units				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Final Fluid pH**	7.91	pH Units				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Sample Weight**	1000	g				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Sample Weight**	5000	g				W110225	ESB	03/09/11 13:20	
Meteoric Water Mobility Leachates (Metals by 200 Series)										
EPA 200.8	Thallium	< 0.00100	mg/L Extract	0.00100	0.000018		W110097	DG	03/01/11 11:26	
EPA 200.8	**Uranium**	0.00135	mg/L Extract	0.00100	0.0000087		W110097	DG	03/01/11 11:26	
SPLP Extraction Parameters										
SW-846 1312	**Final Fluid pH**	8.77	pH Units				W109284	ESB	02/26/11 07:00	
SW-846 1312	**Final Fluid pH**	7.54	pH Units				W110226	ESB	03/09/11 07:20	
SPLP Leachates (Metals)										
EPA 6020	Thallium	< 0.001	mg/L Extract	0.001	0.00002		W110098	DG	03/02/11 11:31	
EPA 6020	Uranium	< 0.001	mg/L Extract	0.001	0.000009		W110098	DG	03/02/11 11:31	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

Kirby Gray

Kirby Gray
Technical Director

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Tetra Tech EM, Inc. (Tucson)
3031 West Ina Road
Tucson, AZ 85741

Project Name: Rosemont
Work Order: **W1B0493**
Reported: 11-Mar-11 14:43

Client Sample ID: **4-7 YEAR COMPOSITE**
SVL Sample ID: **W1B0493-02 (Soil)**

Sample Report Page 1 of 1

Sampled: —
Received: 23-Feb-11
Sampled By:

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total)										
EPA 6020	Thallium	< 0.100	mg/kg	0.100	0.002	5	W109270	DG	02/28/11 10:10	
EPA 6020	**Uranium**	2.66	mg/kg	0.050	0.002	5	W109270	DG	02/28/11 10:10	
Meteoric Water Mobility Extraction Parameters										
ASTM E2242-02	**Extraction Fluid pH**	5.31	pH Units				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Extraction Fluid pH**	5.36	pH Units				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Extraction Time**	24.0	Hrs				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Extraction Time**	24.0	Hrs				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	Extraction Type	Rotation					W109283	ESB	02/26/11 13:30	
ASTM E2242-02	Extraction Type	Rotation					W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Feed Moisture**	0.860	%				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Feed Moisture**	0.860	%				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Final Fluid pH**	5.00	pH Units				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Final Fluid pH**	8.52	pH Units				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Sample Weight**	1000	g				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Sample Weight**	3310	g				W110225	ESB	03/09/11 13:20	
Meteoric Water Mobility Leachates (Metals by 200 Series)										
EPA 200.8	Thallium	< 0.00100	mg/L Extract	0.00100	0.000018		W110097	DG	03/01/11 11:30	
EPA 200.8	Uranium	< 0.00100	mg/L Extract	0.00100	0.0000087		W110097	DG	03/01/11 11:30	
SPLP Extraction Parameters										
SW-846 1312	**Final Fluid pH**	9.00	pH Units				W109284	ESB	02/26/11 07:00	
SW-846 1312	**Final Fluid pH**	7.98	pH Units				W110226	ESB	03/09/11 07:20	
SPLP Leachates (Metals)										
EPA 6020	Thallium	< 0.001	mg/L Extract	0.001	0.00002		W110098	DG	03/02/11 11:40	
EPA 6020	Uranium	< 0.001	mg/L Extract	0.001	0.000009		W110098	DG	03/02/11 11:40	

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Kirby Gray

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Tetra Tech EM, Inc. (Tucson)
3031 West Ina Road
Tucson, AZ 85741

Project Name: Rosemont
Work Order: **W1B0493**
Reported: 11-Mar-11 14:43

Client Sample ID: **COLINA**
SVL Sample ID: **W1B0493-03 (Soil)**

Sample Report Page 1 of 1

Sampled: —
Received: 23-Feb-11
Sampled By:

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total)										
EPA 6020	**Thallium**	0.101	mg/kg	0.100	0.002	5	W109270	DG	02/28/11 10:11	
EPA 6020	**Uranium**	3.39	mg/kg	0.050	0.002	5	W109270	DG	02/28/11 10:11	
Meteoric Water Mobility Extraction Parameters										
ASTM E2242-02	**Extraction Fluid pH**	5.31	pH Units				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Extraction Fluid pH**	5.36	pH Units				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Extraction Time**	24.0	Hrs				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Extraction Time**	24.0	Hrs				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	Extraction Type	Rotation					W109283	ESB	02/26/11 13:30	
ASTM E2242-02	Extraction Type	Rotation					W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Feed Moisture**	0.520	%				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Feed Moisture**	0.520	%				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Final Fluid pH**	5.00	pH Units				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Final Fluid pH**	8.65	pH Units				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Sample Weight**	1000	g				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Sample Weight**	5000	g				W110225	ESB	03/09/11 13:20	
Meteoric Water Mobility Leachates (Metals by 200 Series)										
EPA 200.8	Thallium	< 0.00100	mg/L Extract	0.00100	0.000018		W110097	DG	03/01/11 11:31	
EPA 200.8	Uranium	< 0.00100	mg/L Extract	0.00100	0.0000087		W110097	DG	03/01/11 11:31	
SPLP Extraction Parameters										
SW-846 1312	**Final Fluid pH**	9.13	pH Units				W109284	ESB	02/26/11 07:00	
SW-846 1312	**Final Fluid pH**	8.01	pH Units				W110226	ESB	03/09/11 07:20	
SPLP Leachates (Metals)										
EPA 6020	Thallium	< 0.001	mg/L Extract	0.001	0.00002		W110098	DG	03/02/11 11:41	
EPA 6020	Uranium	< 0.001	mg/L Extract	0.001	0.000009		W110098	DG	03/02/11 11:41	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

Kirby Gray
Technical Director

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Tetra Tech EM, Inc. (Tucson)
3031 West Ina Road
Tucson, AZ 85741

Project Name: Rosemont
Work Order: **W1B0493**
Reported: 11-Mar-11 14:43

Client Sample ID: **HORQUILLA**
SVL Sample ID: **W1B0493-04 (Soil)**

Sample Report Page 1 of 1

Sampled: —
Received: 23-Feb-11
Sampled By:

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total)										
EPA 6020	Thallium	< 0.100	mg/kg	0.100	0.002	5	W109270	DG	02/28/11 10:12	
EPA 6020	**Uranium**	3.07	mg/kg	0.050	0.002	5	W109270	DG	02/28/11 10:12	
Meteoric Water Mobility Extraction Parameters										
ASTM E2242-02	**Extraction Fluid pH**	5.31	pH Units				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Extraction Fluid pH**	5.36	pH Units				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Extraction Time**	24.0	Hrs				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Extraction Time**	24.0	Hrs				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	Extraction Type	Rotation					W109283	ESB	02/26/11 13:30	
ASTM E2242-02	Extraction Type	Rotation					W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Feed Moisture**	0.710	%				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Feed Moisture**	0.710	%				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Final Fluid pH**	8.06	pH Units				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Final Fluid pH**	8.38	pH Units				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Sample Weight**	1000	g				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Sample Weight**	5000	g				W110225	ESB	03/09/11 13:20	
Meteoric Water Mobility Leachates (Metals by 200 Series)										
EPA 200.8	Thallium	< 0.00100	mg/L Extract	0.00100	0.000018		W110097	DG	03/01/11 11:32	
EPA 200.8	**Uranium**	0.00181	mg/L Extract	0.00100	0.0000087		W110097	DG	03/01/11 11:32	
SPLP Extraction Parameters										
SW-846 1312	**Final Fluid pH**	9.04	pH Units				W109284	ESB	02/26/11 07:00	
SW-846 1312	**Final Fluid pH**	8.76	pH Units				W110226	ESB	03/09/11 07:20	
SPLP Leachates (Metals)										
EPA 6020	Thallium	< 0.001	mg/L Extract	0.001	0.00002		W110098	DG	03/02/11 11:43	
EPA 6020	Uranium	< 0.001	mg/L Extract	0.001	0.000009		W110098	DG	03/02/11 11:43	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

Kirby Gray
Technical Director

One Government Gulch - PO Box 929 | Kellogg ID 83837-0929 | (208) 784-1258 | Fax (208) 783-0891

Tetra Tech EM, Inc. (Tucson)
3031 West Ina Road
Tucson, AZ 85741

Project Name: Rosemont
Work Order: **W1B0493**
Reported: 11-Mar-11 14:43

Client Sample ID: **EPITAPH**
SVL Sample ID: **W1B0493-05 (Soil)**

Sample Report Page 1 of 1

Sampled: —
Received: 23-Feb-11
Sampled By:

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total)										
EPA 6020	Thallium	< 0.100	mg/kg	0.100	0.002	5	W109270	DG	02/28/11 10:16	
EPA 6020	**Uranium**	4.23	mg/kg	0.050	0.002	5	W109270	DG	02/28/11 10:16	
Meteoric Water Mobility Extraction Parameters										
ASTM E2242-02	**Extraction Fluid pH**	5.31	pH Units				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Extraction Fluid pH**	5.36	pH Units				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Extraction Time**	24.0	Hrs				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Extraction Time**	24.0	Hrs				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	Extraction Type	Rotation					W109283	ESB	02/26/11 13:30	
ASTM E2242-02	Extraction Type	Rotation					W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Feed Moisture**	0.620	%				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Feed Moisture**	0.620	%				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Final Fluid pH**	8.02	pH Units				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Final Fluid pH**	8.13	pH Units				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Sample Weight**	1000	g				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Sample Weight**	4800	g				W110225	ESB	03/09/11 13:20	
Meteoric Water Mobility Leachates (Metals by 200 Series)										
EPA 200.8	Thallium	< 0.00100	mg/L Extract	0.00100	0.000018		W110097	DG	03/01/11 11:34	
EPA 200.8	Uranium	< 0.00100	mg/L Extract	0.00100	0.0000087		W110097	DG	03/01/11 11:34	
SPLP Extraction Parameters										
SW-846 1312	**Final Fluid pH**	8.50	pH Units				W109284	ESB	02/26/11 07:00	
SW-846 1312	**Final Fluid pH**	8.47	pH Units				W110226	ESB	03/09/11 07:20	
SPLP Leachates (Metals)										
EPA 6020	Thallium	< 0.001	mg/L Extract	0.001	0.00002		W110098	DG	03/02/11 11:44	
EPA 6020	Uranium	< 0.001	mg/L Extract	0.001	0.000009		W110098	DG	03/02/11 11:44	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

Kirby Gray

Kirby Gray
Technical Director

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Tetra Tech EM, Inc. (Tucson)
3031 West Ina Road
Tucson, AZ 85741

Project Name: Rosemont
Work Order: **W1B0493**
Reported: 11-Mar-11 14:43

Client Sample ID: **EARP**
SVL Sample ID: **W1B0493-06 (Soil)**

Sample Report Page 1 of 1

Sampled: —
Received: 23-Feb-11
Sampled By:

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total)										
EPA 6020	Thallium	< 0.100	mg/kg	0.100	0.002	5	W109270	DG	02/28/11 10:18	
EPA 6020	**Uranium**	2.16	mg/kg	0.050	0.002	5	W109270	DG	02/28/11 10:18	
Meteoric Water Mobility Extraction Parameters										
ASTM E2242-02	**Extraction Fluid pH**	5.31	pH Units				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Extraction Fluid pH**	5.36	pH Units				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Extraction Time**	24.0	Hrs				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Extraction Time**	24.0	Hrs				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	Extraction Type	Rotation					W109283	ESB	02/26/11 13:30	
ASTM E2242-02	Extraction Type	Rotation					W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Feed Moisture**	1.03	%				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Feed Moisture**	1.03	%				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Final Fluid pH**	7.82	pH Units				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Final Fluid pH**	7.98	pH Units				W110225	ESB	03/09/11 13:20	
ASTM E2242-02	**Sample Weight**	1000	g				W109283	ESB	02/26/11 13:30	
ASTM E2242-02	**Sample Weight**	5000	g				W110225	ESB	03/09/11 13:20	
Meteoric Water Mobility Leachates (Metals by 200 Series)										
EPA 200.8	Thallium	< 0.00100	mg/L Extract	0.00100	0.000018		W110097	DG	03/01/11 11:35	
EPA 200.8	**Uranium**	0.0476	mg/L Extract	0.00100	0.0000087		W110097	DG	03/01/11 11:35	
SPLP Extraction Parameters										
SW-846 1312	**Final Fluid pH**	8.79	pH Units				W109284	ESB	02/26/11 07:00	
SW-846 1312	**Final Fluid pH**	8.51	pH Units				W110226	ESB	03/09/11 07:20	
SPLP Leachates (Metals)										
EPA 6020	Thallium	< 0.001	mg/L Extract	0.001	0.00002		W110098	DG	03/02/11 11:45	
EPA 6020	**Uranium**	0.001	mg/L Extract	0.001	0.000009		W110098	DG	03/02/11 11:45	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

Kirby Gray

Kirby Gray
Technical Director

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Tetra Tech EM, Inc. (Tucson)
3031 West Ina Road
Tucson, AZ 85741

Project Name: Rosemont
Work Order: **W1B0493**
Reported: 11-Mar-11 14:43

Quality Control - BLANK Data

Method	Analyte	Units	Result	MDL	MRL	Batch ID	Analyzed	Notes
Metals (Total)								
EPA 6020	Thallium	mg/kg	<0.100	0.002	0.100	W109270	28-Feb-11	
EPA 6020	Uranium	mg/kg	<0.050	0.002	0.050	W109270	28-Feb-11	
Meteoric Water Mobility Leachates (Metals by 200 Series)								
EPA 200.8	Thallium	mg/L Extract	<0.00100	0.000018	0.00100	W110097	01-Mar-11	
EPA 200.8	Uranium	mg/L Extract	<0.00100	0.0000087	0.00100	W110097	01-Mar-11	
SPLP Extraction Parameters								
SW-846 1312	Final Fluid pH	pH Units	5.00			W109284	26-Feb-11	
SW-846 1312	Final Fluid pH	pH Units	5.00			W110226	09-Mar-11	
SPLP Leachates (Metals)								
EPA 6020	Thallium	mg/L Extract	<0.001	0.00002	0.001	W110098	02-Mar-11	
EPA 6020	Uranium	mg/L Extract	<0.001	0.000009	0.001	W110098	02-Mar-11	

Quality Control - LABORATORY CONTROL SAMPLE Data

Method	Analyte	Units	LCS Result	LCS True	% Rec.	Acceptance Limits	Batch ID	Analyzed	Notes
Metals (Total)									
EPA 6020	Thallium	mg/kg	2.51	2.50	101	80 - 120	W109270	28-Feb-11	
EPA 6020	Uranium	mg/kg	2.64	2.50	105	80 - 120	W109270	28-Feb-11	
Meteoric Water Mobility Leachates (Metals by 200 Series)									
EPA 200.8	Thallium	mg/L Extract	0.0259	0.0250	103	85 - 115	W110097	01-Mar-11	
EPA 200.8	Uranium	mg/L Extract	0.0271	0.0250	108	85 - 115	W110097	01-Mar-11	
SPLP Leachates (Metals)									
EPA 6020	Thallium	mg/L Extract	0.026	0.0250	103	80 - 120	W110098	02-Mar-11	
EPA 6020	Uranium	mg/L Extract	0.028	0.0250	110	80 - 120	W110098	02-Mar-11	

Quality Control - DUPLICATE Data

Method	Analyte	Units	Duplicate Result	Sample Result	RPD	RPD Limit	Batch ID	Analyzed	Notes
Metals (Total)									
EPA 6020	Thallium	mg/kg	<0.100	<0.100	<RL	20	W109270	28-Feb-11	
EPA 6020	Uranium	mg/kg	3.02	3.10	2.6	200	W109270	28-Feb-11	
Meteoric Water Mobility Leachates (Metals by 200 Series)									
EPA 200.8	Thallium	mg/L Extract	<0.00100	<0.00100	<RL	20	W110097	01-Mar-11	
EPA 200.8	Uranium	mg/L Extract	0.00136	0.00135	0.1	20	W110097	01-Mar-11	
SPLP Leachates (Metals)									
EPA 6020	Thallium	mg/L Extract	<0.001	<0.001	UDL	20	W110098	02-Mar-11	
EPA 6020	Uranium	mg/L Extract	<0.001	<0.001	<RL	20	W110098	02-Mar-11	

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Tetra Tech EM, Inc. (Tucson)
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Tucson, AZ 85741

Project Name: Rosemont
Work Order: **W1B0493**
Reported: 11-Mar-11 14:43

Quality Control - MATRIX SPIKE Data

Method	Analyte	Units	Spike Result	Sample Result (R)	Spike Level (S)	% Rec.	Acceptance Limits	Batch ID	Analyzed	Notes
Metals (Total)										
EPA 6020	Thallium	mg/kg	2.24	<0.100	2.50	87.1	75 - 125	W109270	28-Feb-11	
EPA 6020	Uranium	mg/kg	5.24	3.10	2.50	85.4	75 - 125	W109270	28-Feb-11	
Meteoric Water Mobility Leachates (Metals by 200 Series)										
EPA 200.8	Thallium	mg/L Extract	0.0264	<0.00100	0.0250	105	70 - 130	W110097	01-Mar-11	
EPA 200.8	Uranium	mg/L Extract	0.0294	0.00135	0.0250	112	70 - 130	W110097	01-Mar-11	
SPLP Leachates (Metals)										
EPA 6020	Thallium	mg/L Extract	0.025	<0.001	0.0250	102	75 - 125	W110098	02-Mar-11	
EPA 6020	Uranium	mg/L Extract	0.028	<0.001	0.0250	112	75 - 125	W110098	02-Mar-11	

Quality Control - POST DIGESTION SPIKE Data

Method	Analyte	Units	Spike Result	Sample Result (R)	Spike Level (S)	% Rec.	Acceptance Limits	Batch ID	Analyzed	Notes
Metals (Total)										
EPA 6020	Thallium	mg/kg	2.52	<0.100	2.50	98.5	75 - 125	W109270	28-Feb-11	
EPA 6020	Uranium	mg/kg	5.43	3.10	2.50	93.1	75 - 125	W109270	28-Feb-11	
SPLP Leachates (Metals)										
EPA 6020	Thallium	mg/L Extract	0.027	<0.001	0.0250	109	75 - 125	W110098	02-Mar-11	
EPA 6020	Uranium	mg/L Extract	0.029	<0.001	0.0250	117	75 - 125	W110098	02-Mar-11	

Notes and Definitions

LCS	Laboratory Control Sample (Blank Spike)
RPD	Relative Percent Difference
UDL	A result is less than the detection limit
R > 4S	% recovery not applicable, sample concentration more than four times greater than spike level
<RL	A result is less than the reporting limit
MRL	Method Reporting Limit
MDL	Method Detection Limit
N/A	Not Applicable

ATTACHMENT 6
ANALYTICAL SUMMARY REPORT FROM ENERGY LABORATORIES

ANALYTICAL SUMMARY REPORT

April 12, 2011

SVL Analytical
1 Government Gulch
Kellogg, ID 83837

Workorder No.: C11030492

Project Name: 1B0493 Rosemont Copper Project

Energy Laboratories, Inc. Casper WY received the following 12 samples for SVL Analytical on 3/16/2011 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
C11030492-001	4-7 Year Composite (SPLP)		03/16/11	Extract	Gross Alpha, Gross Beta Radium 226, Total Radium 228, Total
C11030492-002	4-7 Year Composite (MWMP)		03/16/11	Extract	Same As Above
C11030492-003	Escabrosa (SPLP)		03/16/11	Extract	Same As Above
C11030492-004	Escabrosa (MWMP)		03/16/11	Extract	Same As Above
C11030492-005	Horquilla (SPLP)		03/16/11	Extract	Same As Above
C11030492-006	Horquilla (MWMP)		03/16/11	Extract	Same As Above
C11030492-007	Colina (SPLP)		03/16/11	Extract	Same As Above
C11030492-008	Colina (MWMP)		03/16/11	Extract	Same As Above
C11030492-009	Epitaph (SPLP)		03/16/11	Extract	Same As Above
C11030492-010	Epitaph (MWMP)		03/16/11	Extract	Same As Above
C11030492-011	Earp (SPLP)		03/16/11	Extract	Same As Above
C11030492-012	Earp (MWMP)		03/16/11	Extract	Same As Above

This report was prepared by Energy Laboratories, Inc., 2393 Salt Creek Hwy., Casper, WY 82601. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

Client:	SVL Analytical	**Report Date:**	04/12/11
Project:	1B0493 Rosemont Copper Project	**Collection Date:**	Not Provided
Lab ID:	C11030492-001	**DateReceived:**	03/16/11
Client Sample ID:	4-7 Year Composite (SPLP)	**Matrix:**	Extract

Analyses	Result	Units	Qualifier	RL	MCL/ QCL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Gross Alpha	-0.3	pCi/L	U			E900.0	03/22/11 13:47 / ep
Gross Alpha precision (±)	1.9	pCi/L				E900.0	03/22/11 13:47 / ep
Gross Alpha MDC	3.2	pCi/L				E900.0	03/22/11 13:47 / ep
Radium 226	0.41	pCi/L				E903.0	03/29/11 08:57 / trs
Radium 226 precision (±)	0.14	pCi/L				E903.0	03/29/11 08:57 / trs
Radium 226 MDC	0.13	pCi/L				E903.0	03/29/11 08:57 / trs
Radium 228	1.1	pCi/L				RA-05	03/24/11 12:16 / plj
Radium 228 precision (±)	0.67	pCi/L				RA-05	03/24/11 12:16 / plj
Radium 228 MDC	1.0	pCi/L				RA-05	03/24/11 12:16 / plj

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

Client: SVL Analytical
Project: 1B0493 Rosemont Copper Project
Lab ID: C11030492-002
Client Sample ID: 4-7 Year Composite (MWMP)

Report Date: 04/12/11
Collection Date: Not Provided
DateReceived: 03/16/11
Matrix: Extract

Analyses	Result	Units	Qualifier	RL	MCL/ QCL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Gross Alpha	-1	pCi/L	U			E900.0	03/22/11 13:47 / ep
Gross Alpha precision (±)	0.6	pCi/L				E900.0	03/22/11 13:47 / ep
Gross Alpha MDC	1.3	pCi/L				E900.0	03/22/11 13:47 / ep
Radium 226	0.26	pCi/L				E903.0	03/29/11 08:57 / trs
Radium 226 precision (±)	0.14	pCi/L				E903.0	03/29/11 08:57 / trs
Radium 226 MDC	0.16	pCi/L				E903.0	03/29/11 08:57 / trs
Radium 228	0.42	pCi/L	U			RA-05	03/24/11 12:16 / plj
Radium 228 precision (±)	0.79	pCi/L				RA-05	03/24/11 12:16 / plj
Radium 228 MDC	1.3	pCi/L				RA-05	03/24/11 12:16 / plj

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

Client:	SVL Analytical	**Report Date:**	04/12/11
Project:	1B0493 Rosemont Copper Project	**Collection Date:**	Not Provided
Lab ID:	C11030492-003	**DateReceived:**	03/16/11
Client Sample ID:	Escabrosa (SPLP)	**Matrix:**	Extract

Analyses	Result	Units	Qualifier	RL	MCL/ QCL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Gross Alpha	1.4	pCi/L	U			E900.0	03/22/11 13:47 / ep
Gross Alpha precision (±)	4.0	pCi/L				E900.0	03/22/11 13:47 / ep
Gross Alpha MDC	6.6	pCi/L				E900.0	03/22/11 13:47 / ep
Radium 226	0.76	pCi/L				E903.0	03/29/11 08:57 / trs
Radium 226 precision (±)	0.19	pCi/L				E903.0	03/29/11 08:57 / trs
Radium 226 MDC	0.13	pCi/L				E903.0	03/29/11 08:57 / trs
Radium 228	0.72	pCi/L	U			RA-05	03/24/11 12:16 / plj
Radium 228 precision (±)	0.68	pCi/L				RA-05	03/24/11 12:16 / plj
Radium 228 MDC	1.1	pCi/L				RA-05	03/24/11 12:16 / plj

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

Client:	SVL Analytical	**Report Date:**	04/12/11
Project:	1B0493 Rosemont Copper Project	**Collection Date:**	Not Provided
Lab ID:	C11030492-004	**DateReceived:**	03/16/11
Client Sample ID:	Escabrosa (MWMP)	**Matrix:**	Extract

Analyses	Result	Units	Qualifier	RL	MCL/ QCL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Gross Alpha	-0.8	pCi/L	U			E900.0	03/22/11 13:47 / ep
Gross Alpha precision (±)	0.7	pCi/L				E900.0	03/22/11 13:47 / ep
Gross Alpha MDC	1.3	pCi/L				E900.0	03/22/11 13:47 / ep
Radium 226	0.30	pCi/L				E903.0	03/29/11 08:57 / trs
Radium 226 precision (±)	0.14	pCi/L				E903.0	03/29/11 08:57 / trs
Radium 226 MDC	0.15	pCi/L				E903.0	03/29/11 08:57 / trs
Radium 228	1.1	pCi/L	U			RA-05	03/24/11 12:16 / plj
Radium 228 precision (±)	0.76	pCi/L				RA-05	03/24/11 12:16 / plj
Radium 228 MDC	1.2	pCi/L				RA-05	03/24/11 12:16 / plj

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

Client:	SVL Analytical		**Report Date:**	04/12/11
Project:	1B0493 Rosemont Copper Project		**Collection Date:**	Not Provided
Lab ID:	C11030492-005		**DateReceived:**	03/16/11
Client Sample ID:	Horquilla (SPLP)		**Matrix:**	Extract

Analyses	Result	Units	Qualifier	RL	MCL/ QCL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Gross Alpha	2.0	pCi/L	U			E900.0	03/22/11 13:47 / ep
Gross Alpha precision (±)	1.7	pCi/L				E900.0	03/22/11 13:47 / ep
Gross Alpha MDC	2.7	pCi/L				E900.0	03/22/11 13:47 / ep
Radium 226	0.47	pCi/L				E903.0	03/29/11 08:57 / trs
Radium 226 precision (±)	0.15	pCi/L				E903.0	03/29/11 08:57 / trs
Radium 226 MDC	0.13	pCi/L				E903.0	03/29/11 08:57 / trs
Radium 228	1.0	pCi/L	U			RA-05	03/24/11 12:16 / plj
Radium 228 precision (±)	0.67	pCi/L				RA-05	03/24/11 12:16 / plj
Radium 228 MDC	1.1	pCi/L				RA-05	03/24/11 12:16 / plj

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

Client:	SVL Analytical	**Report Date:**	04/12/11
Project:	1B0493 Rosemont Copper Project	**Collection Date:**	Not Provided
Lab ID:	C11030492-006	**DateReceived:**	03/16/11
Client Sample ID:	Horquilla (MWMP)	**Matrix:**	Extract

Analyses	Result	Units	Qualifier	RL	MCL/ QCL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Gross Alpha	-0.3	pCi/L	U			E900.0	03/22/11 13:47 / ep
Gross Alpha precision (±)	0.7	pCi/L				E900.0	03/22/11 13:47 / ep
Gross Alpha MDC	1.3	pCi/L				E900.0	03/22/11 13:47 / ep
Radium 226	0.23	pCi/L				E903.0	03/29/11 08:57 / trs
Radium 226 precision (±)	0.14	pCi/L				E903.0	03/29/11 08:57 / trs
Radium 226 MDC	0.17	pCi/L				E903.0	03/29/11 08:57 / trs
Radium 228	1.6	pCi/L				RA-05	03/24/11 12:16 / plj
Radium 228 precision (±)	0.88	pCi/L				RA-05	03/24/11 12:16 / plj
Radium 228 MDC	1.4	pCi/L				RA-05	03/24/11 12:16 / plj

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

Client:	SVL Analytical		**Report Date:**	04/12/11
Project:	1B0493 Rosemont Copper Project		**Collection Date:**	Not Provided
Lab ID:	C11030492-007		**DateReceived:**	03/16/11
Client Sample ID:	Colina (SPLP)		**Matrix:**	Extract

Analyses	Result	Units	Qualifier	RL	MCL/ QCL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Gross Alpha	5.1	pCi/L	U			E900.0	03/22/11 13:47 / ep
Gross Alpha precision (±)	12.0	pCi/L				E900.0	03/22/11 13:47 / ep
Gross Alpha MDC	19.7	pCi/L				E900.0	03/22/11 13:47 / ep
Radium 226	1.3	pCi/L				E903.0	04/04/11 16:43 / trs
Radium 226 precision (±)	0.21	pCi/L				E903.0	04/04/11 16:43 / trs
Radium 226 MDC	0.1	pCi/L				E903.0	04/04/11 16:43 / trs
Radium 228	0.54	pCi/L	U			RA-05	03/29/11 17:16 / plj
Radium 228 precision (±)	0.71	pCi/L				RA-05	03/29/11 17:16 / plj
Radium 228 MDC	1.2	pCi/L				RA-05	03/29/11 17:16 / plj

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

Client:	SVL Analytical	**Report Date:**	04/12/11
Project:	1B0493 Rosemont Copper Project	**Collection Date:**	Not Provided
Lab ID:	C11030492-008	**DateReceived:**	03/16/11
Client Sample ID:	Colina (MWMP)	**Matrix:**	Extract

Analyses	Result	Units	Qualifier	RL	MCL/ QCL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Gross Alpha	2.4	pCi/L	U			E900.0	03/22/11 13:47 / ep
Gross Alpha precision (±)	2.1	pCi/L				E900.0	03/22/11 13:47 / ep
Gross Alpha MDC	3.3	pCi/L				E900.0	03/22/11 13:47 / ep
Radium 226	0.62	pCi/L				E903.0	04/04/11 16:43 / trs
Radium 226 precision (±)	0.16	pCi/L				E903.0	04/04/11 16:43 / trs
Radium 226 MDC	0.11	pCi/L				E903.0	04/04/11 16:43 / trs
Radium 228	-0.3	pCi/L	U			RA-05	03/29/11 17:16 / plj
Radium 228 precision (±)	0.76	pCi/L				RA-05	03/29/11 17:16 / plj
Radium 228 MDC	1.3	pCi/L				RA-05	03/29/11 17:16 / plj

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

Client:	SVL Analytical	**Report Date:**	04/12/11
Project:	1B0493 Rosemont Copper Project	**Collection Date:**	Not Provided
Lab ID:	C11030492-009	**DateReceived:**	03/16/11
Client Sample ID:	Epitaph (SPLP)	**Matrix:**	Extract

Analyses	Result	Units	Qualifier	RL	MCL/ QCL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Gross Alpha	4.7	pCi/L	U			E900.0	03/22/11 13:47 / ep
Gross Alpha precision (±)	7.8	pCi/L				E900.0	03/22/11 13:47 / ep
Gross Alpha MDC	12.6	pCi/L				E900.0	03/22/11 13:47 / ep
Radium 226	2.6	pCi/L				E903.0	04/04/11 16:43 / trs
Radium 226 precision (±)	0.30	pCi/L				E903.0	04/04/11 16:43 / trs
Radium 226 MDC	0.10	pCi/L				E903.0	04/04/11 16:43 / trs
Radium 228	0.89	pCi/L	U			RA-05	03/29/11 17:16 / plj
Radium 228 precision (±)	0.74	pCi/L				RA-05	03/29/11 17:16 / plj
Radium 228 MDC	1.2	pCi/L				RA-05	03/29/11 17:16 / plj

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

Client: SVL Analytical
Project: 1B0493 Rosemont Copper Project
Lab ID: C11030492-010
Client Sample ID: Epitaph (MWMP)

Report Date: 04/12/11
Collection Date: Not Provided
DateReceived: 03/16/11
Matrix: Extract

Analyses	Result	Units	Qualifier	RL	MCL/ QCL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Gross Alpha	4.2	pCi/L				E900.0	03/22/11 13:47 / ep
Gross Alpha precision (±)	1.7	pCi/L				E900.0	03/22/11 13:47 / ep
Gross Alpha MDC	2.5	pCi/L				E900.0	03/22/11 13:47 / ep
Radium 226	1.1	pCi/L				E903.0	04/04/11 16:43 / trs
Radium 226 precision (±)	0.20	pCi/L				E903.0	04/04/11 16:43 / trs
Radium 226 MDC	0.11	pCi/L				E903.0	04/04/11 16:43 / trs
Radium 228	-0.1	pCi/L	U			RA-05	03/29/11 17:16 / plj
Radium 228 precision (±)	0.77	pCi/L				RA-05	03/29/11 17:16 / plj
Radium 228 MDC	1.3	pCi/L				RA-05	03/29/11 17:16 / plj

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

Client: SVL Analytical
Project: 1B0493 Rosemont Copper Project
Lab ID: C11030492-011
Client Sample ID: Earp (SPLP)

Report Date: 04/12/11
Collection Date: Not Provided
DateReceived: 03/16/11
Matrix: Extract

Analyses	Result	Units	Qualifier	RL	MCL/ QCL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Gross Alpha	36.2	pCi/L				E900.0	03/22/11 13:47 / ep
Gross Alpha precision (±)	4.4	pCi/L				E900.0	03/22/11 13:47 / ep
Gross Alpha MDC	4.0	pCi/L				E900.0	03/22/11 13:47 / ep
Radium 226	4.3	pCi/L				E903.0	04/04/11 16:43 / trs
Radium 226 precision (±)	0.40	pCi/L				E903.0	04/04/11 16:43 / trs
Radium 226 MDC	0.11	pCi/L				E903.0	04/04/11 16:43 / trs
Radium 228	0.68	pCi/L	U			RA-05	03/29/11 17:16 / plj
Radium 228 precision (±)	0.82	pCi/L				RA-05	03/29/11 17:16 / plj
Radium 228 MDC	1.3	pCi/L				RA-05	03/29/11 17:16 / plj

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

Client:	SVL Analytical	**Report Date:**	04/12/11
Project:	1B0493 Rosemont Copper Project	**Collection Date:**	Not Provided
Lab ID:	C11030492-012	**DateReceived:**	03/16/11
Client Sample ID:	Earp (MWMP)	**Matrix:**	Extract

Analyses	Result	Units	Qualifier	RL	MCL/ QCL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Gross Alpha	0.5	pCi/L	U			E900.0	03/22/11 13:47 / ep
Gross Alpha precision (±)	0.8	pCi/L				E900.0	03/22/11 13:47 / ep
Gross Alpha MDC	1.3	pCi/L				E900.0	03/22/11 13:47 / ep
Radium 226	0.29	pCi/L				E903.0	04/04/11 16:43 / trs
Radium 226 precision (±)	0.15	pCi/L				E903.0	04/04/11 16:43 / trs
Radium 226 MDC	0.16	pCi/L				E903.0	04/04/11 16:43 / trs
Radium 228	1.2	pCi/L	U			RA-05	03/29/11 17:16 / plj
Radium 228 precision (±)	1.1	pCi/L				RA-05	03/29/11 17:16 / plj
Radium 228 MDC	1.8	pCi/L				RA-05	03/29/11 17:16 / plj

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
U - Not detected at minimum detectable concentration

QA/QC Summary Report

Prepared by Casper, WY Branch

Client: SVL Analytical **Report Date:** 04/12/11

Project: 1B0493 Rosemont Copper Project **Work Order:** C11030492

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E900.0										Batch: GrAB-1060
Sample ID: MB-GrAB-1060	3	Method Blank				Run: G5000W_110318A				03/22/11 01:38
Gross Alpha		-0.3	pCi/L							U
Gross Alpha precision (±)		0.6	pCi/L							
Gross Alpha MDC		1	pCi/L							
Sample ID: Th230-GrAB-1060		Laboratory Control Sample				Run: G5000W_110318A				03/22/11 01:38
Gross Alpha		79.5	pCi/L		78	80	120			S
- LCS response is outside of the acceptance range for this analysis. Since the MB, MS, and MSD are acceptable the batch is approved.										
Sample ID: C11030481-002CMS		Sample Matrix Spike				Run: G5000W_110318A				03/22/11 01:38
Gross Alpha		99	pCi/L		96	70	130			
Sample ID: C11030481-002CMSD		Sample Matrix Spike Duplicate				Run: G5000W_110318A				03/22/11 01:38
Gross Alpha		98	pCi/L		96	70	130	0.3	16.5	
Sample ID: C11030492-011ADUP	3	Sample Duplicate				Run: G5000W_110318A				03/22/11 13:47
Gross Alpha		38.2	pCi/L					5.5	33.7	
Gross Alpha precision (±)		4.46	pCi/L							
Gross Alpha MDC		4.04	pCi/L							

Qualifiers:

RL - Analyte reporting limit.

MDC - Minimum detectable concentration

U - Not detected at minimum detectable concentration

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Casper, WY Branch

Client: SVL Analytical **Report Date:** 04/12/11

Project: 1B0493 Rosemont Copper Project **Work Order:** C11030492

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E903.0									Batch: RA226-5249	
Sample ID: C11030558-001HMS		Sample Matrix Spike				Run: TENNELEC-3_110321B			03/29/11 08:57	
Radium 226		13	pCi/L		101	70	130			
Sample ID: C11030558-001HMSD		Sample Matrix Spike Duplicate				Run: TENNELEC-3_110321B			03/29/11 08:57	
Radium 226		14	pCi/L		104	70	130	3.0	27	
Sample ID: MB-RA226-5249	3	Method Blank				Run: TENNELEC-3_110321B			03/29/11 08:57	
Radium 226		0.09	pCi/L							U
Radium 226 precision (±)		0.09	pCi/L							
Radium 226 MDC		0.1	pCi/L							
Sample ID: LCS-RA226-5249		Laboratory Control Sample				Run: TENNELEC-3_110321B			03/29/11 08:57	
Radium 226		5.9	pCi/L		91	85	115			
Method: E903.0									Batch: RA226-5255	
Sample ID: C11030578-001GMS		Sample Matrix Spike				Run: TENNELEC-3_110323E			04/04/11 16:43	
Radium 226		14	pCi/L		105	70	130			
Sample ID: C11030578-001GMSD		Sample Matrix Spike Duplicate				Run: TENNELEC-3_110323E			04/04/11 16:43	
Radium 226		13	pCi/L		98	70	130	6.3	24.4	
Sample ID: MB-RA226-5255	3	Method Blank				Run: TENNELEC-3_110323E			04/04/11 16:43	
Radium 226		0.2	pCi/L							
Radium 226 precision (±)		0.1	pCi/L							
Radium 226 MDC		0.1	pCi/L							
Sample ID: LCS-RA226-5255		Laboratory Control Sample				Run: TENNELEC-3_110323E			04/04/11 16:43	
Radium 226		6.4	pCi/L		97	85	115			

Qualifiers:

RL - Analyte reporting limit.

MDC - Minimum detectable concentration

ND - Not detected at the reporting limit.

U - Not detected at minimum detectable concentration

QA/QC Summary Report

Prepared by Casper, WY Branch

Client: SVL Analytical **Report Date:** 04/12/11

Project: 1B0493 Rosemont Copper Project **Work Order:** C11030492

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: RA-05										Batch: RA228-3644
Sample ID: LCS-228-RA226-5249		Laboratory Control Sample				Run: TENNELEC-3_110321A				03/24/11 12:16
Radium 228		7.3	pCi/L		99	80	120			
Sample ID: MB-RA226-5249	3	Method Blank				Run: TENNELEC-3_110321A				03/24/11 12:16
Radium 228		0.4	pCi/L							U
Radium 228 precision (±)		0.6	pCi/L							
Radium 228 MDC		1	pCi/L							
Sample ID: C11030558-002HMS		Sample Matrix Spike				Run: TENNELEC-3_110321A				03/24/11 12:16
Radium 228		16	pCi/L		112	70	130			
Sample ID: C11030558-002HMSD		Sample Matrix Spike Duplicate				Run: TENNELEC-3_110321A				03/24/11 12:16
Radium 228		18	pCi/L		125	70	130	10	31.8	
Method: RA-05										Batch: RA228-3645
Sample ID: LCS-228-RA226-5255		Laboratory Control Sample				Run: TENNELEC-3_110323A				03/29/11 17:16
Radium 228		7.7	pCi/L		107	80	120			
Sample ID: MB-RA226-5255	3	Method Blank				Run: TENNELEC-3_110323A				03/29/11 17:16
Radium 228		0.2	pCi/L							U
Radium 228 precision (±)		0.8	pCi/L							
Radium 228 MDC		1	pCi/L							
Sample ID: C11030585-006FMS		Sample Matrix Spike				Run: TENNELEC-3_110323A				03/29/11 17:16
Radium 228		16	pCi/L		114	70	130			
Sample ID: C11030585-006FMSD		Sample Matrix Spike Duplicate				Run: TENNELEC-3_110323A				03/29/11 17:16
Radium 228		16	pCi/L		114	70	130	0.5	41.8	

Qualifiers:

RL - Analyte reporting limit.

MDC - Minimum detectable concentration

ND - Not detected at the reporting limit.

U - Not detected at minimum detectable concentration

Workorder Receipt Checklist

SVL Analytical

C11030492

Login completed by:	Halley Ackerman	Date Received:	3/16/2011
Reviewed by:	BL2000\tedwards	Received by:	ha
Reviewed Date:	3/18/2011	Carrier name:	Ground

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature:	11.2℃		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Contact and Corrective Action Comments:

None

CHAIN OF CUSTODY RECORD

SVL Analytical, Inc. • One Government Gulch • Kellogg, ID 83837 • (208) 784-1258 • FAX: (208) 783-0891

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FOR SVL USE ONLY
SVL JOB # 1B0493
TEMP on Receipt:

Table 1. -- Matrix Type
1 = Surface Water, 2 = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other

Report to Company: SVL Analytical
Contact: Chris Meyer / Kirby Gay
Address: 1 Government Gulch, Kellogg Id 83837
Phone Number: 208-784-1258
FAX Number: 208-783-0891
E-mail:

Invoice Sent To:
Contact: Same
Address:
Phone Number:
FAX Number:
PO#: 11114

Project Name: Rosemont Copper Project
Sampler's Signature:

Indicate State of sample origination: AZ
USACE? ☐ Yes ☐ No

#	Sample ID	Collection Date	Collection Time	Collected by: (Init.)	Matrix Type (From Table 1)	No. of Containers	Unpreserved	HNO_3 Filtered	HNO_3 Unfiltered	HCl	H_2SO_4	NaOH	Other (Specify)	RAD 226/228 (SPLP EXT)	Gross Alpha (SPLP EXT)	RAD226/228 (MWMP EXT)	Gross Alpha (MWMP EXT)	Rush Instructions (Days)	Comments
1	4-7 YEAR Composite					24			X					X	X	X	X		RAD 226/228 + Gross Alpha done on MWMP + SPLP extractions -
2	Escabrosa					24			X					X	X	X	X		
3	Horquilla					24			X					X	X	X	X		
4	Cotina					24			X					X	X	X	X		
5	Epitaph					24			X					X	X	X	X		
6	Earp					24			X					X	X	X	X		
7																			
8																			
9																			
10																			C1030492

Please take care to distinguish between: 1 and I, 2 and Z, 5 and S, Ø and O. Thanks!

Relinquished by: [signature] Date: 3/11/10 Time: 14:00 Received by: Hailey Ackerman Date: 3.16.11 Time: 915
Relinquished by: Date: Time: Received by: Date: Time:

* Sample Reject: ☐ Return ☐ Dispose ☐ Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY SVL-COC 9/05

11.2° no ice