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Technical Memorandum
Sycamore Tailings and Barrel Waste Alternative
Geochemical Characterization

To:	Kathy Arnold	**From:**	David Krizek
Company:	Rosemont Copper Company	**Date:**	January 10, 2010
CC:	Mark Williamson (Tt)	**Doc #:**	018/10-320871-5.3

1.0 Introduction

This Technical Memorandum was prepared by Tetra Tech and presents a geochemical characterization of the tailings and waste rock materials for the Sycamore Tailings and Barrel Waste Alternative being considered in the US Forest Service Environmental Impact Statement (EIS) for the proposed Rosemont Copper Project (Project).

In 2007, Tetra Tech published a Baseline Geochemical Characterization report and a Geochemical Characterization Addendum Report for the proposed Project as part of the Mine Plan of Operations (MPO). In addition to these two (2) reports, several technical memoranda have been prepared for the Project which provides supplemental geochemical information and testing. The Sycamore Tailings and Barrel Waste Alternative differs from the MPO primarily in the design and location of the Waste Rock Storage Area and the Dry Stack Tailings Facility. This alternative does not change the location of the proposed Open Pit or the source of waste rock and tailings materials.

However, the material used to construct the dry stack tailings buttress may not come from the Open Pit but from a quarry developed on the west side of the Santa Rita Mountain Range.

The following sections of this Technical Memorandum provide a general summary of the overall geochemical characterization of the tailings and waste rock materials associated with the Project. This included a general comparison of the anticipated tailings buttress material composition, derived from a potential quarry site in Sycamore Canyon, to the waste rock previously tested.

2.0 Waste Rock

Upon completion of the 2006-2007 geochemical testing program, a total of 180 waste rock samples were tested for acid-generating potential, metals content, and/or metal release. In 2008, an additional 46 waste rock samples underwent testing, bringing the total count to 226 samples. Less than 1% of 208 samples tested were classified as likely to generate acid. About 24% of the samples were classified as uncertain or moderately acid generating. These samples underwent additional evaluations, including leaching tests.

Based on all the geochemical testing of waste rock samples, the two (2) rock types which have the potential to be acid generating are the Bolsa Quartzite and Andesite. However, only leachates from a few Bolsa quartzite samples gave an acidic pH, and contained low acidity. This low acidity can be easily mitigated during placement of the waste rock by blending with acid-neutralizing rock types. Also, the Bolsa Quartzite and Andesite waste rock material account for a small percentage, 3% and 6% respectively, of the total waste rock volume.

3.0 Tailings

To date, four (4) samples of tailings material have been generated for the Project. All of the samples were tested for acid-generating capacity, metals content, and/or metal release. Results of the acid-generating tests did not indicate the potential to generate acid but exhibited a pronounced acid neutralizing potential. Thus, with respect to the potential for acidic drainage, the tailings are acid consuming, not acid generating. Additionally, when the tailings were tested for the potential release of chemical constituents using both static (Synthetic Precipitation Leaching Procedure) and kinetic (standard humidity cells), the results showed a very limited release of any chemical parameter, including metals.

4.0 Anticipated Sycamore Dry Stack Tailings Buttress Material

Attachment 1 provides information provided by Rosemont Copper on potentially available quarry material in Sycamore Canyon for use in building the buttress of the Dry Stack Tailings Facility. This information is tabulated in a table in Attachment 2 along with a comparison to waste rock materials generated from the Open Pit.

A majority of the formation directly adjacent to and behind the proposed dry stack tailings buttress can be classified as Schellenberger Formation, which is an arkosic sandstone, mudstone, and rare pebbly sandstone. It is estimated that just less than 50% of the Schellenberger Formation is a bedded fine to coarse grained sandstone with varying amounts of fines, arkose, and lithics. The remaining 50% of the formation is dark olive green mudstone which is silty with relatively pure shale or claystone intervals.

In summary, the material types in the proposed buttress area include:

- Arkosic sandstone/mudstone
- Arkosic sandstone/conglomerate
- Andesitic lava
- Quartoze sandstone and mudstone
- Bedded cherty limestone

There is a small band of Quartz-Feldspar porphyry running through the area that may need to be segregated and not placed on the outer surface of the buttress. None of the materials in the Sycamore Canyon area, however, have been tested with either static or kinetic tests, etc.

Tables 1 and 2 in Attachment 2 document the anticipated material types in Sycamore Canyon versus the materials generated from the Open Pit. While the material types in Sycamore Canyon have types in the Open Pit that are classified as similar from a mineralogical mapping perspective, they are not mapped as the identical units and may have slightly different geochemical properties. Only the material mapped as andesitic lava in Sycamore Canyon appears to have any potential to produce acid rock drainage, as it is described (Attachment 1) as similar to the Willow Canyon andesite of the Open Pit. The Willow Canyon andesite did not produce acidic drainage in laboratory test, but did yield acid-base accounting data that indicated the potential for acid drainage. For completeness, the more abundant material types in Sycamore Canyon (e.g. Schellenberger formation) should be characterized.

5.0 Conclusion

The Sycamore Tailings and Barrel Waste Alternative being considered in the EIS for the proposed Rosemont Copper Project has the same geochemical characterization for the tailings and waste rock materials generated from the Open Pit as the MPO design. This alternative does not change the location of the proposed Open Pit or the source of waste rock and tailings materials. Therefore, all the geochemical testing results, reports, and technical memoranda published to date on these materials are still valid and applicable to this alternative.

This alternative also assumes a possible new quarry site on the west side of the Santa Rita Mountains. This quarry would provide buttress material for the Dry Stack Tailings Facility in Sycamore Canyon as opposed to hauling waste rock from the Open Pit to the Sycamore site.

Based on a review of potential quarry material in Sycamore Canyon, these materials are anticipated to be of similar composition and to have similar geochemical characteristics to the waste rock generated from the Open Pit. Therefore, the geochemical characterization work and conclusions developed for the MPO facility designs are not expected to change based on the proposed Sycamore Tailings and Barrel Waste Alternative. However, additional testing of the potential quarry materials would be needed to verify this conclusion.

REFERENCES

Tetra Tech (2007) *Baseline Geochemical Characterization.* Prepared for Augusta Resource Corporation. Report Dated June 2007.

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

Tetra Tech, Levy, D. and Williamson, M. (2008) Geochemistry Sample Update. Technical Memorandum. November 10, 2008.

Tetra Tech, Williamson, M. (2009) Tailings Geochemistry. Technical Memorandum. March 24, 2009.

Tetra Tech, Levy, D. (2009) Bolsa Quartzite – Acid-Base Accounting Properties and Humidity Cell Testing Results. Technical Memorandum. October 7, 2009.

ATTACHMENT 1
ROSEMONT COPPER COMPANY
PROVIDED INFORMATION

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Memorandum

To: File

From: Jeff Cornoyer

Subject: **Review of Available Quarry Material in Sycamore Canyon**

Date: September 25, 2009

Sycamore Canyon is on the western slope of the Santa Rita Mountains near the Helvetia mining district and lies just north and east of Gunsight Pass.

A majority of the formation directly adjacent to and behind the buttress can be classified as Ks - Schellenberger Fm – Arkosic sandstone, mudstone, and rare pebbly sandstone. Just less than 50% of the formation is bedded fine to coarse grained sandstone with varying amounts of fines, arkose and lithics. Colors are browns, tans and dark grays. The remaining 50% is dark olive green mudstone which is silty with relatively pure shale or claystone intervals.

In the southwest buttress quadrant, there are several units identified between the starter buttress and final elevation buttress:

1) Ksl – Lower Schellenberger Fm – Arkosic sandstone and mudstone capped with a 5 meter limestone unit. Sandstone is fine to med grained arkosic to lithic with varying fines. Mudstone is mostly silty with relatively sparse pure shale or claystone intervals. Similar colors to Ks
2) Kw – Willow Canyon Fm – Arkosic sandstone, mudstone, conglomerate. Thin to thick beds of fine to coarse grain and granule, poorly sorted and lithic arkose. Colors are browns, dark grays, reddish browns.
3) Ka – Apache Canyon – Arkosic sandstone, mudstone, and limestone. Limestone is dark and makes up to 50% of formation. Dark mudstone in thick beds is other dominate member with lesser amounts of bedded arkosic sandstones.
4) Tp – Quartz-Feldspar porphyry – Igneous porphyritic dike containing phenocrysts of quartz, feldspar and biotite. Unknown sulfide content but temporally related to mineralized stocks. Color is light gray to pink to bone white.
5) Pr – Rainvalley Fm – Medium to thick bedded limestone to dolostone, with interbedded sandstone and siliceous shale. Colors are light to dark grays.
6) Pch - Concha Limestone – Medium bedded fossiliferous cherty limestone. Colors are dark to medium grays.

The Ks, Ksl, Kw and Ka appear to be better suited for capping or buttress materials. The Pr is geochemically suited for buttress and cover material but for aesthetic considerations should be avoided since it is lighter than the surrounding units. One small band of material (Tp) may not be suited for use as buttress or cover for aesthetic and geochemical considerations. This band may need to be managed separately; however, in general the quarry can encompass any of the area necessary to provide the material needed for buttress and capping material.

Sycamore Units (in approx decreasing quantities) (from Jeff Cornoyer, Rosemont Copper, 25Sept09)

Major Units

1) Ks - Schellenberger Fm: Arkosic sandstone, mudstone, rare pebbly sandstone. Approximately 50% of formation is thick bedded sandstone and 50% is mudstone
2) Ka(Kj) – Andesite: Andesitic lava Andesite lava and lava breccia
3) Kw – Willow Canyon: Arkosic sandstone, mudstone and conglomerate
4) Pch – Concha Limestone: Bedded cherty limestone
5) Pr – Rain Valley Fm: bedded limestone and dolostone with minor quartzose sandstone and siliceous shale

Minor Units

6) Ps – Scherrer Fm: Quartzite with minor bedded limestone
7) Qc – Hillside coalluvium: poorly sorted, ranging from clay to boulders
8) Qm – Miocene alluvium: dissected relic alluvial fans and terraces with strong soil development
9) Kt – Turney Ranch: Thick bedded alternating quartzose sandstone and mudstone
10) Qt- Hillside talus: talus and coalluvium
11) Kr & Kd: Ash flow tuff

ATTACHMENT 2
COMPARISON TABLES

Table 1.0
Open Pit Waste Rock Material Types

Material Type	Geologic Formation	Percent of Total (%)
Arkose Sandstone / Conglomerate	Willow Canyon	43.2%
Overburden & Tertiary Gravel	Overburden & Gila Conglomerate	11.2%
Limestone Conglomerate	Glance	9.1%
Limestone	Abrigo	9.0%
Limestone	Horquilla	6.9%
Andesite	Willow Canyon	3.9%
Limestone	Concha	2.7%
Dolomitic Marble	Martin	2.5%
Siliciclastic Carbonate	Earp	2.3%
Carbonate to Siliciclastic Carbonate	Epitaph	2.1%
Quartzite	Bolsa	1.9%
Limestone	Escabrosa	1.8%
Limestone / Marble	Colina	1.3%
Quartz Monzonite Porphyry (QMP)	-	1.0%
Quartzite	Scherrer	0.7%
Pre-Cambrian Granodiorite	Continental Granodiorite	0.3%

Table 2.0
Estimated Sycamore Quarry Units

Material Type	Geologic Formation	Similar to Open Pit Material Type	Estimated Percent of Total (%)
Arkose Sandstone/ Conglomerate	Willow Canyon	Willow Canyon Arkose	6.3%
Quartoze Sandstone and Mudstone	Turney Ranch	Sandstone/Willow Canyon Conglomorate	1.2%
Arkosic Sandstone/ Mudstone	Schellenberger	Arkose Sandstone/ Conglomerate	84.5%
Clay to Boulders	Hillside Coalluvium	Overburden & Gila Conglomerate	<0.01%
Talus and Colluvium	Miocene Alluvium		<0.01%
Talus and Coalluvium	Hillside Talus		<0.01%
Andesitic Lava	Andesite	Willow Canyon Andesite	6.6%
Bedded Cherty Limestone	Concha Limestone	Concha Limestone	0.01%
Bedded Limestone, Dolostone and Quartzite	Rain Valley	Martin/Epitaph	1.2%
Igneous Porphrytic Dike		Quartz Monzonite Porphyry (QMP)	0.18%
Tuff	Ashflow		<0.01%

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Memorandum

To:	Beverly Everson
Cc:	Tom Furgason
From:	Kathy Arnold
Doc #:	003/10 – 15.3.5
Subject:	**Transmittal of Technical Memoranda and Pit Lake Report**
Date:	February 8, 2010

Rosemont Copper is pleased to transmit the following twenty technical memoranda and one report:

1. Rosemont Hydrology Method Justification, a Tetra Tech memo dated January 7, 2010;
2. Barrel Only alternative –
    a. Noise Analysis, a Tetra Tech memo dated January 15, 2010
    b. Traffic Analysis, a Tetra Tech memo dated January 8, 2010
    c. Geochemical Characterization of Facilities, a Tetra Tech memo dated January 10, 2010
    d. Lighting, an M3 memo dated December 2009
3. Barrel and McCleary alternative –
    a. Noise Analysis, a Tetra Tech memo dated January 9, 2010
    b. Traffic Analysis, a Tetra Tech memo dated December 15, 2009
    c. Geochemical Characterization of Facilities, a Tetra Tech memo dated December 16, 2009
    d. Lighting, an M3 memo dated December 2009
4. Scholefield Tailings and McCleary Waste alternative –
    a. Noise Analysis, a Tetra Tech memo dated January 15, 2010
    b. Traffic Analysis, a Tetra Tech memo dated January 12, 2010
    c. Geochemical Characterization of Facilities, a Tetra Tech memo dated January 10, 2010
    d. Lighting, an M3 memo dated January 2010
5. Sycamore Tailings and Barrel Waste alternative –
    a. Noise Analysis, a Tetra Tech memo dated January 15, 2010
    b. Traffic Analysis, a Tetra Tech memo dated January 9, 2010
    c. Geochemical Characterization of Facilities, a Tetra Tech memo dated January 10, 2010
    d. Lighting, an M3 memo dated January 2010
6. Partial Backfill alternative –
    a. Noise Analysis, a Tetra Tech memo dated January 23, 2010
    b. Traffic Analysis, a Tetra Tech memo dated January 9, 2010
    c. Geochemical Characterization of Facilities, a Tetra Tech memo dated January 10, 2010
7. Geochemical Pit Lake Predictive Model, prepared by Tetra Tech and dated February 2010

As per your request, I am transmitting three hardcopies and two disks (disks contain tech memos only) directly to the Forest Service and two copies and one disk directly to SWCA. The Pit Lake report includes a copy of the report on a CD on the inside of the back cover of each report.