VECTOR
ARIZONA

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TECHNICAL MEMORANDUM

TO:	Jamie Sturgess, Mike Pawlowski
FROM:	Kathy Arnold
DATE:	July 26, 2006
SUBJECT:	**Preliminary Trip Report and Phase 1 Sampling & Analysis Plan**
DOCUMENT NO.	088/06-05-1400-5.3

1.1 Trip Details and Objectives

Vector personnel including Larry Breckenridge, Amy Hudson, Kathy Arnold, Jamie Monte, and Bill Schafer (Schafer Limited) visited the Rosemont site on July 11-12, 2006. The first day was spent on a general site orientation lead by Mike Pawlowski. On the second day, the team worked with the sample database, observed typical core from each principal rock type in the mine pit with assistance from Bill Daffron and others, and hiked the upper perimeter of the pit to sample a few scattered historic waste rock piles. The objectives of the field trip were to gain familiarity with the site characteristics including topography, surface water features, and geology; and to obtain available geologic information. Information gathered during this site visit provides the foundation for the Phase 1 geochemical sampling program.

Figure 1. Panorama of proposed Rosemont Pit from southern edge looking north, east, and south.

The purpose of Phases 1 and 2 of the geochemical sampling program as stated in the Vector proposal is:

> **Phase I Description**
>
> The project begins with a site visit. The Vector team will go to Rosemont to speak with site geologists, inspect core, and perform screening-level tests on the available rock samples. Vector will then prepare a preliminary geochemistry

report that identifies preliminary geochemical risks and describes the plan for further testing.

Phases II and III Description

Next, Vector will collect and analyze samples for static geochemical parameters. This phase may be iterative, if the first round of sampling contains data gaps. This phase will also involve characterizing materials as either Potentially Acid Generating (PAG) or Non-Acid Generating (NAG). Selected PAG materials will be analyzed for kinetic geochemical behavior. The results of the sampling will be summarized in a baseline geochemical report.

1.2 Preliminary Assessment of Geochemical Issues

Based on the available information, which includes general geology (lithology, mineralization and alteration styles), few rocks in the proposed Rosemont project have the potential to become acidic. Exceptions may include localized non-calcareous portions of the arkose and andesite units of the Cretaceous Bisbee Group, higher sulfide portions of the porphyry, and rare lenses of massive sulfide skarn alteration. The Rosemont project is different than many Arizona deposits in at least three ways, 1) it is a skarn meaning host rocks are strongly alkaline, 2) it is a low sulfur system dominated by copper-sulfides and in which pyrite is relatively scarce, and 3) most of the porphyry system including the pyrite shell is absent due to structural controls. Consequently, the environmental evaluation will focus on elements that may occur at elevated concentrations at neutral to alkaline pH levels.

The geochemical assessment being proposed are being developed in a way that it is directly applicable to specific mine facilities. Accordingly, sampling plans for waste rock, the leach materials, tailings (dry or conventional), and the open pit walls have been developed. Geochemical risks associated with other mine features (such as the perimeter berm, or storage stockpiles) can be derived from the aforementioned sampling plans.

1.3 Waste Rock Geochemical Characterization Program

Rocks contained in the pit will fall into three categories depending on their copper grade and leachability: mill grade ore (>0.2 % sulfide copper), leach grade ore (other material, mostly Bisbee Group and quartz latite porphyry with 0.1 to 0.2 % copper), and waste rock. Of course these cut-off grades are subject to refinement as the mining models are developed. The goal of the geochemical characterization program is to assess the potential for environmental risks associated with waste rock, leached ore, tailings, and open pits.

The waste rock characterization program will be conducted in two stages due to the availability of core samples from the re-logged Anaconda core. In the first stage, approximately one-third of the samples necessary to characterize the waste rock will be selected (Table 1) from Augusta drilling coarse rejects (boreholes 2000-2017). The

second stage of sampling will be on-going and conducted as the Anaconda core is being re-logged and re-assayed. By waiting for stage 2 sampling, the environmental sampling program will have less potential to interfere with core-logging efforts, more accurate geologic logs will be available, and new assay data can be used to discriminate between ore and waste rock.

The sample proposed for the environmental geochemistry samples will be a 50 foot composite from selected core intervals. We will require approximately 10 pounds of material per sample, which should provide us with ample material for all Phase 1 and any subsequent kinetic tests that maybe necessary. The approximate number of target tests for characterizing waste rock is shown in Table 1. It is anticipated that approximately one-third of these samples will come from existing coarse rejects. Individual sample intervals are being selected for testing by querying the database and reviewing cross sections provided by Augusta. In addition, information in the block model will be used to verify our selections. Based on on-going planning for this project, Vector presumes that the 16 year, $1.05 pit limit will be the most conservative model to use at this point. A preliminary model query provided the following estimates of the abundance of major rock units in the waste rock pile and open pit (Table 2).

Table 1. Approximate number of static test samples by rock type for characterizing waste rock geochemistry.

Abundance of Rock Type	Static Tests (Sobek, ABA, Paste pH, and NAG pH)	Whole Rock Multi - Element Chemistry	Element Mobility (EPA 1312 and ASTM E2242-02)
Waste Rock Characterization			
> 35 % of total tonnage	70	35	10
10 to 35 % of tonnage	40	20	8
< 10 % of tonnage	20	10	5
Final Highwall Characterization			
> 35 % of total area	30	15	10
10 to 35 % of area	20	10	8
< 10 % of area	15	8	5

Table 2. Formation Proportions in Mine Facilities

Formation	Proportion in WRD	Proportion in Heap	Proportion in Mill	Proportion in Post Mining Pit Walls
Quartz monzonite porphyry	<5%	15%	5%	<5%
Arkose Shale	75%	50%	<5%	50%
Colina	<5%	<5%	40%	<5%
Earp		<5%	5%	<5%
Horquilla			50%	30%
Andesite	15%	35%	<5%	<5%

Note: Percentages do not add up to 100% due to trace proportions less than 5%

1.4 Open Pit Highwall Geochemical Characterization Program

The purpose of the highwall characterization program is to determine the effect that surface runoff from the highwall and groundwater inflow through the weathered highwall will have on pit lake water quality. For now, we are working with assumption that a pit lake will form within the Rosemont open pit, though this has yet to be confirmed by hydrologic modeling. Additional sampling of zones that are near the ultimate highwall (e.g. ± 50 feet) will be used to supplement the waste rock characterization of each rock type. A separate sampling program is recommended because rocks in the highwall, especially in the west highwall, are likely to be less mineralized than those in the central portion of the pit.

This sampling program (Table 1) will be conducted in stages similar to the waste rock program, with stage 1 samples obtained from recent drilling, and stage 2 samples obtained from Anaconda core.

The Augusta drilling program (boreholes 2000-2017) are located within the central area of the pit so the highwall will be intersected only at depth. To supplement the availability of samples from the west and east layback of the highwall, samples will be obtained from geotechnical holes currently being drilled (e.g. into the west highwall zone) or planned (e.g. through the east highwall).

1.5 Tailings Geochemical Characterization Program

About 700 million tons of tailings will either be placed in a dry tailings stack located within the footprint of the waste rock pile or will be managed in a conventional tailings impoundment located north of the open pit. Tailings are expected to be alkaline due to the relatively low pyrite content of the ore and the alkaline nature of ore host rocks (Table 3).

In order to characterize the geochemical characteristics of tailings, Sobek and NAG pH tests, total metals analysis, and EPA 1312, will be performed on pulps from tailings samples created by any subsequent metallurgical testing.

Table 3. Acid base account results for tailings pulps.

Sample	Total Sulfur (%)	Sulfide Sulfur (%)	Lime as $CaCO_3$ (%)	Acid Generation Potential (kg/t)	Acid Neutralization Potential (kg/t)	Net Neutralization Potential (kg/t)
ACZ Sample L-56900-01 collected May 19, 2006	0.04	< 0.01	42.6	<0.3	426	425.7

1.6 Leach Pad Characterization Program

A small reserve of leach grade ore has been delineated within the Rosemont pit, which principally includes Bisbee Group and quartz latite porphyry rocks with 0.1 to 0.2 % copper. These rock units are potentially leachable because they contain mostly ore grade oxide or copper sulfides that are amenable to leaching (e.g. non chalcopyrite). Three column leach tests were recently completed at Mountain States lab in Vail, Arizona. Vector will sample and have tests performed on a composite from each column (3 total samples) including Sobek and NAG pH tests, whole rock analysis, EPA 1312, and meteoric water mobility tests. In addition, one sample will be selected for a kinetic humidity cell test.

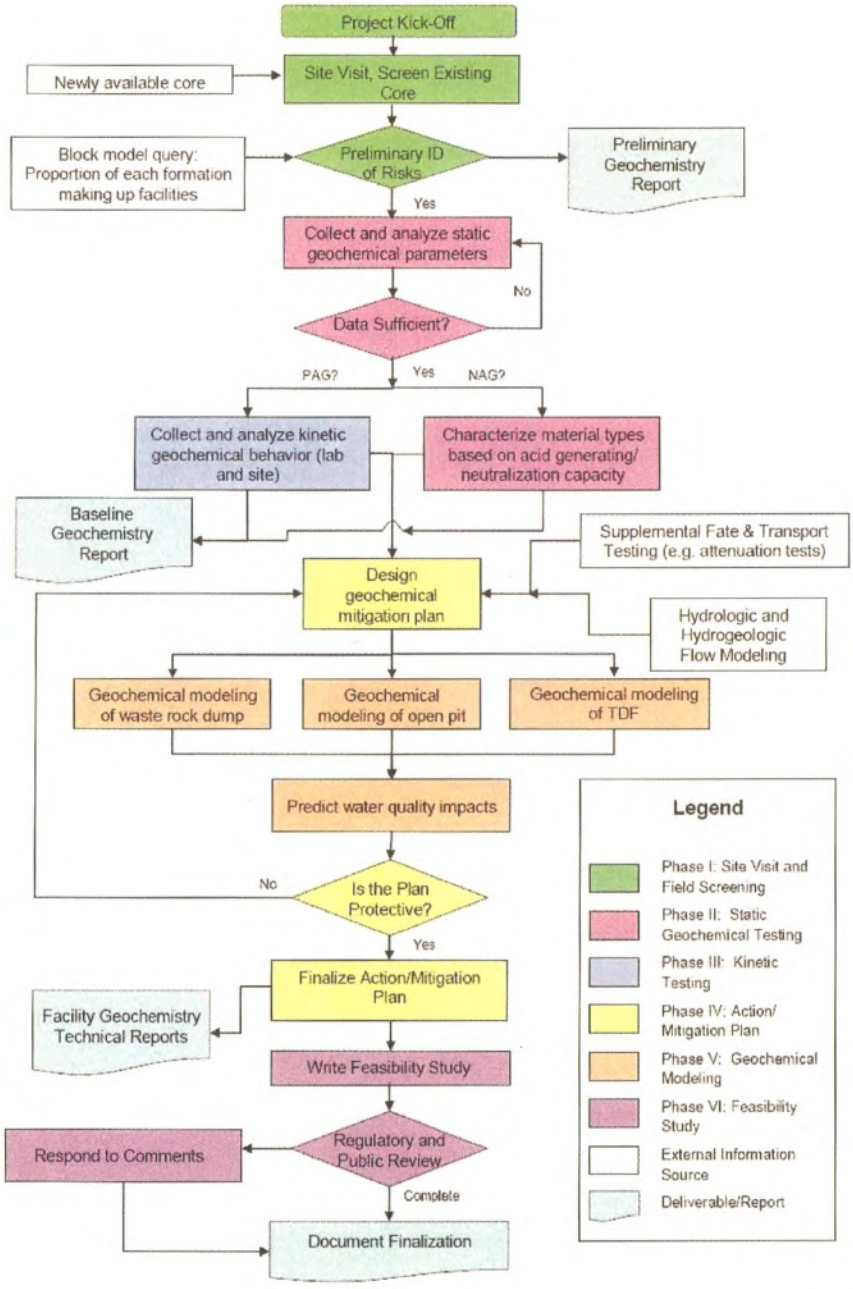
1.7 Program Description

The first objective of the geochemical characterization program is to determine the kind and proportion of rocks that will form acid (if any). The second objective is to predict the nature of water-rock interactions that may yield elevated metal and sulfate levels at neutral to alkaline pH levels. One of the challenges for the second objective is selecting suitable samples that represent weathered material. Core samples (especially in the Paleozoic section below about 200 feet from surface) consist of fresh rock in which the sulfides have not oxidized. Once waste rock is mined, however, residual sulfides could oxidize and may liberate soluble ions. Therefore, the proposal included simulating the weathering process using kinetic humidity tests. Another opportunity would be to locate suitable weathered rock that is analogous to what will be mined from Rosemont.

Kinetic humidity cell tests are intended to simulate weathering, but 20 weeks is scarcely enough time to oxidize more refractory sulfides, especially chalcopyrite. Leaching changes the nature of weathering reactions so secondary minerals cannot readily form.

In order to address this, Vector has obtained a copy of the Aquifer Protection Permit sections prepared for ADEQ that address the potential discharge from tailings and waste rock. Tests performed on these facilities were completed on existing waste rock and tailings and therefore may provide some insight into the effects of weathering. We are still evaluating the information. We are also reviewing the appropriateness of sampling historic dumps and outcrops and their potential to provide information on the effect of weathering; however the location of the historic facilities and the content of the dumps relative to the materials that will be moved has not been fully reviewed.

As the geochemical testing program proceeds into Phase 5 (Figure 2), where fate and transport of solutions may be simulated, data regarding the interaction of foundation materials in the vadose zone and mine water may be required. To better understand this interaction, attenuation batch tests will be necessary. As geotechnical investigations are being conducted, bulk surface samples will be identified and taken for this testwork. The number of samples, attenuation test methods, and constituents to test will be determined during the review of the stage 1 results.


Project Kick-Off
Site Visit, Screen Existing Core
Newly available core
Block model query: Proportion of each formation making up facilities
Preliminary ID of Risks
Preliminary Geochemistry Report
Yes
Collect and analyze static geochemical parameters
No
Data Sufficient?
PAG?
Yes
NAG?
Collect and analyze kinetic geochemical behavior (lab and site)
Characterize material types based on acid generating/ neutralization capacity
Baseline Geochemistry Report
Supplemental Fate & Transport Testing (e.g. attenuation tests)
Design geochemical mitigation plan
Hydrologic and Hydrogeologic Flow Modeling
Geochemical modeling of waste rock dump
Geochemical modeling of open pit
Geochemical modeling of TDF
Predict water quality impacts
No
Is the Plan Protective?
Yes
Finalize Action/Mitigation Plan
Facility Geochemistry Technical Reports
Write Feasibility Study
Respond to Comments
Regulatory and Public Review
Complete
Document Finalization
Legend
Phase I: Site Visit and Field Screening
Phase II: Static Geochemical Testing
Phase III: Kinetic Testing
Phase IV: Action/ Mitigation Plan
Phase V: Geochemical Modeling
Phase VI: Feasibility Study
External Information Source
Deliverable/Report