

**TR-13 COAL REJECTS
GEOCHEMICAL SAMPLING AND
ANALYSIS PLAN, GCC PUEBLO
CEMENT PLANT AND QUARRY
PUEBLO COUNTY, COLORADO**

Submitted to:
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INTRODUCTION

The GCC Pueblo Cement Plant and Quarry is located in Pueblo County, near the town of Pueblo, Colorado. The cement plant utilizes bituminous coal to fire the kiln, which is extracted from the King II Mine located in La Plata County, near Hesperus, Colorado. Coal that is transported to the cement plant is screened for naturally-occurring metal content, and if the metal content surpasses a determined operational threshold, the coal material is separated by a magnet system and is discarded into a coal rejects pile. The coal rejects pile is located at 4220002.26 N, 534540.17 E (UTM meters) adjacent to the Facility coal processing building and is approximately 150 feet long, by 30 feet wide, by 10 feet tall and the volume is roughly estimated at 300 tons. GCC is considering the coal rejects material as potential backfill into the quarry during reclamation activities. Geochemical testing and analysis of the coal rejects material is an important step to determining the potential effects, if any, of incorporating the coal rejects material as backfill into the quarry during reclamation. This sampling and analysis plan (SAP) recommends and describes the collection and analysis of geochemical samples to characterize the physical and chemical parameters of the bulk composition of the coal rejects material being considered for backfill into the quarry during reclamation. This SAP, to be submitted to the Colorado Division of Reclamation, Mining and Safety (DRMS) for approval as Technical Revision 13 (TR-13) provides the purpose, approach, and methods for sample collection and laboratory analysis to be carried out on representative samples of the coal rejects material. This SAP does not include cost estimates for field investigation activities, laboratory analyses, or data management and interpretation.

PURPOSE

The purpose of this SAP is to guide collection of representative samples from the GCC Pueblo Cement Plant and Quarry coal rejects pile and assessment of the feasibility of the coal rejects material for permanent burial during closure and reclamation of the quarry pit.

Data collected as part of this SAP will be used to evaluate the geochemical properties of the coal rejects material and its suitability for permanent burial during the reclamation of the quarry pit. This SAP is developed using the framework established by DRMS (formerly Colorado Mined Land Division, Coal Section) Guidelines (1982) and updated industry standard protocols for coal mining operations.

One previous sampling event was conducted by Aquionix, Inc. on February 8, 2024 to initially investigate the suitability for the coal rejects material to be permanently buried during the reclamation of the quarry pit. A composite sample from the coal rejects pile was collected, split and subjected to laboratory analysis by SGS North America Inc. for leachate analysis by Toxicity Characteristic Leaching Procedure (TCLP) (SW846 1311 6010D) and Synthetic Precipitation

Leaching Procedure (SPLP) (SW846 1312 6020B). Each split sample was analyzed for the Resource Conservation and Recovery Act (RCRA) 8 metals arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Additionally, the coal rejects pile sample split was assessed for pH by Aquionix, Inc. by method SM4500H+B.

APPROACH

Representative coal rejects material samples will be collected in order to determine the physical and geochemical properties of the bulk composition of the coal rejects pile, and provide an indication of the potential for acid generation and mobility of potential constituents of concern. In order to characterize the bulk composition of the coal rejects pile, representative samples will be collected in 1-gallon zip lock bags using hand tools (shovels, trowels) at four target locations and intervals where a range of weathering, from relatively unweathered to weathered material is present to provide representation of the bulk composition of the coal rejects pile as a whole. Additionally, one of these sample locations will be selected for sample splitting in order to submit a blind duplicate sample to the lab for QAQC purposes for a total of five coal rejects pile samples for analysis. **Figure 1** shows the proposed sample locations recommended for this investigation.

METHODS

FIELD

Sample collection will be carried out under the supervision of a qualified Resource Hydrogeologic Services, Inc. (RHS) geochemist to ensure proper sample handling and documentation is followed. Sample documentation will include standard lithologic descriptions of the material, including: 1) identification of primary and secondary minerals present, 2) degree of weathering, 3) visual grain size distribution, 4) angularity of clasts, 5) moisture content, 6) color, and 7) additional material characteristics, such as the presence of odors.

Samples will be collected in laboratory approved containers and chain of custody protocols followed. Sample volumes will be defined by the laboratory for the analyses required, which is typically 1-gallon per sample. Sample documentation required at the time of sample collection includes: 1) date and time of sample, 2) sample depth, 3) XY coordinates of sample location, with datum noted, and 4) photographs of the sample material and area where sample was collected.

A unique sample identifier will be issued to each sample collected from each sample location. The sample locations created for this investigation will follow the naming convention provided below

- Location ID: CRP01-2024 (Coal Rejects Pile sample location number 01 – Year)

Four representative samples will be collected from the coal rejects pile and one additional sample will be collected as a field duplicate. Laboratory QA/QC measures are not defined in this SAP. However, it is known that the laboratory selected for this investigation, ACZ Laboratories in Steamboat Springs, CO, has standard QA/QC protocols in place.

LABORATORY

Laboratory analysis of samples collected will include tests for physical and chemical properties of the material evaluated. **Table 1** presents the analytes and analytical methods proposed for this evaluation, and incorporates the CDRMS Guidelines (1982) as well as updated analytical methodology. Selection of the analytical lab was based on laboratory capabilities and experience. This sampling and analysis plan does not include laboratory recommendations or cost estimates for sampling program described herein.

Geotechnical analysis

Textural analysis to determine the particle size distribution within the sample materials will be carried out in accordance with ASTM D422-63 for particle size analysis of soils. Relative percent sand, silt, and clay will be determined by this method, and will be used to support the geochemical characterization of the sampled material. Percent saturation in the sample material will be determined by USDA No. 60 (2) methodology.

Geochemical analysis

LEACHATE ANALYSIS

Samples collected during this field investigation will be submitted for chemical analysis following the Synthetic Precipitation Leaching Procedure (SPLP, USEPA Method 1312) to assess chemical mobility in the coal rejects material. This method evaluates the potential for a soil material to leach constituents into the receiving environment, and is a relatively quick test to complete when compared to kinetic leachate tests. This analysis helps to determine the leachability of constituents of concern in various soil materials. While data obtained from these tests cannot be directly compared to regulatory guidelines, they provide an overall indication of the readily mobile elements when the soil comes in contact with slightly acidic rainwater.

METALS ANALYSIS

Metals analysis conducted by inductively coupled plasma (ICP) is recommended for the coal rejects material in accordance with the DRMS Guidelines (1982). Soluble and extractable constituents will be analyzed to determine the total content contained within the soil/rock matrix. While results from the metals analysis provide an estimation of the metal content in the coal rejects material, they do not provide information on the dynamic weathering processes that would affect dissolution rates and complex geochemical reactions occurring in nature. Metals

data, when combined with leachate data, can give insight into the source and strength of potential acid forming materials, however additional testing would be warranted to further evaluate the likelihood of chemical constituent mobility under field conditions.

CARBON SOURCES

The characterization of organic matter distribution and sources of carbon in the coal rejects is important to the understanding of geochemical processes occurring within the coal rejects pile. Organic compounds play a substantial role in soil geochemistry as they have the ability to form water-soluble and water-insoluble complexes with metal ions, interact with clay minerals, facilitate sorption/desorption processes, and retain moisture (Schumacher, 2002). This SAP includes the quantification of percent organic matter, total organic carbon (TOC), and total inorganic carbon (TIC), for the determination of potential interaction of organic sediments with surrounding coal rejects material. **Table 1** provides the analytical methodology proposed for the coal rejects material samples.

ACID BASE ACCOUNTING

Samples collected during this field investigation will be submitted for acid base accounting (ABA) analysis. ABA analysis is used to predict the tendency of a material to generate or neutralize acid by providing a snapshot (in time) of the balance between the acid production and acid neutralization properties, based on the sulfur content and presence of neutralizing species, such as carbonate minerals. Parameters that comprise ABA analysis include paste pH, and sulfur speciation (total sulfur, sulfide sulfur, sulfate sulfur, and organic sulfur).

Paste pH analysis estimates the readily available acidity or alkalinity in a solid and generally represents in-situ weathering conditions of the sampled materials. Paste pH methodology for shallow sediment and soils will be carried out in accordance with EPA Method 600/2-78-054 (Section 3.2.2). Generally, a paste pH of greater than 7.0 may indicate the presence of a reactive carbonate phase, and a paste pH of less than 5.0 may signify the initiation of acid generation processes have begun in the sample material, as would be expected in a previously weathered sample (MEND, 1991). Sulfur speciation can also be used to determine the acid-generating potential of sulfidic geological materials. Sulfur speciation (total, sulfate, sulfide, and organic forms) will be completed according to EPA Method 600/2-78-054 (Section 3.2.4 –MOD). Organic sulfur generally occurs in geologic materials that contain organic matter, such as coals. However, organic sulfur generally does not produce net acidity on oxidation, with the exception of the formation of some organic acids (MEND, 1991).

For this evaluation, the acid potential (AP) of the material will be determined from lab results based on the sulfide sulfur content, converted to units of CaCO₃/tonne (calcium carbonate per metric tonne).

DATA MANAGEMENT AND INTERPRETATION

After field sampling is completed, field observations and electronic data deliverables from laboratory reports will be imported into a central Microsoft Access Database. Inside the database environment, further queries and analysis can be performed for single sampling events or across the entire dataset. This makes complete reporting across the data time span possible. Sampling data can then be easily linked to geospatial data in order to perform GIS analysis and site mapping as needed. Geospatial data will be managed inside an ESRI ArcGIS file geodatabase. In the ESRI ArcGIS environment, site data and public data can be called out and presented to provide a comprehensive approach to decision making processes.

Data collected for this sampling and analysis investigation, will be reported out in the TR-13 Geochemical Materials Analysis Report, prepared by RHS.

REFERENCES CITED

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TABLE 1

Table 1: List of Geotechnical and Geochemical Analytes and Analytical Methods Proposed

Category	Parameter	units	Method of Analysis
Synthetic Precipitation Leaching Procedure (EPA Method 1312)	pH	standard units	M9045D/M9040C
	Aluminum	mg/L	M6010B ICP
	Antimony	mg/L	M6020B ICP-MS
	Arsenic	mg/L	M6020B ICP-MS
	Barium	mg/L	M6010B ICP
	Beryllium	mg/L	M6020B ICP-MS
	Bismuth	mg/L	M6010B ICP
	Boron	mg/L	M6010B ICP
	Cadmium	mg/L	M6020B ICP-MS
	Calcium	mg/L	M6010B ICP
	Chromium	mg/L	M6010B ICP
	Cobalt	mg/L	M6010B ICP
	Copper	mg/L	M6010B ICP
	Iron	mg/L	M6010B ICP
	Lead	mg/L	M6010B ICP
	Lithium	mg/L	M6010B ICP
	Magnesium	mg/L	M6010B ICP
	Manganese	mg/L	M6010B ICP
	Mercury	mg/L	M7470 CVAA
	Molybdenum	mg/L	M6010B ICP
	Nickel	mg/L	M6010B ICP
	Phosphorous	mg/L	M6010B ICP
	Potassium	mg/L	M6010B ICP
	Selenium	mg/L	M6020B ICP-MS
	Silver	mg/L	M6020B ICP-MS
	Sodium	mg/L	M6010B ICP
	Strontium	mg/L	M6010B ICP
	Thallium	mg/L	M6020B ICP-MS
	Tin	mg/L	M6010B ICP
	Titanium	mg/L	M6010B ICP
	Uranium	mg/L	M6020B ICP-MS
	Vanadium	mg/L	M6010B ICP
	Zinc	mg/L	M6010B ICP
	Nitrate-Nitrite as N, extractable	mg/kg	M353.2
Soluble Constituents	Arsenic, extractable	mg/kg	AB-DTPA, M6010B ICP
	Boron, soluble	mg/kg	Hot Water, M6010B ICP
	Calcium, soluble	meq/L	Saturated Paste, M6010B ICP
	Iron, extractable	mg/kg	AB-DTPA, M6010B ICP
	Lead, extractable	mg/kg	AB-DTPA, M6010B ICP
	Magnesium, soluble	meq/L	Saturated Paste, M6010B
	Manganese, extractable	mg/kg	AB-DTPA, M6010B ICP
	Mercury	ng/g	Direct Combustion AA, M7473
	Molybdenum, extractable	mg/kg	AB-DTPA, M6010B ICP
	Selenium, soluble	mg/kg	Hot Water, M6020B ICP-MS
	Sodium Adsorption Ratio	Calculation	Calculation
	Sodium, soluble	meq/L	Saturated Paste, M6010B ICP
	Zinc, extractable	mg/kg	AB-DTPA, M6010B ICP
Acid Base Accounting	Carbon, total (TC)	%	ASA No. 9 29-2.2.4 Combustion/IR
	Carbon, total inorganic (TIC)	%	Calculation (TC-TOC)
	Carbon, total organic (TOC)	%	ASA No. 9 29-2.2.4 Combustion/IR
	pH, saturated paste	standard units	EPA 600/2-78-054 section 3.2.2
	Sulfur forms	%	M600/2-78-054 3.2.4 - MOD
Soil Properties	Texture by Hydrometer	%	ASTM D 422 Hydrometer
	Conductivity at 25C	mmhos/cm	SM2510B
	Saturation percent	%	USDA No. 60 (2)

FIGURE 1

